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March 13, 1986
PY-CEI/NRR-0441 L

MURRAY R. EDELMAN
VICE PRESIDENT
NUCLEAR

Dr. W. D. Butler, Director
BWR Project Directorate No. 4
Division of BWR Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

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MAR 14 1986
US NUCLEAR REGULATORY COMMISSION

Perry Nuclear Power Plant
Docket Nos. 50-440; 50-441
FSAR Changes

Dear Mr. Butler:

This letter is to provide information with respect to the status of pending changes to the Perry FSAR. Since the last amendment (Amendment 24) to the Perry FSAR was filed, several changes have been processed using our existing programs. The majority of these changes are editorial and typographical corrections.

A draft version of all pending changes was discussed with your staff, and provided to the Region III resident inspector from Perry. Several items were identified as requiring further review, and are summarized in the attachment to this letter. These items were discussed with the individual staff reviewers and were found to be acceptable. Copies of the pending FSAR change pages are provided as an attachment.

It is our understanding it is acceptable to include these pending changes in the next FSAR amendment to be filed after the issuance of the Perry Unit No. 1 low power operating licensing.

If you have any questions, plese feel free to call.

Very truly yours,

Murray R. Edelman

Murray R. Edelman
Vice President
Nuclear Group

MRE:L
Attachments

cc: Jay Silberg, Esquire
John Stefano (2)
J. Grobe

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Change	Basis	Safety Significance
7.3.1.1.15b, 9.5.6.2		
Clarifies difference between Div. 1 and 2 and Div. 3 controls and incorporates design changes on the diesel generator starting air compressor controls.	Provides further clarification with with repsect to the as-built design.	The change clarifies existing information and updates setpoint values to the most recent vendor design documents.
5.4.5.4		
Deletes generic description in Section 5.4.5.4 on MSIV leak	The description of the General Electric generic test method is not the test method utilized by Perry.	The generic description is one of several acceptable methods of MSIV testing. The Perry specific method in accordance with 10 CFR 50 Appendix J and is described in FSAR Section 6.2.6.
9.5.5		
Updates D/G cooling water additions to vendor recommendations and changes cooling water temperature to agree with vendor manual.	Reflect the current vendor supplied information.	The change does not affect the operability of the diesel generators. The diesel generators are operated and maintained in accordance with the manufacturer's recommendations.
2.4, 15,7		
Updates the Chapter 15 analysis of the rupture of a liquid radwaste tank.	The analysis was performed based upon increased groundwater flow as measured during the underdrain system pre-operatonal test.	The radiation dose from the analyzed accident is still well below the allowed 10 CFR 100 limits.
Table 1.8-1		
Clarifies PNPP's compliance with R.G. 1.105 (Instrument Setpoints)	Provides statement that not all instruments have securing devices on the setpoint adjustment.	This is not a safety concern as revision 2 of this Reg. Guide deleted the requirement for securing devices.
6.1.2, Table 6.1-2		
Updates description of protective coatings used in containment	To reflect that some of the repairs to the coatings were not qualified for post-LOCA conditions.	Evaluation showed that if the coating were to fail there would be no unacceptable consequences.

TABLE 1.8-1 (Continued)

Regulatory Guide (Rev.;RRRC Category)	Degree of Conformance	Reference
1.68.1 - (Revision 1 - 1/77;RRRC Cat. 1)		
Preoperational and initial startup testing of feedwater and condensate systems for boiling water reactor power plants	PNPP conforms to this guide with the exception of commitments to Position C.1 - "Preoperational Testing", and Positions C.2.f and g - "Startup Testing - Vibration and Thermal Expansion Testing" since both the condensate and portions of feedwater systems are classified as nonsafety for testability purposes. The expansion and vibration testing for both preoperational and startup phases will be performed as described in Section 3.9.2.	14.0
1.68.2 - (Revision 1 - 7/78;RRRC Cat. 1)		
Initial startup test program to demonstrate remote shutdown capability for water-cooled nuclear power plants	PNPP conforms to this guide.	14.0

TABLE 1.8-1 (Continued)

Regulatory Guide (Rev.;RRRC Category)	Degree of Conformance	Reference
1.103 - (Revision 1 - 10/76;RRRC Cat. 1)		
Post-tensioned prestressing systems for concrete reactor vessels and containments	Not applicable to the PNPP design.	-
1.104		
Overhead crane handling systems for nuclear power plants	Regulatory Guide 1.104 was withdrawn on August 16, 1979.	-
1.105 - (Revision 1 - 11/76;RRRC Cat. 2)		
Instrument setpoints	PNPP conforms to this guide with the following clarifications. The trip setpoint (instrument setpoint), allowable value (technical specification limit) and the analytical or design basis limit are contained in Technical Specifications. These parameters are appropriately established based on instrument accuracy, calibration capability and design drift (estimated) allowance data. The setpoints are within the instrument accuracy range. The established setpoints provide margin to satisfy both safety requirements and plant availability objectives. Securing devices per regulatory position C.5 are not provided on all the setpoint adjustment mechanisms. Safety related equipment has been seismically qualified for its function per IEEE-344-1975. This qualification documentation demonstrates adequate design without the use of a securing devices.	7.1.2
1.106 - (Revision 1 - 3/77;RRRC Cat. 1)		
Thermal overload protection for electric motors on motor operated valves	Thermal overload relays to protect motor operated valves are not included in the design of the Class IE power system; therefore, the positions of this guide are not applicable to the PNPP design.	8.1

TABLE 1.8-1 (Continued)

Regulatory Guide (Rev.;RRRC Category)	Degree of Conformance	Reference
1.107 - (Revision 1 - 2/77;RRRC Cat. 1)		
Qualifications for cement grouting for prestressing tendons in containment structures	Not applicable to the PNPP design.	-

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TABLE 1.8-1 (Continued)

Regulatory Guide (Rev.;RRRC Category)	Degree of Conformance	Reference
<u>8.4 - (Revision 0 - 2/73)</u>		
Direct reading and indirect reading pocket dosimeters	PNPP Project conforms to this guide.	12.5
<u>8.5 - (Revision 0 - 2/73)</u>		
Immediate evacuation signal	PNPP Project conforms with this guide.	12.3.4, Emergency Plan
<u>8.6 - (Revision 0 - 5/73)</u>		
Standard test procedure for geiger muller counters	PNPP Project conforms with this guide.	12.5
<u>8.7 - (Revision 0 - 5/73)</u>		
Occupational radiation exposure records systems	PNPP Project conforms with this guide.	12.5
<u>8.8 - (Revision 3 - 6/78)</u>		
Information relevant to ensuring that occupational radiation exposures at nuclear power stations will be as low as reasonably achievable	PNPP Project conforms with this guide with exception to Section C.2.D.3. Portable auxiliary ventilation system filters will be visually inspected prior to each use.	11.3.1, 11.4.1, 12.1, 12.3, 12.5, Tech. Specs.
<u>8.9 - (Revision 0 - 9/73)</u>		
Acceptable concepts, models equations and assumptions for a bioassay program	PNPP Project conforms to this guide.	12.3, 12.5

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TABLE 1.8-1 (Continued)

Regulatory Guide (Rev.;RRRC Category)	Degree of Conformance	Reference
8.19 - (Revision 1 - 6/79)		
Occupational radiation dose assessment in light-water reactor power plants design stage man-rem estimates	PNPP conforms to the administrative and procedural considerations as recommended by Section D of the guide.	12.5
8.20 - (Revision 1 - 9/79)		
Applications of bioassay for I-125 and I-131	Not applicable to the PNPP Project.	-
8.21 - (Revision 1 - 10/79)		
Health physics surveys for byproduct material at NRC-licensed processing and manufacturing plants	Not applicable to the PNPP Project.	-
8.22 - (Revision 0 - FC - 7/78)		
Bioassay at uranium mills	Not applicable to the PNPP Project.	-
8.23 - (Revision 0 - FC - 2/79)		
Radiation safety surveys at medical institutions	Not applicable to the PNPP Project.	-
8.24 - (Revision 1 - 10/79)		
Health physics surveys during enriched uranium-235 processing and fuel fabrication	Not applicable to the PNPP Project.	-

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TABLE 1.8-1 (Continued)

Regulatory Guide (Rev.;RRRC Category)	Degree of Conformance	Reference
8.26 - (Revision 0 - 9/80) Applications of bioassay for fission and activation products.	PNPP conforms to this Guide.	12.5
8.28 - (Revision 0 - 8/81) Audible-alarm dosimeters	Not used at the PNFP Project	

TABLE 1.8-2 (Continued)

Regulatory Guide (Rev.;RRRC Category)	Degree of Compliance	Reference
1.88 (Continued)	For storage of special processed records (such as radiographs and microfilm), humidity and temperature controls shall be provided so as to maintain an environmental condition as prescribed in paragraph 6.1.1 of ANSI PH 1.43-1979 in lieu of the last paragraph in section 5.6 of ANSI N45.2.9-1974. Active records may be temporarily stored in one-hour fire rated file cabinets. Active documents are those that have been completed but not yet transferred to the permanent records storage facility. The use of the one-hour fire rated file cabinets for such records shall be limited to temporary storage prior to the time records are transferred to the permanent records storage facility. This temporary storage is limited to approximately three months.	
1.94 - (Revision 1 - 4/76;RRRC Cat. 1) Quality assurance requirements for installation, inspection, and testing of structural concrete and structural steel during the construction phase of nuclear power plants.	For operations, Reg. Guide 1.94 will be applied to activities comparable in nature and extent to to construction phase activities.	17.2
1.116 - (Revision 0 - 5/77;RRRC Cat. 1) Quality assurance requirements for installation, inspection and testing of mechanical equipment and systems.	PNPP complies with this guide with the following clarifications to ANSI N45.2.8-1975: 1) Section 4.5.1.b Pipe will be flushed to maximum velocity using permanent plant equipment or hydrolaser cleaning.	17.2

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TABLE 1.8-2 (Continued)

Regulatory Guide (Rev.;RRRC Category)	Degree of Compliance	Reference
1.116 - (Revision 0 - 5/77;RRRC Cat. 1) (Continued)	2) Procedures will define system restoration as required to prevent contamination after cleanliness class is achieved. 3) For operations, Reg. Guide 1.116 will be applied to activities comparable in nature and extent to construction phase activities including the clarifications made above.	

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verify the degree of conservatism of the calculated inflow. It was estimated that, during this time, the groundwater inflow would be on the order of 4 gpm(59). During preoperational testing, groundwater inflow to the plant underdrain system was measured at 11.7 gpm.

b. Water Table

To monitor the groundwater table outside the nuclear island and within the site boundary, four arrays of piezometers were installed during construction in each of the four compass directions up to a maximum distance of 1,000 feet. The locations of the piezometers were chosen so that the groundwater drawdown profiles during construction and throughout the plant life could be established and are shown on Figure 2.5-157. Four piezometers are installed in the backfill zone. The types of piezometers are open standpipe type or porous tube type (Casagrande type). A brief description of the piezometers can be found in Foundation Instrumentation by T. [illegible] Hanna(59).

The groundwater monitoring was conducted on a more frequent basis initially, so that the seasonal fluctuation could be established. After that, the groundwater level was measured on a regular basis. Regular monitoring will continue during the life of the plant.

The seasonal fluctuations in groundwater level were minimal. As expected, a slight drop in groundwater level occurred but did not exceed more than 3 to 5 feet in proximity to the excavation and did not represent a significant change from preconstruction groundwater levels.

c. Methane Gas

The presence of methane gas was monitored by portable detection equipment at regular intervals during the plant excavation, beyond an approximate depth of 30 feet from existing grade. Procedures will require that all manholes and the gravity drainage pipe be monitored prior to entry by personnel and be ventilated by portable equipment, if necessary (see Section 2.5.4).

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TABLE 3.7-14

SETPOINTS OF THE TRIAXIAL RESPONSE SPECTRUM RECORDER(1)

Horizontal Axis			Vertical Axis		
	Setpoint Value (g)			Setpoint Value (g)	
Freq. (CPS)	Amber Signal(2)	Red Signal(3)	Freq. (CPS)	Amber Signal(2)	Red Signal(3)
2.0	0.23	0.35	2.0	0.14	0.21
2.5	0.28	0.42	2.5	0.17	0.26
3.2	0.29	0.44	3.2	0.21	0.31
4.0	0.27	0.40	4.0	0.23	0.35
5.0	0.23	0.35	5.0	0.26	0.39
6.4	0.23	0.35	6.4	0.27	0.41
8.0	0.23	0.35	8.0	0.38	0.57
10.1	0.23	0.34	10.1	0.43	0.65
12.7	0.21	0.31	12.7	0.37	0.55
16.0	0.19	0.28	16.0	0.19	0.29
20.2	0.18	0.27	20.2	0.09	0.13
25.4	0.08	0.12	25.4	0.07	0.11

NOTES:

1. Instrument No. D51-R160.
2. Two-thirds of OBE
3. OBE

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c. Initial Startup Testing

Vibration measurements will be made during reactor startup at conditions up to 100 percent power and maximum flow. Balanced, unbalanced, and transient conditions of recirculation system operation will be evaluated. The primary purpose of this test series is to verify the anticipated effect of two-phase flow on the vibration response of internals. Previous vibration measurements in BWRs[9] have shown that the effect of the two-phase flow is to broaden the frequency response spectrum and diminish the maximum response amplitude of the shroud and core support structures.

Vibration sensor types will include strain gages, displacement sensors (linear variable transformers), and accelerometers. Accelerometers will be provided with double integration signal conditioning to give a displacement output. Sensor locations will include the following:

1. Top of shroud head, lateral acceleration (displacement).
2. Top of shroud, lateral displacement.
3. Jet pump riser braces, bending and extension strains.
4. Jet pump diffuser, bending strain.
5. Control rod drive guide tubes, bending strain.
6. Incore housings, bending strain.
7. Core spray sparger piping, bending strain.

In all prototype plant vibration measurements, only the dynamic component of strain or displacement will be recorded. Data will be recorded on magnetic tape, and provision will be made for selective on-line analysis to verify the overall quality and level of the data. Interpretation of the data will require identification of the dominant vibration modes of each component by the test engineer, using frequency, phase, and amplitude information from

The design of the isolation valve has been analyzed for earthquake loading. The cantilevered support of the air cylinder, hydraulic cylinder, springs, and controls is the key area. The increase in loading caused by the specified earthquake loading does not result in stresses exceeding material allowables, or prevent the valve from closing as required.

Electrical equipment that is associated with the isolation valves and operates in an accident environment is limited to the wiring, solenoid valves, and position switches on the isolation valves. The expected pressure and temperature transients following an accident are discussed in Chapter 15.

5.4.5.4 Inspection and Testing

The main steam isolation valves can be functionally tested for operability during plant operation and refueling outages. The test provisions are listed below. During refueling outage the main steam isolation valves can be functionally tested, leak-tested, and visually inspected.

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The main steam isolation valves can be tested and exercised individually to the 90 percent open position because the valves still pass rated steam flow when 90 percent open.

Leakage from the valve stem packing will become suspect during reactor operation from measurements of leakage into the drywell, or from observations or similar measurements in the steam tunnel. During shutdown while the nuclear system is pressurized, the leak rate through the inner packing can be measured by collecting and timing the leakage. Leakage through the inner packing would be collected from the packing drain line.

The leak rate through the pipeline valve seats (pilot and poppet seats) can be measured accurately using the periodic surveillance tests developed from the requirements in Section 6.2.6. The main steam isolation valves are closed utilizing both spring force and air pressure on the operating cylinder.

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The nonmetallic insulating system used inside containment (Owens-Corning "Nu'k'on" fiberglass blanket insulation) has also undergone a qualification program(4) to verify its performance following a LOCA.

6.1.2 ORGANIC MATERIALS

Many protective coatings that are common in industrial use can deteriorate in a post accident environment and contribute substantial quantities of foreign solids and residue to the reactor building sump. Therefore, protective coatings to be used inside the reactor building have been demonstrated to withstand the post accident conditions by satisfying all the criteria listed in ANSI N101.2 with minor exceptions as identified in Table 6.1-2. Also included in this qualification is the epoxy calking material which is used to seal weld discontinuities, such as porosity and laminations prior to final application of the coating system. 281.6

The suitability of reactor building coating systems to withstand the DBA has been evaluated. Coatings have been applied in accordance with manufacturer's recommendations. In addition, the guidance of Regulatory Guide 1.54 is followed.

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Organic coating materials used inside the reactor building are listed in Table 6.1-2. Stainless steels will not be placed in contact with organic coatings or cleaning materials that could contribute to stress corrosion cracking. These materials are compounds containing unacceptable levels of leachable chlorides, fluorides, lead, zinc, copper, sulfur or mercury.

Various nonmetallic materials may be used as follows: in bearings; ethylene propylene, silicone or butyl rubber for O-rings; wire wound asbestos for gaskets; and lubricants with less than 200 ppm leachable chlorides. Cross-linked polyethylene or ethylene propylene rubber is used for electrical cable insulation and chlorosulfonated polyethylene is used for cable jacketing. The cabling has been designed to withstand radiation dose. There is approximately 330,000 ft. of electrical cabling inside containment which results in less than 40,000 lbs. of these materials. Total exposed surface area of these materials is conservatively estimated to be 86,400 sq. ft. based 281.6

on an equivalent cable diameter of 1.0 inch. In addition, closed cell polyethelene is provided on chilled water lines in the wetwell areas in containment. The amount is less than 130 lbs. and approximately 1 gallon of contact cement is used to apply the insulation to carbon steel pipe. The cement does include a clorinated compound which will not be leachable under either operating or LOCA temperatures. Any plastics or elastomers used in a high radiation area will be evaluated to determine service deterioration in accordance with ANSI N4.1. 28I.6

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Penetrants used in liquid penetrant testing will contain not more than 1 percent total sulfur and not more than 1 percent total halogens.(5)

The only significant organic materials on equipment supplied by General Electric are the protective coatings used on some carbon steel components. These coatings are specified to meet the requirements of Regulatory Guide 1.54 and are qualified using the standard ANSI tests. However, because of the impracticability of using these special coatings on all equipment, certain small size equipment (e.g., electronic/electrical trim, covers, face plates, valve handles, etc.) may be coated with unqualified organic coatings. In addition, certain touch-up and repair applications, for which valid DBA tests per ANSI N101.2 are not available, were used during construction to repair previously applied qualified coatings. The total coated area for these surfaces and this equipment is approximately 8,900 sq.ft. 281.6 281.6

Heat insulation used in containment (Owens Corning "Nu'K'on") is 95-100 percent inorganic. Exterior cloth and fiberglass insulating wool are the major components of the insulation. Together they represent over 95 percent of the total mass of the insulation.

The insulation is comprised of a quilted, light density, semi-rigid fiberous glass (pad) material, encapsulated in woven glass (cloth) to form a composite blanket. The blankets will use Velcro for ease of installation and removal. The Velcro is made from two components; Nomex nylon for the base mat and loops, and stainless steel for the hooks.

Insulation is encapsulated with rolled and formed 22 gauge (304) stainless steel jacketing, combining quick release stainless steel latches and closure handles.

For anti-sweat insulation a closed cell polyethylene foam is used in limited quantity (less than 130 lbs.) in areas of the wetwell above the el. 620'-6" floor.

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6.1.3 REFERENCES FOR SECTION 6.1

1. Bechtel Corporation, "Standard Specification Coatings for Nuclear Power Plants," Spec. Nos. CP-951, CP-952, CP-956.

2. American National Standards Institute, "Protective Coatings (Paints) for Light Water Nuclear Reactor Containment Facilities," ANSI N101.2, 1972.

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TABLE 6.1-2

ORGANIC COATING MATERIALS INSIDE REACTOR BUILDING

Surface	Area (ft^2)	DFT_{max} (mils)	Materials Type	Material Weight (oz./mil-ft^2)	Total Weight (lbs)
Steel(1)	880,000	8	Polyamide - cured epoxy	.15	66,000
Concrete	92,500	20	Polyamide - cured epoxy	.15	17,350
				Total	83,350
Steel(2)	5,976	8	Water base and polyamide-cured epoxies	.15	448

NOTE:

1. Includes pipe, structural steel, plate and equipment.
2. Applicable DBA tests are not available.

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The strainers are conically shaped and are constructed from stainless steel plate with 0.070 inch openings. With the horizontal orientation of the strainers, the centerline distance from the strainer to the suppression pool floor is approximately 3'-9".

The mechanism for transport of any insulation from the drywell into the containment suppression pool following an accident involves a series of unlikely occurrences, as discussed below.

The following types of insulation are used on piping and equipment within the containment:

a. Metal-reflective insulation for the reactor pressure vessel.

b. Metal-jacketed fiberglass blanket (Nu"K"on) for all hot piping and equipment.

c. Polyethylene closed cell foam insulation on chilled water piping.

Metal-reflective insulation is installed in sections with overlapping edges and quick release latches with keepers.

Metallic jacketed fiberglass blanket insulation is installed in two-foot sections with VELCRO fasteners on the longitudinal seam for ease of installation and removal. The blanket is jacketed with a separate stainless steel sheath combining quick release latches and closure handles.

If a postulated pipe break (LOCA) occurs, some insulation in the immediate vicinity of the break could possibly be removed by direct jet impingement. Only sections in the immediate vicinity of the break would likely be affected. The metal jacket minimizes the possibility of the non-metallic insulation breaking up and becoming transportable debris. Any metal components removed would likely fall to the drywell floor or weir annulus floor and remain there throughout the accident.

If any insulation breaks away from the piping or equipment, the insulation would most probably fall to the drywell floor. The surface area of the weir annulus is very small when compared to the area of the drywell and only a small percentage,

if any, of the insulation would enter the weir annulus. If any insulation that falls to the drywell floor floats when the water level rises in the lower drywell region, the weir wall will act as a skim to prevent the insulation from entering the weir annulus. Entrance of insulation into the weir annulus is also partially restricted by the main steam relief valve discharge piping (uninsulated) in the vicinity.

The velocity of water down through the weir annulus and out through the horizontal vents is less than 0.2 ft/sec. Therefore, most of the metal jacketed insulation that might enter the weir annulus will sink to the floor of the annulus and remain there throughout the accident. If any part of the insulation entering the annulus were to float, it is very unlikely that the insulation would be drawn downward and out through the vents by the ECCS suction lines.

As previously outlined, the probability of transporting insulation into the suppression pool is extremely low. If any insulation were to become entrained in the flow through the horizontal vents (at a flow velocity of less than 0.2 ft/sec), the insulation would float to the surface of the pool or sink to the floor of the pool as the insulation exits from the vents. The insulation would not be close to the suction strainers since the ECCS suction strainers are located about 19 to 20 feet out from the drywall, about 10 feet below the post LOCA pool level, and [illegible] above the suppression pool floor. Since the inlet design velocity through the strainers [illegible] 1.0 ft/sec, the possibility for any insulation [illegible] the strainers and cause clogging is virtually nonexistent.

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A complete DBA analysis of the interaction of the Nu"K"on insulation with the ECCS systems is presented in Owens-Corning Topical Report OCF-1.

The chilled water anti-sweat insulation is only located above the floor grating on the wetwell el. 620'-6". If pieces were to reach the pool below, the pieces would then float on the pool surface since the material has negligible water absorption capacity and weighs 2 lbs/cf.

6.2.2.3 Design Evaluation

In the event of the postulated LOCA, the short-term energy release from the reactor primary system will be dumped to the suppression pool. This will cause a pool temperature rise of approximately 45°F. Subsequent to the accident, fission product decay heat will result in a continuing energy input to the pool. The

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TABLE 6.2-[illegible] (Continued)

Penetration Number(3) Unit 1	Penetration Number(3) Unit 2	ESF Reg. Guide	System Name	Fluid	Line Size (in.)	Essential Sys.(4)	Fig. 6.2-[illegible] Arr. No.	Sys. and Valve Number	Loc.(5)	Type C Test	Pipe Length(6)	Valve Type	Valve Sect.	Actuation Mode Pri.	Actuation Mode Sec.	Valve Position Norm	Valve Position Shut down	Valve Position Post Acc.	Valve Position Pwr. Fail(7)	Isolation Signal(8)	Closure Time (sec)(9)	Pwr. Source Div(10)	Norm. Flow Dir.
[illegible]	[illegible]	[illegible]	HPCS Pump Suction	Water	[illegible]	Yes	[illegible]	[illegible]	[illegible]	Yes	[illegible]	Gate	[illegible]	[illegible]	[illegible]	CL	CL	OP or CL	AI	[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]	Suppression Pool Makeup	Water	[illegible]	Yes	[illegible]	[illegible]	[illegible]	No	[illegible]	Globe	[illegible]	[illegible]	-	OP	OP	OP	AI	[illegible]	<3	-	-
				Water	[illegible]	No	[illegible]	[illegible]	[illegible]	Yes	[illegible]	Globe	[illegible]	[illegible]	-	CL	CL	OP or CL	[illegible]	[illegible]	<3	-	[illegible]
[illegible]	[illegible]	[illegible]	RHR [illegible] Pump Suction	Water	[illegible]	Yes	[illegible]	[illegible]	[illegible]	Yes	[illegible]	Gate	[illegible]	[illegible]	[illegible]	OP	CL	OP	AI	[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]	Suppression Pool Makeup	Water	[illegible]	Yes	[illegible]	[illegible]	[illegible]	No	[illegible]	Globe	[illegible]	[illegible]	-	OP	OP	OP	AI	[illegible]	[illegible]	[illegible]	-
[illegible]	[illegible]	[illegible]	RHR [illegible] Pump Suction	Water	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Yes	[illegible]	Gate	[illegible]	[illegible]	[illegible]	OP	CL	OP	AI	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	Chilled Water Supply	Water	[illegible]	Yes	[illegible]	[illegible]	[illegible]	Yes	[illegible]	B'fly	[illegible]	[illegible]	[illegible]	OP	OP	CL	AI	[illegible]	[illegible]	[illegible]	In
				Water	[illegible]	Yes	[illegible]	[illegible]	[illegible]	Yes	[illegible]	[illegible]	[illegible]	[illegible]	-	OP	OP	CL	-	Rev. Flow	-	-	In
[illegible]	[illegible]	[illegible]	Chilled Water Return	Water	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Yes	[illegible]	B'fly	[illegible]	[illegible]	[illegible]	OP	OP	CL	AI	[illegible]	[illegible]	[illegible]	Out
				Water	[illegible]	Yes	[illegible]	[illegible]	[illegible]	Yes	[illegible]	B'fly	[illegible]	[illegible]	[illegible]	OP	OP	CL	AI	[illegible]	[illegible]	[illegible]	Out
[illegible]	[illegible]	[illegible]	Fire Protection Water	Water	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Yes	[illegible]	Gate	[illegible]	[illegible]	-	[illegible]	[illegible]	[illegible]	-	-	-	-	[illegible]
				Water	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Yes	[illegible]	Gate	[illegible]	[illegible]	-	[illegible]	[illegible]	[illegible]	-	-	-	-	[illegible]
[illegible]	[illegible]	[illegible]	RHR [illegible] Test and Pump Minimum Flow Line, RHR Steam Condensing Mode Bypass Line	Water	[illegible]	Yes	[illegible]	[illegible]	[illegible]	Yes	[illegible]	Gate	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	AI	[illegible]	[illegible]	[illegible]	[illegible]
				Water	[illegible]	Yes	[illegible]	[illegible]	[illegible]	Yes	[illegible]	Globe	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
				Water	[illegible]	Yes	[illegible]	[illegible]	[illegible]	Yes	[illegible]	Gate	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	AI	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	RHR [illegible] Test and Pump Minimum Flow Line	Water	[illegible]	Yes	[illegible]	[illegible]	[illegible]	Yes	[illegible]	Globe	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	AI	[illegible]	[illegible]	[illegible]	[illegible]
				Water	[illegible]	Yes	[illegible]	[illegible]	[illegible]	Yes	[illegible]	Gate	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	AI	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	HPCS Minimum Flow Line and Test Line to Suppression Pool	Water	[illegible]	Yes	[illegible]	[illegible]	[illegible]	Yes	[illegible]	Globe	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	AI	[illegible]	[illegible]	[illegible]	[illegible]
				Water	[illegible]	Yes	[illegible]	[illegible]	[illegible]	Yes	[illegible]	Gate	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	AI	[illegible]	[illegible]	[illegible]	[illegible]
				Water	[illegible]	Yes	[illegible]	[illegible]	[illegible]	Yes	[illegible]	Relief	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	Rev. Flow	-	-	[illegible]

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TABLE 6.2-33

POTENTIAL SECONDARY CONTAINMENT BYPASS LEAKAGE PATHS(1)(2)

Primary Containment Penetration No. Unit 1	Primary Containment Penetration No. Unit 2	Description	Valve No.	Valve Type	Loc.	Line Size	Bypass Leakage Barrier(3)	Expected Air Leakage Rate (SCCM)
P106		See P429						
P107		See P429						
P108	P424	Condensate Supply	P11-F060	Btf.	O	12.00	27(a)	0.63
			P11-F545	Chk.	I	12.00	27(a)	384.48
P109	P428	ILRT Blowdown Line	(6)	-	-	8.00	35	0.00
P111	P426	Condensate Return	P11-F080	Btf.	O	10.00	27(b)	0.52
			P11-F090	Btf.	I	10.00	27(b)	0.52

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TABLE 6.2-33 (Continued)

Primary Containment Penetration No. Unit 1	Unit 2	Description	Valve No.	Valve Type	Loc.	Line Size	Bypass Leakage Barrier(3)	Expected Air Leakage Rate (SCCM)
P114	P121	Containment Vacuum Relief	M17-F015	Btf.	O	24.00	19	3.60
			M17-F010	Chk.	I	24.00	19	3.40
				O-rings	I	24.00	19	(13)
P115		See P429						
P117	P123	Nitrogen Supply to CRO	P86-F002	Glb.	O	2.00	41	64.88
			P86-F528	Chk.	I	2.00	41	64.88
P119	P110	ILRT Pressure Indicating Line	(6)	-	-	0.50	35	0.00
P120	P427	ILRT Pressurization Line	(6)	-	-	8.00	35(b)	0.00
P131	P132	RWCU Pump Suction	G33-F001	Gate	I	6.00	49	192.24
			G33-F004	Gate	O	6.00	49	192.24

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TABLE 6.2-33 (Continued)

Primary Containment Penetration No. Unit 1	Unit 2	Description	Valve No.	Valve Type	Loc.	Line Size	Bypass Leakage Barrier(3)	Expected Air Leakage Rate (SCCM)
P308	P203	Service Air	P51-F150	Glb.	O	2.50	32	0.13
			P51-F530	Chk.	I	2.50	32	80.10
P309	P207	Demineralized Water	P22-F010	Gate	O	3.00	29	96.12
			P22-F577	Chk.	I	3.00	29	96.12
P310	P201	NCC Water Supply	P43-F055	Btf.	O	12.00	25(a)	0.63
			P43-F721	Chk.	I	12.00	25(a)	384.48
P311	P202	NCC Water Return	P43-F140	Btf.	O	12.00	25(b)	0.63
			P43-F215	Btf.	I	12.00	25(b)	0.63
P312	P215	Containment Personnel Air Locks(8)	P53-F541/ F571	Glb.	O	1.00	56	32.04
V313	V216	Containment Purge Supply	M14-F040	Btf.	O	42.00	30(a)	6.30
			M14-F045	Btf.	I	42.00	30(a)	6.30
			M14-F190	Btf.	I	18.00	30(a)	2.70
			M14-F195	Btf.	I	18.00	30(a)	2.70
V314	V214	Containment Purge Exhaust	M14-F090	Btf.	O	42.00	30(b)	6.30
			M14-F085	Btf.	I	42.00	30(b)	6.30
			M14-F200	Btf.	I	18.00	30(b)	2.70
			M14-F205	Btf.	I	18.00	30(b)	2.70
P315	P310	Standby Liquid Control	C41-F518	Glb.	O	2.00	60	0.16
			C41-F520	Chk.	I	2.00	60	0.16

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TABLE 6.2-33 (Continued)

Primary Containment Penetration No. Unit 1	Unit 2	Description	Valve No.	Valve Type	Loc.	Line Size	Bypass Leakage Barrier(3)	Expected Air Leakage Rate (SCCM)
P317	P217	Containment Radiation Monitoring Supply and Return	D17-F089A	Glb.	O	1.00	54	0.00
			D17-F089B	Glb.	I	1.00	54	0.00
			D17-F081A	Ball	O	1.00	54	0.00
			D17-F081B	Ball	I	1.00	54	0.00
		ILRT Instrumentation						
			E61-F549	Glb.	I	0.50		16.02
			E61-F550	Glb.	I	0.75		24.03
P318	P219	Post Accident Sampling	P87-F065	Sol.Glb.	O	0.50	58 (b)	0.43
			P87-F071	Sol.Glb.	O	0.50	58 (b)	0.43
			P87-F074	Sol.Glb.	O	0.50	58 (b)	0.43
			P87-F077	Sol.Glb.	O	0.50	58 (b)	0.43
P319	P442	ILRT Instrumentation						
			E61-F551	Glb.	I	0.75		24.03
			E61-F552	Glb.	I	0.50		16.02
P401	P401	Post Accident Sampling	P87-F037	Sol.Glb.	O	0.75	55	(12)

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TABLE 6.2-33 (Continued)

Primary Containment Penetration No. Unit 1	Unit 2	Description	Valve No.	Valve Type	Loc.	Line Size	Bypass Leakage Barrier(3)	Expected Air Leakage Rate (SCCM)
P424	P420	RWCU to Main Condenser and Radwaste	G33-F034	Gate	O	4.00	14	128.16
			G33-F028	Gate	I	4.00	14	128.16
P428	P309	Containment Vacuum Relief	M17-F035	Btf.	O	24.00	19	3.60
			M17-F030	Chk.	I	24.00	19	3.40
			O-rings		I	24.00	19	(13)
P429	P419	RHR A&B Relief Valve Discharge to Suppression Pool, RCIC Turbine Exhaust, and RCIC Pump Turbine Exhaust Vacuum Relief						
			N27-F751	Glb.	O	1.0	37	0.08
			P87-F083	Glb.	O	0.50	57	0.0
			P87-F264	Glb.	O	0.50	57	0.0
P436	P416	Containment Vacuum Relief	M17-F045	Btf.	O	24.00	19	3.60
			M17-F040	Chk.	I	24.00	19	3.40
			O-rings		I	24.00	19	(13)

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TABLE 6.2-40 (Continued)

Penetration No. Unit 1/Unit 2	Description	Penetration Test	Inboard Barrier Test	Inboard Containment Isolation Barrier Barrier Description/ Valve No.	Notes	Outboard Barrier Test	Outboard Containment Isolation Barrier Barrier Description/ Valve No.	Notes
			C	E51F068	13,26	-	Closed system	7
			C			-	-	
			C	E21F018	8,13	-	Closed system	7
			C	N27F751	13	B	N27DG027	13
			C	E51F077	13,25	C		
			C	P87F264	3	C	P87F083 *	3
P429/P419	RHR B relief valve discharge to suppression pool	-	-	Same as penetration P107/109			Same as penetration P107/109	
P422/P407	Steam supply to RCIC turbine @ RHR heat exchanger	B	C	E51F063	12	C	E51F064	-
			C	E51F076	3	C		
P118/P133	RHR heat exchanger vents to suppression vessel	-	C	E12F558A	13	C	E12F073A	13
			C					
P431/P421	RHR heat exchanger vents to suppression vessel	-	C	E12F558B	13	C	E12F073B	13
			C					

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TABLE 6.2-40 (Continued)

Penetration No. Unit 1/Unit 2	Description	Penetration Test	Inboard Barrier Test	Inboard Containment Isolation Barrier Barrier Description/ Valve No.	Notes	Outboard Barrier Test	Outboard Containment Isolation Barrier Barrier Description/ Valve No.	Notes
P317/P217	Containment Atmosphere Radiation Monitor	- -	C C	D17F081B D17F089B	23 23	C C	D17F081A D17F089A	- -
P319/P422	Containment Atmosphere Monitoring	-	A A	1/4" orifice and D23F030B 1/4" orifice and D23F040B	14,23 14,23	-	-	-
P320/P423	Containment Atmosphere monitoring	-	A A	1/4" orifice and D23F020B 1/4" orifice and D23F010B	14,23 14,23	-	-	-
P425/P219	Containment Atmosphere Monitoring	-	A	1/4" orifice and D23F050	14	-	-	-
P433/P220	Containment Atmosphere Monitoring	-	A A	1/4" orifice and D23F030A 1/4" orifice and D23F040A	14,23 14,23	-	-	-
P434/P221	Containment Atmosphere Monitoring	-	A A	1/4" orifice and D23F010A 1/4" orifice and D23F020A	14,23 14,23	-	-	-
P102/P102	Suppression Pool Level	-	A C C	G43F050A	14,23	-	-	-
P402/P402	Suppression Pool Level	-	A C C	G43F050B	14,23	-	-	-
P401/P401	Suppression Pool Level	-	A C C	G43F060	14,23	-	-	-
			C C	F87F037	3,9,14,23			
Various	Spares	-	A	Capped	-	-	-	-
Various	Electrical	-	B	Double O-rings	11	-	-	-

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available in the day tank and to alert the plant operators to any conditions which might jeopardize that objective so that corrective action can be taken.

Level switches are provided to automatically start and stop the fuel transfer pumps to maintain the fuel oil level in the day tanks within predetermined limits. Abnormal level conditions within the fuel tanks are annunciated in the control room. Pressure and level indicators are provided locally at the equipment as shown on Figure 9.5-8.

The diesel-generator fuel oil transfer system has two motor-driven fuel transfer pumps per day tank. These pumps are normally operated automatically, although manual operation is possible from the local control panel for functional checkout or instrumentation calibration. 430.13
In the automatic mode, a "low" level switch on the day tank starts the primary on-line pump. A separate "lowlow" level switch starts the standby pump and annunciates this condition on the standby diesel generator local control panel and in the control room by actuating the general diesel generator trouble alarm. Both pumps are stopped by individual "high" level switches. Additional level switches on the day tanks annunciate alarms on the standby diesel generator local control panel and in the control room if the tank level should continue to rise past the high level pump cutoff point or drop below the standby pump start level. Overflow is diverted back to the main storage tank.

Level switches are provided on the main storage tank to annunciate when fuel oil inventory drops below minimum required levels. Separate alarms are provided, both on the standby diesel generator local control panel and in the main control room, for level corresponding to a seven day supply of fuel oil and for level corresponding to a 24 hour supply of fuel oil. Alarms are also provided for the standby diesel generators only on the local diesel generator control panel for fuel oil transfer pump strainer high pressure drop. Actuation of any of the alarms on the local control panel annunciate the diesel generator trouble alarm in the control room.

Control room indication is provided for the storage and day tank levels. Local indication is provided for transfer pump discharge pressure, fuel oil strainer pressure drop, and standby diesel generator day tank level.

A discussion of diesel generator engine protection interlocks is contained in Section 8.3. The detailed description of the fuel oil day tanks, storage tank, and fuel transfer system is provided in Section 9.5.4 for the standby diesel generator, and Section 9.5.9.1 for the HPCS diesel generators. 430.13

2. Diesel Generator Starting Air System

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The diesel generator starting air system instrumentation and controls are provided to ensure that an adequate supply of compressed air is always available during plant operation. Alarms are provided to alert the plant operators to lack of adequate air pressure in either of each diesels redundant air start systems so that corrective action can be taken. The starting air system is completely described in Section 9.5.6 for the standby diesel generators and Section 9.5.9.1 for the HPCS diesel generators and is shown on Figure 9.5-10. Control of each engine's two independent air compressors is through controls mounted on a local panel. The compressor may be operated manually by use of a selector switch but the normal mode is automatic operation. Automatic controls cycle the compressor as required to maintain the required receiver tank pressure. A local pressure indicator is provided for each receiver tank. 430.36

To provide for monitoring of starting air availability and interfacing with the standby diesel generator engine controls, a pressure sensing line is routed from just upstream of each pair of air admission solenoid valves on the engine to the local diesel generator control panel. In the control panel these lines connect to the following instrumentation:

(a) Pressure switches, one per air start system, either of which will actuate common starting air pressure low alarms on the local diesel generator control panel and in the control room. Actuation of the local alarm also actuates the diesel generator trouble alarm in the control room.

(b) Pressure switches, one per air start system, which interlock with the diesel generator start circuit. Inadequate starting air pressure will prevent the corresponding start air admission solenoid valves from opening. 430.36

(c) Pressure transmitters, one per air start system, which provide signals to trip unit which controls each air compressor.

(d) Pressure gauges, one per air start system.

A discussion of engine generator protection [illegible] is contained in Section 8.3.

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5. Diesel Generator Lubrication System

The diesel engine lubrication oil system is provided with sensors, controls, and alarms as required to ensure complete monitoring of satisfactory system performance, safe engine operation, and to alert the plant operators to abnormal conditions requiring investigation and corrective action. For the standby diesel generators, this system is instrumented as shown on 9.5-11. For the standby diesel generators, instrumentation and controls are provided to monitor system pressures at important points, lubrication oil temperatures in and out of the engine, sump tank level, and provide automatic operation of the keepwarm circulating pump and heater. The HPCS diesel generator lubricating oil system is detailed in Section 9.5.9.4. 430.42

To alert the plant operators of abnormal conditions which should be investigated for corrective action on the standby diesel generators, alarms are provided for the following parameters:

On the standby diesel generator, the keepwarm oil pump is provided with controls permitting automatic or manual operation. Except for testing or maintenance situations the pump is operated in the AUTO mode and is interlocked with the diesel generator so that the pump runs whenever the diesel generator is not running. The keepwarm heater control is interlocked with the pump so that the heater can only be energized when the pump is running.

When the standby diesel generator keepwarm pump is running, the heater cycles on and off as demanded by a lubricating oil thermostat located on the engine.

Separate indicators are provided on the standby diesel generator local control panel for lubricating oil pressure, right bank and left bank turbocharger oil pressure and lubricating oil filter differential pressure. Thermocouples in the lubricating oil piping feed signals corresponding to lubricating oil temperature into and from the engine to the multiple position selector switch on the local control panel. Through the use of this switch, which also receives signals from the combustion air intake and exhaust system and the engine cooling water system, these temperatures may be displayed on the digital temperature indicator on the local control panel. 430.42

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Another set of thermocouples in the lubricating oil piping feed oil temperature in and out of the engine signals to a slow speed temperature recorder in the local control panel. This recorder operates continuously and provides a continuous record of important engine temperature for performance monitoring, trending and engine diagnostics.

4. Diesel Generator Cooling Water System

The diesel engine cooling water system is designed to remove the heat loads of the engine air intercooler, oil cooler and water jacket. Additional information on this system is provided in Section 9.5.5 for the standby diesel generators and Section 9.5.9.2 for the HPCS diesel generators.

4. In accident conditions with no loss of power, starts and stands by.

The diesel generator is only used for emergencies and testing. It is not used for peaking during normal operation of the station.

The manufacturer's recommendation specifies that at synchronous speed and loads less than 20 percent of rated, a 200 hour cumulative time limit should be placed on the diesel engine turbocharger. Between 20 percent and 50 percent load, there is a 1000 hour cumulative time limit. The time limits specified above are conservatively lower by a factor of three than the time limits arrived at from operating 430.12 experience, test and [illegible] ve[illegible]y [illegible]l generator overhaul should be undertaken [illegible] nt[illegible]

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In operating mode 1 [illegible] s n[illegible] placed under no load or light load conditions for extended periods. Indeed, the cumulative operating time under low load conditions should be very small compared with the cumulative time limit provided that operating procedures are followed (which includes compliance with Regulatory Guide 1.108).

In operating modes 2 and 3, the diesel generator is likely to operate under 430.31 low load conditions but in this instance the event is extremely rare and easily documented. To ensure adequate loading, the diesel generator shall be operated in accordance with the limitations and precautions of the manufacturer's recommendations. Operating procedures have been developed to assure operation through prevention of lubricant oil exhaust as well as in consideration of turbocharger problems.

b. Design Aspects

1. Start Initiating Circuits

The Division 3 (HPCS) diesel generator is started automatically upon receipt of a LOCA signal (high drywell pressure or reactor vessel level 2) or associated bus undervoltage signal. Manual

are qualified to operate under accident conditions from 40°F to 137°F, at 10 to 95 percent relative humidity and survive a total integrated radiation dose of 2×10^5 rads. The assemblies are seismically qualified to the Safe Shutdown Earthquake and Operating Base Earthquake acceleration response spectra and environmentally qualified. The enclosure dimensions are approximately 16x24x8 inches and accommodate power cable sizes from 6 AWG to 250 MCM.

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8.3.1.1.5.2 Components

Each of the high inertia motor generator sets have a voltage regulator which is designed to respond to a step load change of [illegible] percent of rated load with an output voltage change of not more than 15 percent. The motor generator sets require no manual operation or adjustment during the coastdown or acceleration period. High inertia is provided by a flywheel. The inertia is sufficient to maintain the voltage and the frequency of generated voltage within 5 percent of the rated values for at least 2 seconds following a total loss of power to the drive motor.

8.3.1.1.5.3 Sources

Power to each of the RPS buses is supplied from two 120 volt a-c sources. The primary source of power is the motor generator sets. The alternate source of 120 volt a-c power is the station non-Class 1E power supply. The two motor generator sets are supplied from separate 480 volt motor control centers fed from non-Class 1E buses. The alternate power switch design and arrangement prevents paralleling of the power sources. Indicating lights are provided in the control room to monitor the status of both the motor generator sets and the instrument buses.

8.3.1.1.5.4 Operating Configuration

During operation, the RPS buses are energized by the respective motor generator sets. Either motor generator set can be taken out of service by manually operating the power source selector switch which disconnects the motor generator set and connects the respective RPS bus to the alternate power source. Provision is made to prevent connection of both RPS buses to the alternate source at the same time. A loss of power to either motor generator set is monitored in the control room where the operator, upon detecting such a condition, can switch to

8.3.2 DC POWER SYSTEMS

8.3.2.1 Description

Five independent 125 volt d-c power systems are provided for each unit. Each of these systems consists of a battery, one or two battery chargers, d-c load center, distribution panels, and associated equipment. The five systems are identified as follows:

a. Non-Class 1E 125 volt d-c system A.
b. Non-Class 1E 125 volt d-c system B.
c. Class 1E Division 1, 125 volt d-c system.
d. Class 1E Division 2, 125 volt d-c system.
e. Class 1E Division 3, 125 volt d-c system.

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8.3.2.1.1 Non-Class 1E 125 Volt D-C Systems

Non-Class 1E 125 volt d-c system A supplies power for the inverter associated with the vital a-c system, and for instrumentation and control type loads, such as the main annunciator and the fire detection system. Non-Class 1E 125-volt d-c system B supplies power for loads such as motors, switchgear and transformer controls, and emergency lighting. This equipment is located in the turbine power complex. There is no interaction between the non-Class 1E 125-volt d-c systems and the Class 1E 125-volt d-c systems.

If the d-c batteries are the only available power source, the maintenance tie circuit breakers may be closed to allow the Unit 1 - Unit 2 batteries to be paralleled.

8.3.2.1.2 Class 1E Division 1 and Division 2, 125 Volt D-C Systems

8.3.2.1.2.1 General

The Class 1E Division 1 and Division 2, 125 volt d-c systems are two completely redundant systems. Each is capable of supplying required d-c power to associated

loads needed for safe shutdown. (No non-Class 1E loads are supplied from a Class 1E d-c system.) Each system includes a 60 cell, 1200 ampere hour battery, a 400 ampere battery charger, and a load center. The Division 1 system also includes a motor control center and a distribution panel. The Division 2 system has two distribution panels. In addition, 400 ampere reserve battery

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charger is provided for each division. These battery chargers are located with the equipment associated with Unit 1 but can be connected to the appropriate division of either the Unit 1 or Unit 2 Class 1E 125 volt d-c system by means of the maintenance tie buses. No interdivisional ties are provided between the divisions associated with Unit 1 or Unit 2. Maintenance tie buses connect only the same divisions of the two units (i.e., Unit 1, Division 1 to Unit 2, Division 1). If the d-c batteries are the only available power source, the maintenance tie circuit breakers may be closed to allow the Unit 1 - Unit 2 batteries to be paralleled.

Figure 8.3-21 illustrates the connection of batteries, battery chargers, load centers, motor control centers, and distribution panels of the Class 1E Division 1 and Division 2, 125 volt d-c systems. Each of the systems is of the two wire, ungrounded type.

Maintenance tie bus circuit breakers are normally open. These circuit breakers are manually operated under administrative control. They permit isolation of the battery and normal battery charger associated with either Unit 1 or Unit 2 for purposes of maintenance or equalizing the battery. Independence of the individual Class 1E Division 1 and Division 2, 125 volt d-c system is shown by Figure 8.3-21.

The reserve battery charger in each division is supplied from the associated Unit 1 480 volt a-c system. The Division 1 and 2 reserve battery chargers are supplied from different 480 volt switchgear sections than those which supply the normal battery chargers. Thus, a single failure in the 480 volt a-c system will not disable both battery chargers.

Batteries, battery chargers and distribution equipment for the Class 1E Division 1 and Division 2, 125 volt d-c systems are located in separate, locked rooms in a Seismic Category I structure (see Figure 8.3-4). DC system safety related equipment is identified in accordance with Section 8.3.1.1.2.9 and Table 8.3-3.

Each Class 1E 125 volt d-c system is equipped with a bus undervoltage relay and a battery undervoltage relay which, upon detection of an undervoltage condition, actuate a d-c system trouble alarm in the control room. Two voltage relays are also provided for each d-c bus for purposes of ground fault detection. One of these relays is connected from positive toground; the other, from negative to

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8.3.2.1.3 High Pressure Core Spray - Division 3 - Engineered Safety Features DC System

8.3.2.1.3.1 General

The objective of the Division 3, 125 volt d-c power system is to provide a continuous, and independent 125 volt d-c source of control and motive power as required for HPCS system logic, HPCS diesel generator control and protection, and all Division 3 related 125 volt d-c control. A normal and a reserve battery charger are provided. The reserve battery charger is connected to the tie bus between Units 1 and 2. The Division 3, 125 volt d-c system is classified as Class 1E. The system is independent of all other divisional batteries and there is no manual or automatic connection to Division 1 and 2 battery systems. A manually operated maintenance tie between Unit 1 and Unit 2 Division 3 d-c systems is provided. If the d-c batteries are the only available power source, the maintenance tie circuit breakers may be closed to allow the Unit 1 - Unit 2 batteries to be paralleled.

8.3.2.1.3.2 High Pressure Core Spray D-C Loads

Division 3, 125 volt d-c power is required for HPCS diesel generator field flashing, control logic, and the control and switching function of circuit breakers. Table 8.3-7 lists Division 3, 125 volt d-c loads.

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8.3.2.1.3.3 Battery and Battery Charger

The 125 volt d-c system for the HPCS power supply has a 60 cell, lead calcium battery (100 ampere-hours at 8 hours), one 50 ampere battery charger, one 50 ampere reserve battery charger, and a distribution panel with molded case circuit breakers. Figure 8.3-22 shows the connection of batteries, battery chargers, and distribution panel.

The 125 volt d-c system equipment is designed as Class 1E in accordance with the applicable clauses of IEEE Standard 308. It is designed so that no single failure in the system will result in conditions that prevent safe shutdown of the plant. The plant design and circuit layout of the d-c systems provide physical separation of equipment, cabling, and instrumentation essential to plant safety.

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9.2.3 DEMINERALIZED WATER MAKEUP SYSTEM

The primary water source for the demineralized water makeup system is raw Lake Erie water supplied by the service water system. An alternate and/or supplemental water supply is from the potable water system.

The Lake Erie water is pretreated with a biocide and coagulant chemicals in one or both of two coagulators provided for this purpose. The coagulator effluent is passed through gravity filters to a clearwell. Potable water can also be used as makeup to the clearwell in whole or part. Part of the clearwell water is used for miscellaneous services and the remainder is used for plant makeup to the demineralizers. The demineralizer system is not safety related. It consists of two parallel cation-anion trains with a two bed water storage tank followed by one mixed bed train with a mixed bed water storage tank. The system is designed to produce .0040 of the rated steam flow per unit with one cation-anion train and the mixed bed train, and .0080 of the rated steam flow per unit with both cation-anion trains and the mixed bed train. The two bed water is used to supply the mixed bed train and also miscellaneous services. The mixed bed water is used to supply miscellaneous services and makeup to the condenser, or alternatively, the condensate storage tank.

Demineralized water quality measured at the outlet of the mixed bed train will be as follows:

a.	pH	5.8-7.5 at 25°C
b.	Specific conductivity	$\leq$0.5 µmho/cm at 25°C
c.	Chloride (Cl)	$\leq$0.05 ppm
d.	Silica (SiO_2)	$\leq$0.02 ppm

The specific conductivity of the mixed bed effluent is continuously monitored and recorded. When the conductivity exceeds a preset value the mixed bed train is automatically shut down and alarmed at the local control panel. All local panel alarms are relayed to the main control room as a common trouble alarm.

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TABLE 9.2-9

EMERGENCY SERVICE WATER SYSTEM HEAT EXCHANGER HEAT LOAD AND OUTLET TEMPERATURES

	Heat Load (Btu/hr)		Outlet Temperature (°F)(2)	
Mode	RHR Heat Exchanger A	RHR Heat Exchanger B	RHR Heat Exchanger A	RHR Heat Exchanger B
a. Hot Standby(1)	0	0	Closed	Closed
b. Normal Shutdown	141.7×10^6	141.7×10^6	119	119
c. Continuation of Normal Shutdown	87.2×10^6	87.2×10^6	104	104
d. Post-Accident	166.4×10^6	0	126	126

NOTE:

1. During the steam condensing mode at 1/2 hour, two heat exchangers are required for condensing with a total heat load of 209.6×10^6 Btu/hr. At 1½ hour, one heat exchanger is required for condensing with a heat load of 150.4×10^6 Btu/hr and one heat exchanger is required for pool cooling with a heat load of 63.4×10^6 Btu/hr. At 4 hours, two heat exchangers are required for condensing with a total heat load of 126.6×10^6 Btu/hr and at 8 hours, one heat exchanger is required for condensing with a heat load of 106.4×10^6 Btu/hr.

2. Inlet temperature equals 80° F.

Building at Elevation 574'-10". Samples are drawn individually from the following points for each unit:

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- Drywell Atmosphere
- Containment Atmosphere
- Suppression Pool Atmosphere
- Annulus Atmosphere
- Reactor Water Recirculation System - 2 points
- Reactor Water Cleanup System - 3 points
- Residual Heat Removal System - 2 points
- Drywell Floor Drain Sump
- Suppression Pool

The location and routing of the sample points and lines are shown on Figures 9.3-33 Sheets 1 and 2.

The Post Accident Sampling System is manually controlled by an operator from the Process Control/Monitor Panel located adjacent to the Grab Sample Panels (CSP) and the Chemical Analysis Panel (CAP). There are two CSPs, one for each unit. In the event of a LOCA in one of the units, the CAP becomes dedicated to that unit and is isolated from the normal unit.

Liquid sample streams drawn from selected sample locations pass through a remotely located cooler rack to the Grab Sample Panel. Five individual sample streams can be collected for analysis. Dissolved gases are extracted and analyzed locally by the in-line dissolved hydrogen and total dissolved gas analyzer module. Liquid streams super saturated with gases are depressurized, degassed and directed to the Chemical Analysis Panel for pH, specific conductivity and dissolved oxygen analysis. Chloride and boron contents are analyzed using an ion chromatograph located near the chemical analysis panel. Diluted liquid samples are collected for onsite gamma spectrum and gross activity analysis in the station laboratory. Undiluted liquid samples can be collected for offsite analysis, if necessary.

A modified laboratory ion chromatograph, mounted on a mobile cart is provided for chloride and boron ion analysis. This unit can be attached to the CAP sample line by quick disconnects.

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2. Differential pressure switch (1M41-N030A, B; 2M41-N030A, B) across the supply fans (1M41-C001A, B; 2M41-C001A, B) to give indication on the local panel on low air flow. Differential pressure switches (1M41-N050A, B; 2M41-N050A, B) across the exhaust fans (1M41-C002A, B; 2M41-C002A, B) to give indication on the local panel on low air flow.

3. Temperature controller (1M41-R042, 2M41-R042) downstream of the heating coil to modulate the three way valve of the heating coil depending on the entering air temperature.

4. Temperature switches (1 & 2 M41-N280, 281, 282, 283) downstream of the heating coil to alarm and shut down the supply fans (1M41-C001A, B; 2M41-C001A, B) on low temperature.

   An audible alarm and an alarm acknowledge pushbutton is provided at the local panel. The acknowledge pushbutton silences the local audible alarm and clears the control room system trouble alarm.

5. Radiation monitor in the heater bay vent stack to alarm in the control room on detection of high radioactivity level in the exhaust air.

9.4.4.5.3 Off-Gas Building Exhaust System

a. Operation of this system is initiated manually from the control room. During normal operation, one of the two fans operate continuously. Details of the instrumentation and controls for this system are discussed in Section 7.6.1.12.a.9.

b. The operation of the off-gas holdup pipe room fan is initiated manually from wall panel 1H51-P5236 next to the off-gas holdup pipe room entrance. During normal operation of the off-gas system this fan would operate continuously.

9.4.5 ENGINEERED SAFETY FEATURES VENTILATION SYSTEM

The engineered safety features (ESF) ventilation systems discussed in this section are the emergency service water pump house ventilation system, emergency closed cooling pump area cooling system, ECCS pump room cooling systems, and the diesel generator building ventilation system. Additional ESF ventilation systems are discussed in the sections noted:

a.	Annulus exhaust gas treatment system	Section 6.5.3
b.	Control room HVAC and control room emergency recirculation system	Section 6.4
c.	MCC, switchgear and miscellaneous electric equipment areas HVAC/battery room exhaust system	Section 9.4.1
d.	Fuel handling area ventilation system	Section 9.4.2
e.	Control complex chilled water system	Section 9.4.9

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9.5.5 DIESEL GENERATOR COOLING WATER SYSTEM

The sections that follow discuss the cooling water system for the standby diesel generators. This system for the high pressure core spray (HPCS) diesel generator is discussed in Section 9.5.12.

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9.5.5.1 Design Bases

The standby diesel generator cooling water system is designed to dissipate the heat given up by the engine air intercooler, the lube oil heat exchanger, the governor cooler and the engine water jacket heat exchanger. There are no shared systems or piping interconnections among each of the standby diesel generators cooling systems. The jacket water heat exchanger is cooled with water from the emergency service water system. Cooling for the engine water jackets, the lube oil heat exchanger, governor cooler, and the engine air intercoolers is provided with a closed loop cooling system. The jacket water system coolant consists of demineralized water with corrosion inhibiting additives and ethylene glycol, added as required in accordance with manufacturer's recommendations. The performance and water chemistry of the diesel generator cooling water system is in conformance with the manufacturer's recommendations. 430.28

Conformance with applicable GDC's is discussed in Section 3.1. Conformance with regulatory guides is discussed in Section 1.8. Conformance with Branch Technical Positions ASB 3-1 and MEB 3-1, as related to breaks in high and moderate energy piping systems outside containment, is discussed in Sections 3.6.1 and 3.6.2. The guidelines presented in Branch Technical Position ICSB-17 (PSB) have been considered in the design of this system as described in Chapter 8.

9.5.5.2 System Description

The standby diesel generator jacket water cooling system is shown on Figure 9.5-9. 430.26, 32

day period would therefore be approximately 2.17 inches of water height or 6.64 gallons.

The NPSH required for the pump is 11.5 feet. At operating temperature and with the water at the low level alarm point the NPSH available is 10.05 feet. The results of this analysis indicate that the level decrease of 2.17" over a seven day period would not impair pump performance. 430.32

The keepwarm pump is of the horizontal, centrifugal type with a capacity of 50 gpm at 50 ft head with a three horsepower 460 volt, 3 phase, 60 hertz motor. The motor is powered from a safety related Class 1E motor control center. The pump may be momentarily stopped manually with its control switch; however, with its control switch in AUTO it will operate continuously with the diesel in standby and will de-energize when the diesel receives a start signal. 430.33 430.27 430.26

The standby diesel jacket water heat exchanger will be without emergency service water flow for approximately 70 seconds from the start of the diesel generators. Ten seconds are required to bring the diesel generator up to speed and 60 seconds or less elapse before the sequential loading process initiates emergency service water system operation. The standby diesel engine cooling water system can operate without emergency service water for 1-1/2 minutes before the maximum allowable cooling water temperature of 200°F is reached. The standby diesel cooling water system is required to remove 21,589,100 Btu/hr, and is capable of removing a maximum of 23,748,000 Btu/hr which is a heat rejection margin of 9 percent. The temperature of the cooling water coming out of the standby diesel during normal operation is approximately 175°F. 430.26

Control of the system is normally automatic during all modes of plant operation.

Details of the diesel generator starting sequence are discussed in Section 8.3.1. The cooling water system for the HPCS diesel generator is discussed in Section 9.5.9.2. 430.27

9.5.5.5 Instrumentation Application

The diesel generator cooling water system is provided with sensors, controls, and alarms as required to ensure complete monitoring of satisfactory system performance, safe engine operation, and to alert the plant operators to abnormal conditions requiring investigation and correctve action.

The diesel generator cooling water system is instrumented as shown on Figure 9.5-9 and described below. Instrumentation and controls are provided to monitor system pressure, cooling water temperatures in and out of the engine, standpipe level, and provide automatic operation of the keepwarm circulating water pump and heater.

To alert the plant operators to abnormal conditions which should be investigated for corrective action, alarms are provided for the following parameters:

a. Water pressure low
b. Standpipe level low
c. Water into engine temperature low 430.29
d. Water into engine temperature high
e. Water from engine temperature low
f. Water from engine temperature high
g. Circulating water pump/heater control switch not in "AUTO"
h. Trip of unit due to high temperature water from engine.

With the exception of item g., each parameter actuates a separate alarm on the local diesel generator control panel. The local alarm for item g. is shared with other control switches which are normally to be in an AUTO position. Actuation of any of the alarms also actuates a common diesel generator trouble alarm in the control room.

During the periodic surveillance testing of the complete diesel generator unit the engine will automatically trip if the cooling water temperature from the engine exceeds 200°F. This condition also actuates an alarm, h. above.

Each redundant diesel generator starting system train is capable of providing five cranking start cycles, each with a duration of three seconds.

Each air compressor is capable of recharging one air receiver tank from minimum (210 psig) to maximum (250 psig) starting air pressure in 28 minutes. The air compressors are reciprocating, two stage, air cooled type with a capacity of 84 scfm at a discharge pressure of 250 psig and a 30 horsepower motor.

The compressors may be operated with manual control switches; however, they normally are operated automatically by pressure transmitters and trip units which sense the air pressure from the respective receiver tanks. The pressure transmitters and trip units start and stop the compressors, as necessary, to maintain the desired system pressure range.

The after coolers are the air cooled type and are provided downstream of each compressor to cool the compressor discharge air temperature prior to entering the air dryer. The compressed air passes on the tube side of the cooler, and cooling air is fan-blown over the [illegible]. [illegible]ch [illegible]tercooler operates continuously in conjunction with it[illegible]. 430.38

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An air-to-air aftercooler is provid[illegible]tream side of the motor-driven starting air compressors to cool the compressed air prior to entering the air dryer. The compressed air passes on the tube side of the cooler and cooling air is fan-blown over the finned tubes. Each aftercooler operates continuously in conjunction with its respective compressor.

Each starting air dryer assembly consists of a prefilter, two dehydrator towers, an afterfilter, and the interconnecting piping and valves which control the air flow to each tower. Each air dryer assembly processes 77 scfm of air at 140°F and 250 psig through one of the two available dehydrator towers which contain desiccant to remove moisture. While one tower dries the air, the other tower is purged with a portion of the dried air to reactivate the dessicant. An automatic control system provided with the air dryer

If starting air pressure at the engine from either of the two redundant sections drops below the required minimum alarms are annunciated both in the main control room and at the local diesel control panel.

9.5.6.4 Inspection and Testing Requirements

Proper operation of the air compressors, aftercoolers, dryers, system low pressure alarms and the engine air admission valves will be checked at scheduled intervals to assure their availability. The following will be checked:

a. System pressure control pressure transmitters and trip units automatically start and stop the compressors, as required, to maintain the desired pressure range in their respective receiver tanks.

b. Low pressure alarm signals for low air pressure to the engine are actuated at the designated pressure. 430.36

c. Engine air admission valves function properly in response to the engine start control.

d. Pressure gauges on the receiver tanks indicate accurately.

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The immersion heater is 15 kW, 460 a-c, 3 phase, 60 Hz and is fed from its associated Class 1E motor control center. During engine shutdown conditions, jacket water heated by the immersion heater will circulate through the lube oil cooler by thermosyphon action to warm the lubricating oil which is circulated by an a-c motor-driven pump. This "keep warm" feature will provide the engine with capability of quick start and load acceptance. The engine low lube oil temperature condition is alarmed locally and annunciated on the main control room HPCS diesel generator trouble alarm.

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The closed loop water cooling system is connected to an external heat exchanger which dissipates heat to the emergency service water system.

The engine of the HPCS diesel generator is provided with two 50 percent capacity pumps. Both pumps are driven by the diesel engine. When the diesel engines are in the standby condition, the cooling water is maintained at a constant temperature by circulating it through the separate electric immersion heater. The jacket water heater element is installed near a low point in the diesel generator jacket water supply, and by natural convection circulation, the hot water from the heater, by being less dense, rises causing a natural flow. This flow causes a thermosyphon effect drawing water over the heater, which is set to maintain the jacket water temperature above 125°F at the engine inlet. The heat conduction from the water channels and the engine will keep the lube oil as well as the engine block warm. Operating experience has demonstrated that a motor driven jacket water "keep warm" pump is not necessary. This "keep warm" feature helps to provide the engine with high reliability and enhances its capability of quick start and load acceptance. The immersion heater is thermostatically controlled and operates in conjunction with a temperature controlled regulating valve. Natural circulation of the cooling water is used for the diesel generators.

The HPCS DGCWS also provides a sufficient heat sink to permit a hot HPCS diesel engine to start and operate for 2 minutes without standby service water flow through the DGCWS heat exchanger. Standby service water flow through the HPCS diesel generator DGCWS heat exchangers begins 10 seconds after the generator supplies power to the bus. Power is supplied to the bus 10 seconds after the HPCS generator start signal. Therefore, the additional time during

which the HPCS diesel engines could operate without emergency service water flow, the time margin, is 1 minute, 40 seconds. The DGCWS can be vented to ensure that the entire system is filled with water.

The diesel generator cooling water is treated as appropriate to preclude long term corrosion and organic fouling.

Demineralized water is used for makeup to the cooling water system. In the unlikely event that both the immersion heater and the diesel generator ventilation system fail, with concurrent severe weather conditions, ethylene glycol antifreeze may be added per manufacturer's recommendations. Since failure of these support systems would render a diesel generator inoperable, without corrective action, plant alarm response instructions would provide adequate assurance that action would be taken.

These additives are compatible with the carbon steel material construction of the cooling water system for diesels. Water chemistry complies with generally accepted water quality standards of the industry.

A diagram of the diesel generator cooling water system is shown in Figure 9.5-16. Component data for the diesel generator cooling water system is shown in Table 9.5-4. 430.28

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9.5.9.2.3 Safety Evaluation

The HPCS diesel generator cooling water system, except for components located on the diesel generator skids, is designed in accordance with the requirements of Section III of the ASME Boiler and Pressure Vessel Code. Components located on the diesel generator skids, are designed to DEMA standards except the jacket water heat exchanger which is designed to ASME - Section III.

The HPCS diesel generator cooling water system is Seismic Category I. Each diesel generator set, with its attendant cooling water system, is located in a separate Seismic Category I structure. No non-Seismic Category I structures or components are located close enough to impair diesel generator cooling. The system is classified Safety Class 3, as detailed in Section 3.2.

valve which in turn opens the air starting valve and releases the main starting air supply. Starting air passes through the air line lubricator, releasing an oil air mist into the starting motors. The motors drive the pinion gears, rotating the ring gear and cranking the engine. Only two of the air motor pinions need to be engaged to the flywheel ring gear of each diesel engine to start the engine. However, all four of the air motor pinions are normally engaged to the flywheel simultaneously to improve starting reliability, and to further ensure positive starting. Both solenoids are energized simultaneously and both banks of dual starting motors crank the engine to start in the required time.

The following measures have been taken in the design of the diesel generator starting systems to preclude the fouling of the air start valve or filter with moisture and contaminants such as oil carry-over and rust.

a. The air for the diesel is delivered to the air receiver by the air compressors where it is stored at rated pressure until required to start the diesel engine. Upon leaving the compressor, the air enters an air dryer, which removes moisture from the air. Each air dryer has a prefilter and an afterfilter to remove particulate contamination in the air flow. 430.35

b. The air start system is completely redundant. Failure of one system will not prevent the other system from starting.

c. Wye strainers are provided in the air start system piping to filter any particulate carryover. Inspection and cleaning of the system components are made after the initial trial runs during installation. It is expected that after the initial trial runs, all loose particles will either collect or get blown out.

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lake by means of the dicharge tunnel entrance structure (Figure 9.2-2). Makeup flow to each cooling tower varies from 16,000 gpm to 23,300 gpm depending on atmospheric conditions.

A blowdown system is provided at the circulating water pump discharge to maintain the concentrated solids in the system at a design level of 2-1/2 concentrations. The blowdown is added to the service water discharge flow and conveyed to the discharge tunnel entrance structure from which it will flow to the lake by means of the discharge tunnel. Blowdown from each cooling tower varies from 6,000 gpm to [illegible] gpm depending on atmospheric conditions.

Cleanliness of the main and auxiliary condenser tubes will be maintained by a mechanical cleaning system. A hypochlorite system will be used to provide the required level of chlorination for limiting algae growth in the cooling towers. Hypochlorite solution is added to the cooling water and circulating systems to prevent biological fouling such as accumulations of algae growth in the various system components. Some residual hypochlorite will enter the condensers which are mechanically cleaned.

The cooling and circulating water systems will be dosed separately with hypochlorite in accordance with Perry's National Pollutant Discharge Elimination System (NPDES) permit. Hypochlorite is injected into the circulating water systems at the discharge of the condensers and into the cooling water systems at the pump suctions.

Hypochlorite injection is initiated by a programmed timer for each system. Since the cooling water systems are once through type and the circulating water systems have continuous blowdown, a plant effluent dechlorination system utilizing sodium sulfite is used. The dechlorination system is programmed to operate in conjunction with the hypochlorite injection system to reduce residual hypochlorite in the plant effluent water to allowable limits.

Circulating water residual chlorine is continuously monitored for each unit. Plant effluent water consisting of cooling water discharge and circulating water blowdown is also continuously monitored for residual chlorine.

Personnel contamination survey instruments shall include Geiger-Mueller friskers and portal monitors. These instruments will be calibrated according to Health Physics Instructions at least annually when in use, or prior to use after repair. Personnel internal exposures will be evaluated by whole body counting as described in Section 12.5.3.6.2.

Typical personnel monitoring instruments are listed in Table 12.5-[illegible].

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12.5.2.3.4 Health Physics Equipment

Portable air samplers are used to determine airborne radioactive material concentrations. Portable air samplers will be calibrated for flow semi-annually in accordance with Regulatory Guide 8.25 and Health Physics Instructions. Typical surveys will be performed for particulate and radioiodine airborne concentrations. 471.17

Portable continuous air monitors will be used in various plant locations, and are normally located in the fuel handling building, solid radwaste drumming area, turbine operating floor, and the heater bay, to provide local information and trending data. Alarm setpoints are variable in accordance with health physics instructions. Audible and visual alarms are provided to warn local personnel of airborne radioactive concentrations in excess of specified limits.

Respiratory equipment will be provided and stored in the Respirator Cleaning and Issue Area or any remote controlled access point in the plant, as required. Emergency respiratory equipment shall be stored at strategic locations within the plant. The equipment will be maintained and used in accordance with applicable plant procedures and Health Physics Instructions. These instructions are prepared in conformance with Reg Guide 8.15.

Protective clothing will be provided for personnel working in radiologically controlled areas. Specific requirements for clothing will be prescribed by Health Physics personnel based on actual or anticipated radiological conditions. An adequate inventory of protective clothing will be maintained and available at in-plant clothing storage areas and access control points. This clothing includes: coveralls, booties, hoods, rubber overshoes, rubber gloves, cotton glove liners, and waterproof suits. All respiratory equipment complies with the guidelines of Regulation Guide 8.15.

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14.2.2.13 Startup Test Element Supervisor

The Startup Test Element Supervisor, under the direction of the Startup Test Program Director is responsible for startup test procedure preparation and for directing and coordinating the activities of the Test Coordinators, Test Directors, Test Engineers and the GE Startup Test Design and Analysis personnel, for all startup tests.

14.2.2.14 Test Coordinators, Test Directors and Test Engineers

Test Coordinators are responsible for coordinating startup testing with other plant activities. Test Directors, are responsible for individual startup test conduct and coordination, and preparation and analysis of startup test results. Test Engineers provide testing support as needed. Unless specified otherwise, only qualified Test Directors or Test Engineers may sign-off the satisfactory completion of startup test steps. When conduct of specific startup tests require more than one shift for completion, Test Directors will be assigned to provide 24-hour shift coverage for these tests. These Test Directors shall obtain concurrence to conduct all startup tests from the Operations Unit 1 or Unit 2 Unit Supervisor and shall keep the Unit Supervisor informed of the test and component status. Test Coordinators and Test Engineers will be assigned "as-needed" to support the Startup Test Element Supervisor or Test Directors.

14.2.2.15 Perry Plant Operations/Technical Department Personnel

The Perry Plant Operations/Technical Departments are responsible for the operations phase of the PNPP and will assume responsibility for operation and maintenance of PNPP systems upon turnover from NTS to PPOD/PPTD. The Manager of the Perry Plant Operations/Technical Departments have the necessary supervision and personnel reporting to them to efficiently execute this responsibility, as discussed in Chapter 13.

During the startup testing phase, PPOD/PPTD supervisors will be responsible for assigning their section personnel to support the Startup Test Program and providing technical expertise, as required, to review startup test procedures and results.

performance. The occurrence must be documented in the test report. DRAFT

Control System Operating Modes

Specific control systems operating modes are required for the performance of various startup tests. Table 14.2-7 provides a description of control system operating modes referenced in the startup test descriptions.

Plateau Instructions

A controlling instruction will be written for each test plateau which will identify those startup tests scheduled for each test plateau and for each test condition within these plateaus and will provide a means to ensure that all outstanding items are satisfactorily completed before entering the next test condition/plateau. These plateau instructions will follow the same format and approval process as the other startup tests.

14.2.12.2.1 Test Number 1 - Chemical and Radiochemical

a. Test Objective

This test describes how to collect chemical and radiochemical data for use in analyzing plant operations. During various plant conditions data is collected from the following systems: Reactor Water, Condensate, Feedwater, Control Rod Drive Water, Condensate Demineralizer, Reactor Water Cleanup, Main Steam and Liquid Radwaste. Using established methods and approved procedures, the analysis of the samples will be conducted and the results reviewed.

Chemistry data will be collected prior to fuel load, prior to heatup, during heatup, power ascension and during "No RWCU" test. The radiation doses at selected locations on Recirculation Piping and RWCU piping will be measured after plant shutdown to identify any buildup of radioactive crud in the piping.

General Chemistry data will be collected at various test conditions to gain baseline data to be analyzed and used for future plant testing.

The purpose for testing the chemical and radiochemical parameters of the plant are first; to verify that chemical parameters of the reactor coolant and selected support systems meet acceptable limits and second; to determine, using approved plant procedures, the adequacy of sampling equipment and analytical procedures/techniques for sampling. Additional objectives for this test are to evaluate fuel performance, confirmation of condenser integrity, demonstrate proper steam separation-dryer operation, and to measure and calibrate certain process instrumentation.

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b. Prerequisites and Initial Conditions

The preoperational tests have been completed as applicable. The following systems are available for operation: Reactor water cleanup, condensate demineralizers, fuel pool cooling and cleanup. Chemistry personnel are available to draw and analyze samples and sample systems are operational.

c. Test Instruction

Prior to fuel loading, samples will be taken to determine initial concentrations. Subsequent to fuel loading during reactor heatup and at each major power level change, samples will be taken and measurements will be made to determine the chemical and radiochemical quality of reactor water, chemical quality of reactor feedwater, gaseous activities at the offgas charcoal bed inlet, and performance of filters and demineralizers. Also, if necessary, NaOH may be injected into the reactor water to increase the Na-24 activity levels to aid in determining moisture carryover in the steam at the reactor exit.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

1. Chemical factors defined in the technical specifications and Fuel Warranty must be maintained within the limits specified.

2. The activity of gaseous and liquid effluents must conform to license limitations.

3. Water quality must be known at all times and must remain within the guidelines of the Water Quality Specifications.

Action	Test Conditions Reactor Pressure with Core Loaded psig (kg/cm²) 0	600(42.2)	800(56.2)	Rated
Position Indication	all			
Insert/Withdraw				
a) Single CRD Continuous Modes	all			
b) Gang Groups Continuous Modes	all			
Coupling	all			
Friction	all			50%***
Cooling Water Flow Rates (Total)				1
Individual CRD Scram	all	4*	4*	all
Individual CRD scram				4**

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NOTE: Single CRD scrams should be performed with the charging valve closed.

*Refers to four CRDs selected for continuous monitoring based on slow normal accumulator pressure scram times as determined from pre-operational testing, or unusual operating characteristics. The "four selected CRDs" must be compatible with the requirements of both the withdrawal sequence and the installed rod movement limitation systems.

**Scram times of the four slowest CRDs that are fully withdrawn will be determined at Test Conditions 1, 3, and 6 before or during planned reactor scrams. The CRDs selected for this test should be the same for Test Conditions 1, 3 and 6. (See Tests 25b, 27 and 28.)

***Rods to be tested are chosen by the Test Director. If hot test pressure for one or more drives exceeds maximum allowable pressure, test all drives and perform corrective action on all drives exceeding maximum allowable pressure.

d. Acceptance Criteria

Acceptance Criteria for Level 1:

1. Each CRD must have a normal withdraw speed less than or equal to 3.6 inches per second, indicated by a full 12-foot stroke in greater than or equal to 40 seconds.

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Acceptance Criteria for Level 2:

1. Each CRD must have a normal insert and withdraw speed of 3.0 ± 0.6 inches per second, indicated by a full 12 foot stroke in 40 to 60 seconds.

2. With respect to the control rod drive friction tests, if the differential pressure variation exceeds 15 psid for a continuous drive in, a setting test must be performed, in which case, the differential settling pressure should not be less than 30 psid nor should it vary by more than 10 psid over a full stroke.

   <u>NOTE</u>: For Perry, the differential settling pressure should be nominally 5 psid higher at the 00 position than at any other position due to the functioning of the spring actuated buffer piston located at the top of the drive.

3. The CRD's total cooling water flow rate shall be between 0.28 and 0.34 gpm times the total number of drives.

4. For vessel pressures below 950 psig, the maximum scram time of individual fully withdrawn CRD's shall comply with the criteria given in the GE Startup Test Specifications.

5. Buffer time (pickup of position indicator probe switch "52" to drop out of "52") shall not be less than 10 milliseconds when scram testing at nominal accumulator conditions with the reactor open to the atmosphere and 15 milliseconds at nominal accumulator conditions with the reactor at rated pressure. |

6. In the continuous ganged rod mode, the rods shall move together so that all rods are within two notches of all other rods.

Acceptance Criteria for Level 2:

If the above criteria are satisfied, then the APRM channels will be considered to be reading accurately if they agree with the heat balance, (to within +2, -2 percent of rated power as required by the Technical Specifications) or the value required by the Technical Specifications (based on the ratio of CMFLPD to FRTP).

14.2.12.2.11 Test Number 13 - NSSS Process Computer

a. Test Objective

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The purpose of this test is to verify the performance of the NSSS Process Computer and on-line NSSS computer programs under plant operating conditions.

b. Prerequisites and Initial Conditions

Computer hardware is checked out and operational. The computer stored data shall be compared to the GE supplied NSSS data. The TIP system is operable and the reactor power distribution is constant. The control rod pattern must have octant symmetry.

c. Test Instruction

The process computer system program verifications and calculational program validations at static and at simulated dynamic input conditions are preoperationally tested. Following fuel loading, during plant heatup, and the ascension to rated power, the nuclear steam supply system and the balance-of-plant system process variable values sensed by the computer as digital or analog signals will be verified to be received correctly. The results of performance calculations of the nuclear steam supply system and the balance-of-plant using these variable values, will also be verified correct.

14.2.12.2.22.3 Test Number 25C - Main Steamline Flow Venturi Calibration

a. Test Objective

The purpose of this test is to calibrate the main steam flow venturis at selected power levels over the entire core flow range, the final calibration taking place with the data accumulated along the 60 percent and 100 percent rod lines.

b. Prerequisites and Initial Conditions

The preliminary calibration of the differential pressure cells associated with the flow venturis has been completed. The ERIS system is available. The reactor water cleanup dump flow is zero.

c. Test Instruction

Plant data will be collected during power ascension and descent along the 60 percent and 100 percent rod lines. The accumulated data will then be compared against the calibration curves and calibrated feedwater flow to verify that the steam flow indication is accurate.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

The accuracy of the main steamline flow venturi relative to the calibrated feedwater flow shall be at least ±5 percent of rated flow at flow rates between 20 and 120 percent of rated. The repeatability/noise shall be within ±5 percent of rated flow.

14.2.12.2.24 Test Number 27 - Turbine Trip and Generator Load Rejection

a. Test Objective

The purpose of this test is to demonstrate the response of the reactor and its control systems to protective trips in the turbine and generator.

b. Prerequisites and Initial Conditions

The HPCS and RCIC systems are operable. ERIS is available. The Steam Bypass and Pressure Control System is in the NORM mode of operation. The preoperational tests have been completed as applicable.

c. Test Instruction

Turbine trip (closure of the main turbine stop valves within ~0.1 second) and generator load rejection (closure of the main turbine control valves in about 0.1 to 0.2 second) will be performed at selected power levels during the Startup Test Program. At low power levels (<40 percent), reactor protection is provided by high neutron flux and high vessel pressure scrams. At higher power levels (>40 percent), the reactor will scram by sensing loss of stop and control valve hydraulic fluid pressure in anticipation of valve closure. Backup scram action is provided by high neutron flux and high vessel pressure.

A generator load rejection will be performed at low power level, such that nuclear boiler steam generation is within bypass valve capacity, to demonstrate scram avoidance. At an intermediate power level, in excess of bypass capacity, a manual turbine trip will be performed, and the response of the plant to this trip and scram will be determined. A generator load rejection will also be performed at near 100% power.

Generator load rejections shall be initiated by opening the generator output breakers. The resultant automatic plant actions (e.g., turbine control valve fast closure, recirculation pump trip, reactor trip) will be analyzed for proper response. 640.56

It should be noted that above 40 percent power, the recirculation pump trip (RPT) feature automatically trips both recirculation pumps in response to both a turbine trip and a generator trip. The transient pressure rise will be limited by opening the bypass valves initially, and the safety/relief valves later, if required.

d. Acceptance Criteria

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Acceptance Criteria for Level 1:

1. For turbine and generator trips at power levels greater than 50 percent NBR, there should be a delay of less than 0.1 second following the beginning of control or stop valve closure before the beginning of bypass valve opening. The bypass valves should be opened to a point corresponding to greater than or equal to 80 percent of their capacity within 0.3 second from the beginning of control or stop valve closure motion.

2. Feedwater system settings must prevent flooding of the steam line following these transients.

3. The two pump drive flow coastdown transient during the first 3 seconds must be bounded by the criteria that is specified in Test 30 (see Section 14.2.12.2.27).

4. The positive change in vessel dome pressure occurring within 30 seconds after either generator or turbine trip must not exceed the Level 2 criteria by more than 25 psi.

   The positive change in simulated heat flux shall not exceed the Level 2 criteria by more than 2 percent of rated value.

5. If any safety/relief valves open, no more than one valve shall reopen after the first blowdown.

measurements and predictions of strain and vibration. Tolerances are based on instrument accuracy and suspension free play.

2. Operating Vibration: Acceptable levels of operating vibration and strain will be supplied by the vendor. The evaluation criteria consists of limits on vibratory displacement and strain. The limits have been set based on consideration of analysis, operating experience and protection of pipe mounted components.

14.2.12.2.30 Test Number 34 - Vibration Measurement

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a. Test Objective

To obtain vibration measurements on the reactor internal components to demonstrate the mechanical integrity of the system to flow-induced vibration.

b. Prerequisites and Initial Conditions

Reactor internals vibration sensors are installed and checked out. The vibration signal conditioning and data recording equipment has been installed. The preoperational tests have been completed as applicable.

c. Test Instruction

This test consists of measurements taken after fuel load and prior to initial nuclear heatup and at various power levels during power ascension. During non-nuclear heatup the thermal shock interlocks may be bypassed, if required, to place the recirculation pumps on fast speed.

Sensors used for the measurements are resistance wire strain gages, linear variable differential transformers (LVDT), and accelerometers with double integrating output signal conditioning. Sensors will be installed in a manner to indicate the most probable mode of vibration as indicated by analysis.

Vibration measurements will be obtained for various flows up to maximum flow. Maximum flow is the highest flow at which operation is permissible, and will be established by a vibrational limit or by an operational limit such as pump motor current, cavitation, core differential pressure, etc. The maximum flow is anticipated to exceed the rated core flow of the power-to-flow maps (Figures 15.0-1 and 4.4-2) and will be maintained only when necessary for internals vibration testing. Other tests may be performed in conjunction with internals vibration testing at flows greater than rated, but only for the purpose of data collection.

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14.2.12.2.37 Test Number 100 - Integrated HVAC

a. Test Objective

To demonstrate the ability of ventilation systems to maintain specified Unit 1 and common area temperatures and relative humidity within specified limits during plant operation.

b. Prerequisites and Initial conditions

Applicable preoperational tests have been completed. Ventilation systems are lined-up and operating. Outside atmospheric conditions are stable. Required test equipment is available and calibrated.

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c. Test Instruction

First at a low power level (approximately 15%), and then at a high power level (approximately 100%), data will be recorded to demonstrate proper operation of plant ventilation systems.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

Recorded data will be compared to GAI specified temperature and relative humidity limits. See Section 9.4.

14.2.12.2.38 Test Number 113 - Service Water System

a. Test Objective

The purpose of this test is to demonstrate that the service water system can provide a sufficient amount of cooling water to the heat loads it supplies.

c. Test Instruction

With the specified equipment in operation to provide a heat load, data will be recorded to ensure that this system is supplying sufficient cooling water to those components specified by

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d. Acceptance Criteria

Acceptance Criteria for Level 2:

The Emergency Closed Cooling System maintains its heat loads within the temperature limits specified by the vendor. See Section 9.2.2.

14.2.12.2.40 Test Number 115 - Nuclear Closed Cooling System

a. Test Objective

To demonstrate that the Nuclear Closed Cooling System (NCCS) can provide sufficient heat removal to the heat loads it supplies.

b. Prerequisites and Initial Conditions

The preoperational tests have been completed as applicable. The plant is operating at greater than or equal to 95 percent power and core flow. Specified equipment is in service to provide a heat load. The NCCS and associated heat loads have reached steady state conditions. The required instruments are operable.

c. Test Instruction

Flow and temperature data will be recorded to verify the acceptance criteria.

b. Prerequisites and Initial Conditions

The preoperational tests have been completed as applicable. Specified equipment is in service to provide a heat load. The required instruments have been calibrated.

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c. Test Instruction

Flow and temperature data are gathered with the maximum possible heat load on the Emergency Service Water System to verify its performance.

d. Acceptance Criteria

Acceptance Criteria for Level 2:

The Emergency Service Water System is capable of maintaining its heat loads within the limits specified by the vendor. See Section 9.2.1.

14.2.12.2.43 Test Number 118 - Circulating Water System

a. Test Objective

To demonstrate that the Circulating Water System can provide sufficient heat removal to its heat loads.

b. Prerequisites and Initial Conditions

The preoperational tests have been completed. The unit is operating near 100 percent power with specified equipment in operation. The circulating water system and its heat loads have reached steady state conditions. The required instruments have been calibrated.

c. Test Instruction

Temperature and flow data will be recorded and used to verify the acceptance criteria.

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c. Test Procedure

During preoperational, acceptance and other system testing, the system piping will be visually inspected for vibration. If visual inspection detects questionable vibration, the system will be checked using a vibration monitor.

d. Acceptance Criteria

1. Piping steady state and transient vibrations for BOP piping identified in the Test Objective, as a result of cyclic vibration in the range of 10^8 to 10^9 cycles shall be limited to 1/2 of the fatigue endurance limit, at 10^6 cycles, as defined in the ASME Code Appendix I. For those piping systems which the plant life cycle vibrations are expected to be 10^6 cycles or less, stress limits of the ASME Code Appendix I will be applied.

2. The total stress due to dynamic loading, plus all other combined stresses, shall not exceed ASME Section III of ANSI B.31.1 allowable stresses, as applicable.

14.2.12.4.2 Special Test Number 2 (Deleted)

(See Startup Test 123, Section 14.2.12.1.48)

TABLE 14.2-2 (Continued)

STI NO.	TEST NAME	COLD TEST OF OPEN RPV	HEAT UP	TEST CONDITIONS 1	2	3	4	5	6
122	BOP Piping Expansion and Vibration		X	X	X	X		X	X
123	Concrete Temp. Survey		X	X		X			X
124	Main and Reheat Steam								X
125	Condensate								X
126	Main, Reheat Extraction and Miscellaneous Drains					X			X
127	LP/HP Heaters Drains and Vents								X
128	Condensate Filters/ Demineralizers								X
129	Steam Seal			X		X			X
130	Condenser Air Removal		X						X
131	Off-Gas Vault Refrigeration		X						X
132	Turbine Plant Sampling								X
133	Loose Parts Monitoring System		X	X	X	X	X	X	X
134	Equipment Area Cooling			X					

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liquids in the Seismic Category I radwaste building. The radioactive inventory in the system is listed in Table 15.7-12.

b. After the liquids leave the building, they enter the porous concrete mat and are mixed with clean uncontaminated groundwater.

c. The plant operating procedures require that upon indication of a seismic event or high radiation levels in the radwaste building, the service and backup underdrain pumps are manually tripped with a positive, safety-related cutoff switch. In addition, in-line type radiation monitors located directly in the underdrain system effluent discharge line to the gravity discharge manholes will alarm in the control room and automatically stop the service and backup underdrain pumps upon detection of high radioactivity (see Section 11.5). The radwaste building is then inspected to determine whether a gross failure of any components housing radioactive liquids has occurred. If no failure has occurred, the underdrain pumps are reactivated. If failure is discovered, the pumps will not be reactivated until it can be determined that contaminated water has not entered the underdrain system. If radioactivity has been released to the underdrain system, the pumps will not be reactivated, and the groundwater will be allowed to rise to the gravity drain discharge system (Elevation 582.6').

The time required for this level to be achieved is approximately 80 days. During this time credit is taken for radiological decay of the released radioisotopes. The quantity of clean groundwater available for dilution at this time is conservatively calculated to be 1.72 million gallons.

d. This decayed and diluted mixture then drains via the gravity drain system to the emergency service water pumphouse bay area at a rate of 15 gpm (conservative estimate value of groundwater flow rate into underdrain system).

e. The isotopic concentrations are then further reduced by mixing with the minimum emergency service water flow of 15,000 gpm. No credit is assumed

for any dilution with the non-contaminated water in the emergency service water pumphouse bay.

f. The emergency service water pump would normally discharge to Lake Erie via the plant discharge tunnel where the radioactive liquids would be well mixed (diluted) with the non-contaminated lake water. In the event of a collapse or blockage of the non-seismic portion of the ESW discharge piping, however, the emergency service water system will discharge via a standpipe to the yard outside of the auxiliary building. At this location a grass swale is provided to carry the flow from the auxiliary building area, between the cooling towers, to the minor stream diversion on the east side of the plant. This water then flows in the stream diversion over the sediment control dam and ultimately enters Lake Erie at the shoreline. If this path were used by the effluents following the postulated accident, dilution of the radioactive liquids would occur in the minor stream diversion and in Lake Erie with the non-contaminated lake water. In calculating the resultant individual exposures from this pathway, it was conservatively assumed not to take credit for the dilution mechanisms available in the grass swale.

g. No credit is taken for any settling or plating out of the radioisotopes.

h. The dose conversion factors for the isotopes [illegible] are taken from Reference 2.

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i. For the purposes of calcul[illegible] the average fraction of MPC the total release of the radioisotopes into the lake is averaged over a one year period.

j. The resultant ingestion exposure is calculated for an individual drinking potentially contaminated water for a period of one year at a rate of 1,200 cc/day. The isotopic concentrations in this water are conservatively assumed to be the concentrations calculated at the nearest drinking water intake.

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TABLE 15.7-12

INVENTORY ACTIVITIES FOR LIQUID RADWASTE SYSTEM COMPONENTS(1)
(microcuries)

Isotope	Waste Collector Tank(2)	Waste Sample Tank	Floor Drains Collector Tank	Floor Drains Sample Tank	Chemical Waste Tank	Concentrated Waste Tank	Chemical Waste Distillate Tank	Spent Resin Tank	Cond. Filter Backwash Rec. Tank	Cond. Filter Backwash Settling Tank	RWCU F/D Backwash Settling Tank	Fuel Pool F/D Backwash Settling Tank
F-18	-	-	-	-	-	-	-	-	-	-	-	-
Na-24	-	-	-	-	-	-	-	-	-	-	-	-
P-32	-	-	-	-	-	-	-	-	-	-	-	-
Cr-51	6.6+4	6.6+4	6.6+4	6.6+4	1.9+5	1.9+6	1.9+1	8.4+7	2.6+4	3.1+5	7.8+7	3.2+7
Mn-54	5.3+3	5.3+3	5.3+3	5.3+3	1.7+[illegible]	1.8+5	1.7+0	9.7+6	2.1+3	2.6+4	6.8+6	3.2+6
Mn-56	-	-	-	-	-	-	-	-	-	-	-	-
Co-58	6.6+5	6.6+5	6.6+5	6.6+5	2.1+[illegible]	2.2+7	7.1+1	1.1+9	2.6+5	3.2+6	8.1+8	3.7+8
Co-60	6.6+4	6.6+4	6.6+4	6.6+4	2.2+[illegible]	2.2+6	2.2+1	1.3+8	2.7+4	3.2+5	8.4+7	4.0+7
Fe-59	1.1+4	1.1+4	1.1+4	1.1+4	3.2+[illegible]	3.2+5	3.2+0	1.6+7	4.2+3	5.0+4	1.3+7	5.8+6
Ni-63	-	-	-	-	-	-	-	-	-	-	-	-
Zn-65	2.7+2	2.7+2	2.7+2	2.7+2	9.1+[illegible]	9.3+3	-	4.8+5	1.1+2	1.3+3	3.3+5	1.6+5
Zn-69m	-	-	-	-	-	-	-	-	-	-	-	-
I-131	1.6+6	1.6+6	1.6+6	1.6+6	6.0+1	6.1+8	6.0+3	9.6+8	1.1+7	1.4+8	2.6+9	7.4+8
I-134	-	-	-	-	-	-	-	-	-	-	-	-
Sr-89	3.6+5	3.6+5	3.6+5	3.6+5	1.1+[illegible]	1.1+7	1.1+2	5.4+8	1.4+5	1.7+6	4.2+8	1.9+8
Cs-134	1.9+4	1.9+4	1.9+4	1.9+4	3.5+4	3.6+5	3.5+0	3.2+7	4.1+3	5.0+4	2.3+7	1.1+7
Cs-136	1.2+4	1.2+4	1.2+4	1.2+4	1.6+4	1.6+5	1.6+0	9.7+7	2.5+3	3.0+4	1.3+7	4.4+6
W-187	-	-	-	-	-	-	-	-	-	-	-	-
Sr-90	2.7+4	2.7+4	2.7+4	2.7+4	9.1+4	9.3+5	9.1+0	5.2+7	1.1+4	1.3+5	3.3+7	1.6+7
Y-90	-	-	-	-	-	-	-	-	-	-	-	-
Sr-92	-	-	-	-	-	-	-	-	-	-	-	-
Y-92	-	-	-	-	-	-	-	-	-	-	-	-
Mo-99	-	-	-	-	-	-	-	-	-	-	-	-
Tc-99m	-	-	-	-	-	-	-	-	-	-	-	-
Ru-103	2.3+3	2.3+3	2.3+3	2.3+3	6.7+3	6.8+4	-	3.2+6	8.8+2	1.1+4	2.7+6	1.1+6
Rh-103m	-	-	-	-	-	-	-	-	-	-	-	-
Ru-106	3.1+2	3.1+2	3.1+2	3.1+2	9.8+2	1.0+4	-	5.6+5	1.2+2	1.5+3	3.8+6	1.8+5
Ag-110m	8.0+3	8.0+3	8.0+3	8.0+3	2.7+4	2.7+5	2.6+0	1.5+7	3.2+3	3.8+4	1.0+7	4.9+6
Te-132	-	-	-	-	-	-	-	-	-	-	-	-
I-132	-	-	-	-	-	-	-	-	-	-	-	-
I-135	-	-	-	-	-	-	-	-	-	-	-	-
Cs-137	2.8+4	2.8+4	2.8+4	2.8+4	5.2+4	5.3+5	5.2+0	4.8+7	6.2+3	7.5+4	3.5+7	1.7+7
Ba-140	1.0+6	1.0+6	1.0+6	1.0+6	2.4+4	2.4+7	2.4+2	2.7+8	3.8+5	4.6+6	1.1+9	3.7+8
La-140	-	-	-	-	-	-	-	-	-	-	-	-
Ce-141	-	-	-	-	-	-	-	-	-	-	-	-
Pr-143	4.4+3	4.4+3	4.4+3	4.4+3	1.1+4	1.2+5	1.1+0	4.3+6	1.7+3	2.1+4	4.7+6	1.6+6
Ce-144	4.0+3	4.0+3	4.0+3	4.0+3	1.3+4	1.3+5	1.3+0	7.3+6	1.6+3	1.9+4	5.1+6	2.4+6
Nd-147	-	-	-	-	-	-	-	-	-	-	-	-
Pm-147	-	-	-	-	-	-	-	-	-	-	-	-
Np-239	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 15.7-12 (Continued)

Isotope	Waste Collector Tank	Waste Sample Tank	Floor Drains Collector Tank	Floor Drains Sample Tank	Chemical Waste Tank	Concentrated Waste Tank	Chemical Waste Distillate Tank	Spent Resin Tank	Cond. Filter Backwash Rec. Tank	Cond. Filter Backwash Settling Tank	RWCU F/D Backwash Settling Tank	Fuel Pool F/D Backwash Settling Tank
Pu-239	-	-	-	-	-	-	-	-	-	-	-	-
Sr-91	-	-	-	-	-	-	-	-	-	-	-	-
Y-91m	-	-	-	-	-	-	-	-	-	-	-	-
Y-91	-	-	-	-	-	-	-	-	-	-	-	-
Zr-95	4.6+3	4.6+3	4.6+3	4.6+3	1.7+5	1.8+6	1 [illegible]+1	9.2+7	1.7+4	2.0+5	-	-
Nb-95	-	-	-	-	1.4+4	1.5+5	1 [illegible]+0	8.7+6	1.8+3	2.2+4	5.7+6	2.[illegible]+6
Zr-97	-	-	-	-	-	-	-	-	-	-	-	-
Nb-97	-	-	-	-	-	-	-	-	-	-	-	-
Te-129m	4.0+4	4.0+4	4.0+4	4.0+4	-	-	-	-	-	-	-	-
Te-129	-	-	-	-	1.1+5	1.2+6	3 [illegible]+1	5.4+7	1.6+4	1.9+5	4.5+7	1.[illegible]+7
I-133	-	-	-	-	-	-	-	-	-	-	-	-
Ce-141	4.5+3	4.5+3	4.5+3	4.5+3	4.2+4	4.3+5	4 2+0	2.0+7	5.4+3	6.5+4	5.4+6	2. +6

NOTES:

1. Activity in detergent tank is negligible.
2. Where no value for activity is specified in the table the quantity is negligible.

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TABLE 15.7-14

ANNUAL INTEGRATED
RADIOLOGICAL DOSES FROM INGESTION OF
WATER FOR FAILURES IN THE QUALITY GROUP D
PORTION OF THE LIQUID RADWASTE SYSTEM

Component	Whole Body Exposure (mrem)[1]	Thyroid Exposure (mrem)[1]
1. Condensate Filter Backwash Settling Tank	1.2-1	4.9-3
2. Condensate Filter Backwash Receiving Tank	1.1-2	4.0-4
3. Chemical Waste Distillate Tank	1.2-5	2.1-7
4. Concentrated Waste Tank	8.9-1	2.1-2
5. RWCU Backwash Settling Tank	3.3+1	8.9-2
6. Fuel Pool F/D Backwash Settling Tank	1.6+1	2.6-2
7. Waste Collector Tank	2.6-2	5.7-5
8. Waste Sample Tank	2.6-2	5.7-5
9. Floor Drains Collector Tank	2.6-2	5.7-5
10. Floor Drain Sample Tank	2.6-2	5.7-5
11. Spent Resin Tank	4.8+1	3.3-2
12. Chemical Waste Tank	8.6-1	2.1-3

NOTE:

1. Based on the isotopic concentrations calculated to be present at the nearest drinking water intake.

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TABLE 15.7-15

RADIONUCLIDE CONCENTRATIONS AT NEAREST DRINKING WATER INTAKE FOR FAILURE OF SPENT RESIN TANK

Isotope	MPC	Radionuclide Concentration (uCi/cc)	Fraction of Maximum Permissible Concentration
F-18	5.0-4	(1)	(1)
Na-24	3.0-5	(1)	(1)
P-32	2.0-5	(1)	(1)
Cr-51	2.0-3	2.7-8	1.3-5
Mn-54	1.0-4	1.9-8	1.9-4
Mn-56	1.0-4	(1)	(1)
Co-58	9.0-5	1.1-6	1.3-2
Co-60	3.0-5	2.8-7	9.4-3
Fe-59	5.0-5	1.0-8	2.1-4
Ni-65	1.0-4	(1)	(1)
Zn-65	1.0-4	8.8-10	8.8-6
Zn-69m	6.0-5	(1)	(1)
I-131	3.0-7	1.24-9	4.2-3
I-134	2.0-5	(1)	(1)
Sr-89	3.0-6	2.3-7	7.5-2
Cs-134	9.0-6	3.7-8	4.1-3
Cs-136	6.0-5	1.8-9	3.0-5
W-187	6.0-5	(1)	(1)
Sr-90	3.0-7	6.2-8	2.1-1
Y-90	2.0-5	(1)	(1)
Sr-92	6.0-5	(1)	(1)
Y-92	6.0-5	(1)	(1)
Mo-99	4.0-5	(1)	(1)
Tc-99m	3.0-3	(1)	(1)
Ru-103	8.0-5	9.8-10	1.2-5
Rh-103m	1.0-2	(1)	(1)
Ag-110m	3.0-5	2.7-8	8.9-4
Te-132	2.0-5	(1)	(1)
I-132	8.0-6	(1)	(1)
I-135	4.0-6	(1)	(1)
Cs-137	2.0-5	5.9-8	3.0-3
Ba-140	2.0-5	1.5-8	7.3-4
La-140	2.0-5	(1)	(1)
Ce-143	4.0-5	(1)	(1)
Pr-143	5.0-5	9.0-11	1.8-6
Ce-144	1.0-5	7.4-9	7.4-4
Nd-147	6.0-5	1.0-11	1.7-7
Pm-147	2.0-4	(1)	(1)
Np-239	1.0-4	(1)	(1)
Pu-239	5.0-6	(1)	(1)

TABLE 15.7-15 (Continued)

Isotope	MPC	Radionuclide Concentration (μCi/cc)	Fraction of Maximum Permissible Concentration
Sr-91	5.0-5	(1)	(1)
Y-91m	3.0-3	(1)	(1)
Y-91	3.0-5	4.4-8	1.5-3
Zr-95	6.0-5	3.9-9	6.4-5
Nb-95	1.0-4	(1)	(1)
Zr-97	2.0-5	(1)	(1)
Nb-97	9.0-4	(1)	(1)
Te-129m	2.0-5	1.3-8	6.5-4
Te-129	8.0-4	(1)	(1)
I-133	1.0-6	(1)	(1)
Ce-141	9.0-5	4.5-9	5.0-5
Ru-106	1.0-5	6.0-10	6.0-5
Total		1.9-6	3.2-1

NOTE:

1. Concentration at nearest drinking water intake is negligible.

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TABLE 15.7-16

SUMMARY OF TOTAL CONCENTRATION AND TOTAL FMPC AT NEAREST DRINKING WATER INTAKE FOR FAILURES OF QUALITY GROUP D EQUIPMENT

Component	Radionuclide Concentration (μCi/cc)	Fraction of Maximum Permissible Concentration
1. Waste Collector Tank	1.2-9	1.9-4
2. Waste Sample Tank	1.2-9	1.9-4
3. Floor Drains Collector Tank	1.2-9	1.9-4
4. Floor Drains Sample Tank	1.2-9	1.9-4
5. Chemical Waste Distillate Tank	2.4-15	6.6-8
6. Condensate Filter Backwash Receiving Tank	4.9-10	1.2-4
7. Condensate Filter Backwash Settling Tank	5.9-9	1.5-3
8. Chemical Waste Tank	3.8-9	8.4-4
9. Concentrated Waste Tank	3.9-8	8.4-3
10. RWCU Backwash Settling Tank	1.4-6	2.3-1
11. Fuel Pool F/D Backwash Settling Tank	6.6-7	1.1-1
12. Spent Resin Tank	1.9-6	3.2-1

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Inspectors shall be qualified in accordance with applicable codes, standards and CEI training programs and their qualification and certification shall be kept current and documented.

Individuals performing inspections shall be other than those who performed or directly supervised the activity being inspected. Furthermore, the responsible inspector shall not report directly to the supervisor who is immediately responsible for the activity.

Witness or hold points are established either contractually by procurement documents or internally by plant procedures. When hold points have been established, work shall not proceed until either inspection is performed or waivered by the responsible QA Organization. When witness points have been established, the responsible QA Organization shall be given advance notification but work need not be stopped pending inspection or waiver. Justification for waivers for hold and witness points shall be documented by the responsible QA organization.

Inspection results shall be documented, evaluated and their acceptability determined by the responsible inspection group.

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CHAPTER 4

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492.27 We require that the LPMS be operational before the fuel loading. (4.4.6)

Response

The LPMS will be operational before the fuel loading in accordance with the Technical Specifications.

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CHAPTER 9

QUESTIONS AND RESPONSES (Q&R)

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430.40 (9.5.7) For the diesel engine lubrication system in Section 9.5.7 provide the following information: (1) define the temperature differentials, flow rate, and heat removal rate of the interface cooling system external to the engine and verify that these are in accordance with recommendations of the engine manufacturer; (2) discuss the measures that will be taken to maintain the required quality of the oil, including the inspection and replacement when oil quality is degraded; (3) describe the protective features (such as blowout panels) provided to prevent unacceptable crankcase explosion and to mitigate the consequences of such an event; and (4) describe the capability for detection and control of system leakage. (SRP 9.5.7, Part II, Items 8a, 8b, 8c, Part III, Item 1.)

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Response

The following response is applicable to the standby diesel generators:

1.

Lube Oil Cooler

	Shell Side (Lube Oil)	Tube Side (Jacket Water)
Flow (gpm)	500	900
Temperature In (°F)	185	148
Temperature Out (°F)	156	155
Heat Removal Rate (Btu/hr)	3,224,100	

2. The diesel engine manufacturer has provided a specification for the lube oil to be used in the engine. The required oil quality is maintained by performing monthly laboratory analysis on a sample of the lube oil. From the results of the analyses, it is determined if the oil quality has degraded and replacement is necessary. In addition, clogged oil filters will be annunciated.

3. The crankcase is fully enclosed and theoretically air tight.

Crankcase pressure is maintained at a level approximately atmospheric, measured in inches H_2O by a standard U-type manometer. During testing two motor-driven blowers are used to draw directly from the

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crankcase of each engine, and then the vapor is discharged through oil separators to remove the oil in the vapor. The discharged vapor is piped outside the engine room to the atmosphere.

Crankcase pressure readings shall be taken and compared with previous readings. In this way, gradual changes can be detected and investigated so that minor problems can be corrected before they reach major proportions. Should the readings indicate an increasing crankcase pressure, the cause should be promptly determined and corrected.

Crankcase pressure readings shall be carefully observed during heavy load operations. Should the pressure go to a high positive reading beyond the diesel trip setpoint, the engine will be shut down immediately except when operating under emergency conditions. The engine will not be operated with a high positive pressure inside the crankcase since this indicates that the action source for purging the crankshaft has been plugged and/or otherwise obstructed, or that some condition exists that is creating abnormal heat. If a hot spot develops in the engine and the oil flows or splashes over it, a considerable amount of oil vapor will be formed. This vapor is explosive and the engine will be stopped by the crankcase pressure trip described above. After such a trip, the engine will be allowed to rest for fifteen minutes to allow fumes and vapors to dissipate before removing any engine covers. The cause will be determined and corrected before continuing operation.

As a further safety measure, doors on the crankcase will automatically open if the pressure inside the crankcase exceeds the pressure of the ambient atmospheric pressure by 0.7 psi. The doors are designed so that only a small amount of vapor will be released to the room. No oil will be released.

4. The following are two methods to detect oil leakage from the system:

   a. Make comparisons of oil levels and the rate of level reduction with previous rates. An increase in the rate of reduction of the oil level could mean a leak in the system.

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CHAPTER 12

QUESTIONS AND RESPONSES (Q&R)

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471.15 (12.3.1.1) Outline the Perry Nuclear Power Plant's program for implementing a chemistry control program to reduce radiocobalt production and crud buildup in normally radioactive systems (See Regulatory Guide 8.8, Section C.2.e(3)).

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Response

The response to this question is provided in revised Section 12.3.1.1.

To further minimize corrosion and crud transport in operating conditions 1 and 2, oxygen shall be controlled in the range of 20 ppb to 200 ppb in the final feedwater. The condensate cleanup system is further described in Section 10.4.6.

The Company has participated in the BWR Radiation Assessment and Control (BRAC) Program since its inception in 1973. BRAC is a joint venture between utilities, General Electric and EPRI formed to investigate and research the problem of radiocobalt production and associated radiation field buildup on primary system piping. The Perry Plant design and operation of cleanup systems is based on results and recommendations that the BRAC program has developed through its research.

In addition to the installed water purification systems, consideration has been given to reduce radiocobalt production and crud buildup in normally radioactive systems through material selection and equipment design as discussed in Section 12.3.1.1.

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CHAPTER 14

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640.17 (14.2.12.1) Regulatory Guide 1.68.1 states the staff regulatory position for initial testing of BWR feedwater and condensate systems. In Section 1.8 you state you do not intend to commit to the preoperational testing section of the Regulatory Guide because those systems are not safety related. The staff position is that systems whose failure would challenge the safety systems should be preoperationally tested. Indicate specific items of Regulatory Guide 1.68.1 for which you do not intend to comply and justify.

Response

The reponse to this question is provided in revised Sections 14.2.12.3.11 and 14.2.12.3.8, respectively.

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640.18 (14.2.12.1) Section 14.2.12.1 of your FSAR does not indicate that the condenser circulating system described in Section 10.4.5 will be preoperationally tested in compliance with Regulatory Guide 1.68, Appendix A.1.f. However, 10.4.5.4 indicates that manufacturer's performance tests will be conducted. Will these tests include post-installation operability tests of all system equipment including piping, valves, pumps, tower, instrumentation and controls, chemistry control equipment, and protective devices?

Response

The response to this question is provided in revised Section 14.2.12.3.14.

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640.19 (14.2.12.1) The Perry FSAR does not indicate preoperational testing will be performed on non-IE power distribution systems in compliance with Regulatory Guide 1.68, Appendix A.1.g. Show that proper operation of all components whose failure would challenge safety systems will be demonstrated prior to fuel loading.

Response

The response to this question is provided in revised Section 14.2.12.3.22.

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640.38 (14.2.12.1) Based on Regulatory Position C.1.a of Regulatory Guide 1.68, and Appendix A.1.n(2) of this Regulatory Guide, the Nuclear Closed Cooling Water System should be preoperationally tested. Modify Section 9.2.8.4 and (or) 14.2.12.1 to include appropriate preoperational testing of this system.

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Response

The response to this question is provided in revised Section 14.2.12.3.16.

640.39 (14.2.12.1) Based on Regulatory Position C.1.a, and Appendix A.1.n(1) of Regulatory Guide 1.68, the Service Water System should be preoperationally tested. Modify Section 9.2.7.4 and (or) 14.2.12.1 to include an appropriate preoperational test.

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Response

The response to this question is provided in revised Section 14.2.12.3.15.

640.40 (14.2.12.1) Based on Regulatory Position C.1.a, and Appendix A.1.n(2) of Regulatory Guide 1.68, the Turbine Building Closed Cooling System should be preoperationally tested. Modify Section 9.2.9.4 and (or) 14.2.12.1 to include an appropriate preoperational test for this system.

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Response

The response to this question is provided in revised Section 14.2.12.3.17.

640.41 (14.2.12.1)

For our review of Sections 1.8 and 9.3.1.4 it is not clear to us as to what extent you intend to comply with Regulatory Guide 1.80 for the instrument air preoperational test. Provide a test description for the instrument air test.

Response

Clarification to the extent to which PNPP will comply with Regulatory Guide 1.80 is provided in revised Table 1.8-1.

The Safety Related Instrument Air System (P57) preoperational test description is provided in revised Section 14.2.12.1.48.

The Non-Safety Related Instrument Air System (P52) acceptance test description is provided in revised Section 14.2.12.3.19.

The Non-Safety Related Instrument Air System Loss of Instrument Air to acceptance test is provided in revised Section 14.2.12.3.19.2.

640.42 (14.2.12.1)	The communications systems described in Section 9.5.2 should be verified operable by testing prior to fuel loading. Expand Section 9.5.2.3 to indicate compliance with our position stated in Appendix A.1.n(13) of Regulatory Guide 1.68.

Response

The response to this question is provided in revised Sections 14.2.12.3.20 and 14.2.12.3.21.

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640.44 (14.2.12.1) Section 9.4.9.4 indicates that the containment vessel chilled water system and the turbine building chilled water system will be preoperationally tested in addition to the control complex chilled water system. However, 14.2.12.1 only covers the latter system. Confirm that all three chilled water systems will be preoperationally tested.

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Response

The response to this question is provided in revised Sections 14.2.12.3.18 and 14.2.12.3.23, respectively.

640.45 (14.2.12.1) Regulatory Guide 1.68 states that penetration cooling systems should be tested. Chapter 14 does not indicate that any such systems are to be provided or tested. Explain any testing or surveillance which you intend to perform during initial testing or subsequent inservice inspection to ensure that concrete in areas of high temperature penetrations is not subjected to temperatures in excess of design (200°F). If heat transfer analyses will be relied upon to ensure adequate cooling of high temperature penetrations by ventilation air, show that testing will confirm adequate air circulation in the vicinity of the penetrations.

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Response

The response to this question is provided in revised Sections 14.2.12.2.48.

640.50 (14.2.12.2) Regulatory Guide 1.68 Appendix A Item 5.x states that you should demonstrate adequate performance margin for auxiliary systems required to maintain proper environment in ESF spaces. Startup test No. 76 determines the ability of room coolers for RCIC and RHR (A&B) Pumprooms to meet design heat removal conditions. Explain why this test is limited to those spaces only.

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Response

During the preoperational test phase, heat balances will be performed on ESF equipment according to Section 14.2.12.1.26, 14.2.12.1.35, 14.2.12.1.36, 14.2.12.1.37 and revised 14.2.12.1.39, while the associated equipment is operating to produce a heat load.

During the startup test phase, nuclear plant heat will contribute substantially to the heat loads experienced by the RCIC pump room and the RHR (A&B) pump room coolers. Heat balances will be performed on these coolers while their associated equipment is operating with a nuclear heat load according to Section 14.2.12.2.59, Startup Test No. 134.

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640.58 (14.2.12) The following startup test abstracts should be modified to clarify the noted items:

1. The Control Rod Drive System Test (Section 14.2.12.2.5) Level 1 acceptance criteria should describe the allowable number of slow and inoperative CRDs.

2. The RCIC System Test (Section 14.2.12.2.12) Level 1 acceptance criteria should clarify reference to Figure 4.2-7. If this reference should be Figure 14.2-7, then this figure should be reinstated.

3. The Water Level Reference Leg Temperature Test (Section 14.2.12.2.13.1) appears to have omitted Level 2 acceptance criteria for the shutdown range and fuel range level instrument systems.

4. The Recirculation System - Trip of Two Pumps (Section 14.2.12.2.27.2) acceptance criteria reference Figure 14.2-6, which no longer addresses the concerns of this test. Either reinstate the appropriate figure, or modify the test to delete references to Figure 14.2-6 and further modify Figure 14.2-6 tto reference the test abstract to which it refers.

<u>Response</u>

This response is identical to the response to Question 640.65 since these questions are the same. The limitation on the number of slow CRDs will be added to Section 14.2.12.2.5. The limitation on the number of inoperative CRDs is not a test acceptance criteria, but is covered in the Technical Specifications.

Section 14.2.12.2.12 should reference Figure 14.2-7, which will be reinstated.