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October 30, 1986

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Byron Station Units 1 and 2
Braidwood Station Units 1 and 2
FSAR Update
NRC Docket Nos. 50-454/455 and 50-456/457

Dear Mr. Denton:

Enclosed with this letter is a set of revised FSAR pages for Commonwealth Edison's Byron and Braidwood Stations. These changes are primarily concerned with the preoperational testing program at the Byron and Braidwood Stations and were reviewed with members of your staff in Bethesda, MD on October 27, 1986.

These changes are being provided to you for your information and will be formally included in the next FSAR amendment for the Byron and Braidwood Stations.

If any further questions arise regarding this matter, please direct them to this office.

Very truly yours,

K. A. Ainger

K. A. Ainger
Nuclear Licensing Administrator

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Attachment

cc: Byron Resident Inspector
Braidwood Resident Inspector
L. N. Olshan - NRR
J. A. Stevens - NRR

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PDR ADOCK 05000454
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Four coil stack assemblies were removed from four hot control rod drive mechanisms mounted on 11.035-inch centers on a 550°F test loop, allowed to cool, and then placed without incident as a test to prove the preceding.

Coil Fit in Coil Housing

Control rod drive mechanism and coil housing clearances are selected so that coil heat up results in a close to tight fit. This is done to facilitate thermal transfer and coil cooling in a hot control rod drive mechanism.

3.9.4.3.4 CRDS Performance Assurance Program

Evaluation of Adequacy of Materials

The ability of the pressure housing components to perform throughout the design lifetime as defined in the equipment specification is confirmed by the stress analysis report required by the ASME Boiler and Pressure Vessel Code, Section III.

Internal components subjected to wear will withstand a minimum of 3,000,000 steps without refurbishment as confirmed by life tests (Reference 9).

To confirm the mechanical adequacy of the fuel assembly, the control rod drive mechanism, and full length rod cluster control assembly, functional test programs have been conducted on a full scale 12-foot control rod. The 12-foot prototype assembly was tested under simulated conditions of reactor temperature, pressure, and flow for approximately 1000 hours. The prototype mechanism accumulated about 3,000,000 steps and 600 trips. At the end of the test the control rod drive mechanism was still operating satisfactorily. A correlation was developed to predict the amplitude of flow-excited vibration of individual fuel rods and fuel assemblies. Inspection of the drive line components did not reveal significant fretting.

These tests include verification that the trip time achieved by the full length control rod drive mechanisms meets the design requirement of 2.4 seconds or less from beginning of decay of stationary gripper coil voltage to dashpot entry. This trip time requirement will be confirmed for each control rod drive mechanism prior to initial reactor operation and at periodic intervals after initial reactor operation as required by the proposed technical specifications.

There are no significant differences between the prototype control rod drive mechanisms and the production units. Design materials, tolerances and fabrication techniques are the same.

These tests have been reported in Reference 9.

It is expected that all control rod drive mechanisms will meet specified operating requirements for the duration of plant life with normal refurbishment.

If a rod cluster control assembly cannot be moved by its mechanism, adjustments in the boron concentration ensure that adequate shutdown margin would be achieved following a trip. Thus, inability to move one rod cluster control assembly can be tolerated. More than one inoperable rod cluster control assembly could be tolerated, but would impose additional demands on the plant operator. Therefore, the number of inoperable rod cluster control assemblies has been limited to one as discussed in the Technical Specifications.

In order to demonstrate proper operation of the control rod drive mechanism and to ensure acceptable core power distributions during operation, rod cluster control assembly partial-movement checks are performed on the rod cluster control assemblies. (Refer to Technical Specifications.) In addition, periodic drop tests of the full length rod cluster control assemblies are performed at each refueling shutdown to demonstrate continued ability to meet trip time requirements, to ensure core subcriticality after reactor trip, and to limit potential reactivity insertions from a hypothetical rod cluster control assembly ejection. During these tests the acceptable drop time of each assembly is not greater than 2.4 seconds, at full flow and operating temperature, from the beginning of decay of stationary gripper coil voltage to dashpot entry.

Actual experience in operating many Westinghouse plants indicates excellent performance of control rod drive mechanisms.

All units are production tested prior to shipment to confirm ability of the control rod drive mechanism to meet design specification-operational requirements.

Each production full length control rod drive mechanism undergoes a production test as listed below:

Test	Acceptable Criteria
Cold (ambient) hydrostatic	ASME Section III
Confirm step length and load transfer (stationary gripper to movable gripper or movable gripper to stationary gripper)	Step Length 5/8 ± 0.015 inch axial movement Load Transfer 0.047 inch nominal axial movement
Cold (ambient) performance test at design load - 5 full travel excursions	Operating Speed 45 in./min Trip Delay Free fall of drive rod to begin within 150 milliseconds

Units 1 and 2 Safety Injection Pumps A and B Rooms	364 feet-0 inch
Units 1 and 2 Positive Displacement charging Pump Rooms	364 feet-0 inch
Units 1 and 2 Centrifugal Charging Pumps A and B Rooms	364 feet-0 inch
Units 1 and 2 RHR Heat Exchanger Rooms	364 feet-0 inch
Units 1 and 2 Spray Additive Tank Rooms and Pipe Penetration Area	364 feet-0 inch, 383 feet-0 inch, 401 feet-0 inch
Units 1 and 2 Heat Exchanger Valve Aisle/Valves Operating Area	383 feet-0 inch
Spent Resin and Concentrates Room and Auxiliary Steam Pipe Tunnel	401 feet-0 inch, 394 feet-6 inches
Radwaste Distillate Condensers Rooms A, B, C	401 feet-0 inch
Radwaste Evaporator Rooms A, B, C	414 feet-0 inch
Radwaste Gas Compressors OA, OB Rooms	426 feet-0 inch
Clothes Change and Shower Room	426 feet-0 inch

Each non-accessible area exhaust filter plenum consists of the following components in sequence:

1. An isolation damper.
2. Three 20,950-cfm capacity each, HEPA filter plenums connected to operate in parallel, each consisting of the following components:
    - a) An isolation damper.
    - b) A high-efficiency prefilter.
    - c) A HEPA filter.
3. A bypass damper is provided downstream of the HEPA filters which provides direct connection to the Auxiliary Building Exhaust filter plenum, bypassing the charcoal adsorber.
4. Three, 20,950-cfm capacity each, charcoal adsorber plenums connected to operate in parallel, and each consisting of the following components:

Units 1 and 2 Safety Injection Pumps A and B Rooms	364 feet-0 inch
Units 1 and 2 Positive Displacement charging Pump Rooms	364 feet-0 inch
Units 1 and 2 Centrifugal Charging Pumps A and B Rooms	364 feet-0 inch
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   a) A high-efficiency prefilter.
   b) A HEPA filter.
3. A bypass damper is provided downstream of the HEPA filters which provides direct connection to the Auxiliary Building Exhaust filter plenum, bypassing the charcoal adsorber.
4. Three, 20,950-cfm capacity each, charcoal adsorber plenums connected to operate in parallel, and each consisting of the following components:

a) An isolation damper.

b) A charcoal adsorber with fire protection provisions.

c) A downstream HEPA filter.

5. Two nominal 62,840-cfm capacity each, charcoal adsorber booster fans. Each booster fan has a flow measuring element and a flow control damper downstream.

e. Fuel Handling Building Exhaust Plenum

This is described in detail in Subsection 6.5.1.2.3.

f. Accessible Area Exhaust Filter Plenums (Non-ESF)

Each of the four accessible area exhaust filter plenums A, B, C, and D, are identical, and each has 33% of the capacity required to treat exhaust air from non-accessible area, i.e. each plenum is designed to handle a nominal 54,100 cfm. Each accessible area exhaust filter plenum consists of the following components in sequence:

1. An upstream isolation damper.

2. Three 13,943-cfm capacity each HEPA filter subplenums each consisting of the following components:

   a) An isolation damper.

   b) A high-efficiency prefilter.

   c) A HEPA filter.

3. A downstream isolation damper and a backdraft damper before discharging into the Auxiliary Building exhaust plenum.

g. The high-efficiency prefilters provided in the Auxiliary Building Exhaust System are UL listed, all-glass media, exhibiting no less than 80-85% efficiency based on ASHRAE 52-1968.

h. The high-efficiency particulate air (HEPA) filter provided in the Auxiliary Building Exhaust System is water resistant and capable of removing 99% minimum of particulate matter which is 0.3 micron or larger in size. The filter is designed to be fire resistant. Each element provided is rated for 1000-cfm capacity. All elements are fabricated in

    a) A charcoal adsorber with fire protection provisions.

    b) A downstream HEPA filter.

5. Two nominal 62,840-cfm capacity each, charcoal adsorber booster fans. Each booster fan has a flow measuring element and a flow control damper downstream.

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g. The high-efficiency prefilters provided in the Auxiliary Building Exhaust System are UL listed, all-glass media, exhibiting no less than 80-85% efficiency based on ASHRAE 52-1968.

h. The high-efficiency particulate air (HEPA) filter provided in the Auxiliary Building Exhaust System is water resistant and capable of removing 99% minimum of particulate matter which is 0.3 micron or larger in size. The filter is designed to be fire resistant. Each element provided is rated for 1000-cfm capacity. All elements are fabricated in reactor) of the Containment Systems Experiment (CSE) at BNWL. In the 3 years since the containment spray tests were begun, the iodine-removal capability of spray systems has been well established by over 80 spray tests in the NSPP and 28 spray tests in the eight CSE experiments.

The verification of the containment spray system spray coverage within the containment and system design parameters has been completed at the Zion Station. The experimental verfication of the acceptability of the containment spray system as a viable means of rapidly removing iodine from the containment has been completed by Westinghouse Electric Corporation and reported in WCAP-7742 and other publications. The adequacy of sodium hydroxide spray additive has been documented in various ORNL and BNWL reports.

The extensive research on the behavior of iodine in accident environments and the dose reduction factors provided by containment spray systems has been completed, and the conclusion is that the containment spray system is an effective safety system which has been proven by experimental studies and large-scale model tests.

One of the advantages of the sodium hydroxide spray system is that it responds rapidly by starting to clean all the gas in the containment after an accident by absorbing and reacting with the airborne iodine. Other types of iodine-removal systems respond much more slowly and thus permit the iodine to remain airborne for a longer time. In comparison to other systems, the spray system is much simpler in design. It utilizes system components which are reliable and well understood through extensive use. The fission product removal capability is discussed in detail in Attachment A6.5.

6.5.2.4 Tests and Inspections

6.5.2.4.1 Preoperational Test Program

The preoperational test program may be conducted at any time. It does not rely on the functioning of any other pumping system. The pump discharge may be routed through the test recirculating line back to the refueling water storage tank (RWST), routed directly into the refueling cavity inside containment, or discharged outside the plant. The valve operating and pump starting times, the pump and eductor delivery rates, and valves adjusted to ensure proper flows through the eductors, will be recorded. The eductors will be tested with demineralized water instead of [redacted] hydroxide.

sodium

6.5.2.4.2 Reliability Tests and Inspections

Routine periodic testing of the Containment Spray components and support systems at power is planned. Remote operated valves are cycled to verify operability and inspected for leakage. The pumps are tested using the recirculation line to the RWST.

automatic safeguard actuation. Alarms on the main control board are provided for pump, automatic trip, automatic start, fail to start and valves fail to open.

Refueling water storage tank level is indicated on the main control board, and alarms are provided for high, low, low-low, and empty tank level.

Spray additive tank level is indicated locally and on the main control board, and alarms are provided for high, low, and empty tank levels.

During preoperational testing, adjustable manual valves CS018A or CS021A, and CS018B or CS021B in the caustic line will be set (utilizing water and correcting for specific gravity) and locked in position at the desired 30% NaOH rate of flow to the eductor (55 gpm). Main control board flow indicators are provided for pump discharge, pump recirculation, and eductor NaOH suction, and an alarm is provided for NaOH injection flow failure.

The temperature of the pump motor bearings is monitored. Ammeters are provided on the main control board to monitor motor current.

Design details of the containment spray controls and instrumentation are presented in Section 7.3.

6.5.2.6 Materials

All components in the containment spray system which come into contact with spray solution during either the injection or recirculation phase are fabricated of austenitic stainless steel. All containment materials are compatible with the NaOH solution with the exception of galvanized steel and aluminum. These materials are discussed in Subsection 6.2.5.

6.5.3 Fission Product Control Systems

The primary containment fission product control systems during normal plant operating conditions consist of the containment charcoal filter units and the containment normal and miniflow purge systems. For further discussion of these systems refer to Subsections 9.4.9 and 9.4.10.

The system which operates following a design-basis accident to remove fission products is the containment spray system. For further discussion of this system refer to Subsection 6.5.2.

a. Electrical Interlocks

1. Bridge, Trolley and Hoist Drive Mutual Interlocks

   Bridge, trolley and winch drives are mutually interlocked using redundant interlocks to prevent simultaneous operation of any two drives and can therefore withstand a single failure.

2. Bridge Trolley Drive - Gripper Tube Up

   Bridge and trolley drive operation is prevented except when the gripper tube up position switches are actuated. The interlock is redundant and can withstand a single failure.

3. Gripper Interlock

   An interlock is supplied which prevents the opening of a solenoid valve in the air line to the gripper except when zero suspended weight is indicated by a force gauge. As backup protection for this interlock, the mechanical weight-actuated lock in the gripper prevents operation of the gripper under load even if air pressure is applied to the operating cylinder. This interlock is redundant and can withstand a single failure.

4. Excessive Suspended Weight

   Two excessive suspended weight switches open the hoist drive circuit in the up direction to protect the fuel assembly and the refueling machine. The first switch is set to open the hoist drive circuit in the up direction, if the suspended weight is in excess of approximately 110% (2700+100/-0) of the combined weight of a fuel assembly, RCCA and the gripper mast. The second switch is set to open the hoist drive circuit in the up direction if the load is in excess of approximately 125% (3200+200) of the combined load of a fuel assembly, RCCA and the gripper mast.

5. Hoist-Gripper Position Interlock

An interlock in the hoist drive circuit in the up direction permits the hoist to be operated only when either the open or closed indicating switch on the gripper is actuated. The hoist-gripper position interlock consists of two separate circuits that work parallel such that one circuit must be closed for the hoist to operate. If one or both interlocking circuits fail in the closed position, an audible and visual alarm on the console is actuated. The interlock is therefore not redundant but can withstand a single failure, since both an interlocking circuit and the monitoring circuit must fail to cause a hazardous condition.

b. Bridge drive operation is prevented, except in the jog mode, when the hoist is not in the full up position.

c. An overload protection device is included on the hoist to limit the uplift force which could be applied to the spent fuel storage racks. The protection device limits the hoist load to 100% (4000 pounds) of the rated 2-ton hoist capacity and can withstand a single failure.

d. The design load on the hoist is the weight of one fuel assembly (approximately 1600 pounds), weight of one failed fuel container (approximately 1000 pounds), and the weight of the tool, which gives it a total weight of approximately 3000 pounds.

e. Restraining bars are provided on each truck to prevent the bridge from overturning.

f. Two independent wire ropes support the load and can withstand single failure.

Fuel Handling Tools and Equipment

All fuel handling tools and equipment handled over an open reactor vessel are designed to prevent inadvertent decoupling from machine hooks (i.e., lifting rigs are pinned to the machine hook, and safety latches are provided on hooks supporting tools).

Tools required for handling internal reactor components are designed with fail-safe features that prevent disengagement of the component in the event of operating mechanism malfunction. These safety features apply to the following tools:

a. Control rod drive shaft unlatching tool: The air cylinders actuating the gripper mechanism are equipped with backup springs which close the gripper in the event of loss of air to the cylinder. Air-operated valves are equipped with safety locking rings to prevent inadvertent actuation.

b. Spent fuel handling tool: When the fingers are latched, a pin is inserted into the operating handle and prevents inadvertent actuation. The tool weighs approximately 385 pounds and is preoperationally tested at 125% percent the weight of one fuel assembly (approximately 1600 pounds).

c. New fuel assembly handling tool: When the fingers are latched, a safety screw is screwed in, preventing inadvertent actuations. The tool weighs approximately 100 pounds and is preoperationally

TABLE 9.4-9

AUXILIARY BUILDING HVAC SYSTEM EQUIPMENT PARAMETERS

NAME OF EQUIPMENT	NUMBER, TYPE, QUANTITY, AND NOMINAL CAPACITY
A. PREFILTERS	OVA01FA, OVA01FB, OVA01FC, OVA01FD, OVA01FE, OVA01FF
Type	Medium Efficiency
Quantity	6
Capacity (cfm)	42,633
Pressure Drop: Clean (inches water)	0.34
Dirty (inches water)	1.00
Efficiency (% by ASHRAE 52-68 Test Std.)	30% (min.)
Media	Glass Fiber
B. FILTERS	OVA02FA, OVA02FB, OVA02FC, OVA02FD, OVA02FE, OVA02FF
Type	Medium Efficiency
Quantity	6
Capacity (cfm)	42,633
Pressure Drop: Clean (inches water)	0.39
Dirty (inches water)	1.00
Efficiency (% by ASHRAE 52 - 68 Test Std.)	80%
Media	Glass Fiber
C. HEATING COILS	OVA01AA, OVA01AB
Type	Hot Water
Quantity	2

TABLE 9.4-9 (Cont'd)

NAME OF EQUIPMENT	NUMBER, TYPE, QUANTITY, AND NOMINAL CAPACITY
Capacity (Btu/hr)	12.2×10^6
Air Quantity (scfm)	127,900
D. COOLING COILS	0VA02AA, 0VA02AB
Type	Chilled Water
Quantity	2
Cooling Capacity (Btu/hr)	6.5×10^6
Air Quantity (scfm)	127,900
E. SUPPLY FANS	0VA01CA, 0VA01CB, 0VA01CC, 0VA01CD
Type	Vaneaxial
Quantity	4
Drive	Direct
Capacity (cfm)	127,900
Total Pressure (inches water)	9.5
F. ESSENTIAL SERVICE WATER PUMPS 1A, 1B, 2A, 2B CUBICLE COOLERS	1VA01SA, 1VA01SB, 2VA01SA, 2VA01SB
Type	Built-up
Quantity	4
Following are the components:	
1. Fans	1VA01CA,B,C&D 1VA01CE,F,G&H 2VA01CA,B,C&D 2VA01CE,F,G&H
Type	Propeller
Quantity	8
Drive	Direct
Capacity (cfm)	25,575

TABLE 9.4-9 (Cont'd)

NAME OF EQUIPMENT		NUMBER, TYPE, QUANTITY, AND NOMINAL CAPACITY
N. FILTERS		0VA03FA, 0VA03FB, 0VA03FC, 0VA03FD, 0VA03FE, 0VA03FF, 0VA03FG, 0VA03FH, 0VA03FI
Type		High Efficiency
Quantity		9
Capacity (cfm)		20,950
Pressure Drop:	Clean (inches water)	0.20
	Dirty (inches water)	1.00
Efficiency (% by ASHRAE 52-68 Test Std.)		80%
Media		Glass Fiber
O. UPSTREAM HEPA FILTERS		0VA04FA, 0VA04FB, 0VA04FC, 0VA04FD, 0VA04FE, 0VA04FF, 0VA04FG, 0VA04FH, 0VA04FI
Type		Nuclear Grade
Quantity		9
Capacity (cfm)		20,950
Pressure Drop:	Clean (inches water)	0.83
	Dirty (inches water)	2.00
Efficiency (% minimum 0.3 micron and larger)		99.97
Media		Glass Fiber - Waterproof and Fire Retardant
P. CHARCOAL ADSORBERS		0VA05FA, 0VA05FB, 0VA05FC, 0VA05FD, 0VA05FE, 0VA05FF, 0VA05FH, 0VA05FI

TABLE 9.4-9 (Cont'd)

NAME OF EQUIPMENT	NUMBER, TYPE, QUANTITY, AND NOMINAL CAPACITY
Type	Tray
Quantity	9
Capacity (cfm)	20,950
Pressure Drop (inches water)	1.2
Media	2 inch - impregnated charcoal
Q. DOWNSTREAM HEPA FILTER	OVA06FA, OVA06FB, OVA06FC, OVA06FD, OVA06FE, OVA06FF, OVA06FG, OVA06FH, OVA06FI
Type	Nuclear Grade
Quantity	9
Capacity (cfm)	20,950
Pressure Drop: Clean (inches water)	0.83
Dirty (inches water)	2.00
Efficiency (% minimum 0.3 micron and larger)	99.97
Media	Glass Fiber - Waterproof and Fire Retardant
R. CHARCOAL BOOSTER FANS	OVA03CA, OVA03CB, OVA03CC, OVA03CD, OVA03CE, OVA03CF
Type	Vaneaxial
Quantity	6
Drive	Direct
Capacity (cfm)	62,840
Total Pressure (inches water)	5.4

TABLE 9.4-9 (Cont'd)

NAME OF EQUIPMENT	NUMBER, TYPE, QUANTITY, AND NOMINAL CAPACITY
Media	2 inches impregnated charcoal
V. DOWNSTREAM HEPA FILTER	0VA10FA, 0VA10FB
Type	Nuclear Grade
Quantity	2
Capacity	21,000
Pressure Drop: Clean (inches water)	0.83
Dirty (inches water)	2.00
Efficiency (% minimum 0.3 micron and larger)	99.97
Media	Glass Fiber - Waterproof and Fire Retardant
W. CHARCOAL BOOSTER FANS	0VA04CA, 0VA04CB
Type	Vaneaxial
Quantity	2
Drive	Direct
Capacity (cfm)	21,000
Total Pressure (inches water)	4.0
X. PREFILTER	0VA11FA-L
Type	Medium Efficiency
Quantity	12
Capacity (cfm)	13,943
Pressure Drop: Clean (inches water)	0.20
Dirty (inches water)	1.00

TABLE 9.4-9 (Cont'd)

NAME OF EQUIPMENT	NUMBER, TYPE, QUANTITY, AND NOMINAL CAPACITY	
Efficiency (% by ASHRAE 52 - 68 Test Std.)	80%	
Media	Glass Fiber	
Y. HEPA FILTERS	OVA12FA-L	
Type	Nuclear Grade	
Quantity	12	
Capacity (cfm)	13,943	
Pressure Drop: Clean (inches water)	0.83	
Dirty (inches water)	2.00	
Z. EXHAUST FANS	OVA02CA-D	
Type	Vaneaxial	
Quantity	4	
Drive	Direct	
Capacity (cfm)	136,080	
Total Pressure (inches water)	13.6	
AA. HVAC CHILLER ROOM AREA COOLERS	OVA02S, OVA035, OVA04S	OVA05S
1. Cooling Coils		
Type	Chilled water	Chilled water
Quantity	3	1
Air Quantity (cfm)	1200	800
Cooling Capacity (Btu/hr)	28,600	20,100
Water Quantity (gpm)	5.4	3.8

TABLE 14.2-11

AUXILIARY POWER SYSTEM

(Preoperational Test)

Plant Condition or Prerequisite

Prior to core load, Auxiliary Power system powered from offsite power supplies.

Test Objective

To verify proper operation of the auxiliary power transformers, breakers, switchgear, and other components.

Test Summary

Prior to core loading the auxiliary power system will be tested and verified that all interlocks, protective features, alarms, and indications are operational. It will demonstrate that a loss of offsite power will transfer to onsite power and function as per its design capabilities. Tests of the vital buses will be performed as early as the necessary components become available for testing, but not during the period when electrical separation requirements are in effect for Unit 1 operation and Unit 2 construction. It will also demonstrate that the two ESF Divisions 11 and 12 are completely independent. Voltages and proper phase rotations will be demonstrated to perform as per its design. Full accident load testing will be performed using the system auxiliary transformer, reserve feed, and diesel-generator. During full load accident testing, voltage readings of the off-site power source and voltage readings of the vital buses will be taken.

The voltage levels at the vital buses are predicted throughout the anticipated range of voltage variation of the offsite power source by an engineering analysis. Unit 1 readings will be taken at a threshold level equal to ~~30%~~ 30±2% of startup loading, include transient recordings for both safety and nonsafety motors, and at an initial minimum steady state loading. Unit 2 readings will only be taken at ~~30%~~ 30±6% loading in order to verify transformer TAP selection.

Acceptance Criteria

Each 480V or 4-kV Auxiliary Power bus can be supplied with power in accordance with Subsection 8.3.1.1.1.

TABLE 14.2-18

CONTAINMENT SPRAY SYSTEM

(Preoperational Test)

Plant Condition or Prerequisite

Prior to core load, and during ECCS full flow testing period.

Test Objective

To verify that the containment spray system can deliver water at proper flow and pressure to the containment spray headers.

Test Summary

All modes of containment spray pump operation will be tested to verify flow paths and pump flow and pressure characteristics. System response to a containment high-high-high pressure signal will be demonstrated. Spray nozzles will be tested using hot air injected into the nozzles and infra-red thermography or alternative methods to verify proper nozzle flow. Water injection through the spray nozzles is not planned. Spray pump "Head vs. Flow Curves" will be obtained while the pumps are in a recirculation mode back to the refueling water storage tank. Valve operability, interlocks, and indication will be verified. The paths for the air flow test of the containment spray nozzles will overlap the water flow test paths of the pumps at the connecting spool pieces.

The spray additive tank will be filled with demineralized water and with the containment spray pumps operating adjustment of valves CS018A or CS021A ~~and B~~ and CS018B or CS021B will be made to yield 55 gpm flow across ~~[illegible]~~ the respective flow indicator, corrected for specific gravity to simulate a 30% NaOH solution.

Acceptance Criteria

The containment spray system operates in accordance with Subsections 6.5.2.2 and 7.3.1.1.13.

QUESTION 212.18

> "The functional operability of the Control Rod Drive System in respect to its ability to bring the plant to a safe shutdown must be verified during preoperational and startup tests. Provide information on your test objectives, methods of testing and test acceptance criteria, so as to verify that functionability of this system will be shown. Test for scram times should envelope all system thermal hydraulic conditions which would be experienced during normal and off-normal conditions."

RESPONSE

Commonwealth Edison Company has purchased equipment for rod drop and sensor response timing but has not received functional instructions from the manufacturer for its use, therefore, a detailed test procedure has not been written for rod drop time measurements. In general, however, the rod cluster control assemblies will be dropped and the drop will be timed. The time from beginning of decay of stationary gripper coil voltage to dashpot entry shall be less than or equal to 2.4 seconds for each rod, the technical specification limit. In compliance with FSAR Table 14.2-66, all rods falling outside the two-sigma limit will be retested a minimum of three times each. Rods will be dropped into the cold (temperature <200° F) no flow, cold full flow, hot (~557° F) no flow, and hot full flow conditions. When the test is complete, it will be available for review.

In accordance with FSAR Table 14.2-65, the reactor trip system is verified operational in a preoperational test prior to fuel load. This test ensures that the system operates in accordance with the safety analysis report, design requirements, and plant installation. A final test is performed in which a manual reactor trip is initiated, with all rods out (after fuel load, prior to initial criticality), to verify that all rods do fully insert.

QUESTION 212.26

"Expand and clarify your discussion of the leakage detection system. Include a discussion of the system relative to each of the positions of Regulatory Guide 1.45. Provide diagrams showing the placement and design of the containment floor drain sump and their corresponding weir boxes."

RESPONSE

All Regulatory Guide 1.45 positions have been discussed in Section 5.2 of the FSAR except for the following:

Position 6. The Regulatory Guide requires that if a seismic (SSE) event occurs, one leak detection system must remain functional. The containment and reactor cavity sump leak detection system have been designed to remain functional after an SSE.

Position 7. The use of dewpoint and drybulb temperature and humidity are not relied upon to quantify leakage rate. This is because small leaks at high temperatures produce the same effects as large leaks at low temperatures. Likewise, containment radiation monitoring is not relied upon to quantify leakage rate since small leakage rates of systems with high radioactivity levels produce the same effects as large leakage rates of systems with low radioactivity levels.

Position 8. All parts of the leak detection system can be tested for operability and calibration.

Position 9. The technical specifications include the limiting conditions for identified and unidentified leakage and address the availability of various types of instruments to ensure adequate coverage at all times.

The location of the containment leak detection sump is shown in Figure Q212.26-1. Sump and weir box details are shown in Figure Q212.26-2.

QUESTION 212.29

> "It is not clear that the sytems of either the identified or unidentified leakage weir boxes have sufficient sensitivity to meet the detection requirements of Regulatory Guide 1.45. Provide design details to allow for staff evaluation of the system's sensitivities. Also discuss the calibration procedures which will verify that the desired sensitivity is obtained."

RESPONSE

The weir boxes are 27 inches wide x 18 inches deep x 24 inches high. The weir plate is 27 inches wide x 16 inches high having a rectangular 1/8-inch sharp-crested weir notch. The horizontal crest is located 4 inches above the bottom of the weir box and extends to the top of the weir plate. Assuming constant flow rates of 1 gpm for unidentified leakage, the height of the water behind the weir was calculated. The change in level is a function of flow and is detected by a differential pressure transmitter fed by a bubbler system. The verification of flow sensitivity is performed in the preoperational test by passing a known measured flow into the sump and detecting the desired response.

QUESTION 212.90

"Per SRP 5.2.5 (II.3), discuss reactor vessel sump level monitoring."

RESPONSE

The reactor vessel sump contains a weir box to collect, monitor, and detect leakage. The weir will detect and monitor a leakage rate of 1 gpm above the normal leakage rate, and the design will allow the detection system to respond to a 1 gpm increase in leakage within 1 hour. The weir box contains a bubbler assembly which detects level variations behind the weir box. This change in level is sensed by a differential pressure transmitter inside containment and the specific relationship that exists between water level and flow over the weir is verified in the preoperational test. The flow is recorded and alarmed in the main control room.

QUESTION 212.92

"Per SRP 5.2.5 (II.7), provide a discussion of the methods utilized in the calibration of flow and dewpoint measuring devices."

RESPONSE

Measurement of water flow over a weir is possible based upon the specific relationship that exists between water level above the weir crest and the flow over the weir. This relationship is verified in the preoperational test phase by introducing a measured water flow into the weir boxes and detecting the corresponding water buildup behind the weir. A bubbler system detects water level changes behind the weir and by means of a differential pressure transmitter generates a corresponding electrical signal. The relationship between water level and differential pressure is expected to remain constant. The transmitter will be periodically calibrated with test signals.

Measurement of dew point is accomplished using a commercially available dewpoint measuring instrument. It operates on the principle that for any given water vapor pressure in the atmosphere, there is an equilibrium temperature at which the water molecules leaving a saturated salt solution equal the water molecules reentering the solution. Therefore, measurement of this temperature is equivalent to measurement of the partial pressure of the water vapor in the atmosphere.

Calibration of the dewpoint sensor is checked as follows. The temperature probe is checked in a temperature controlled water bath. The electronics are adjusted based upon bath temperature using the characteristic curves provided by the manufacturer which relate equilibrium temperature to dewpoint.

After installation of the sensor, rough performance checks will be made by comparing instrument readings to other types of instruments such as a sling psychrometer or wet and dry bulb thermometers. Calibration however will be as described above.

QUESTION 212.93

"Per SRP 5.2.5 (II.8), provide a discussion on the provisions made to permit calibration and operability tests of the entire leakage detection system during plant operation."

RESPONSE

1. Containment and Reactor Cavity Sumps. The leakage flow is measured by a level sensing bubbler-transmitter system (see Question 212.92). The relationship of water level and differential pressure is not expected to vary. Channel calibration of this system will be performed during plant shutdowns at the appropriate interval.

2. Containment Atmosphere Radiation Monitor. This monitor is located outside the containment. A sample is piped to the monitor from the containment. The monitor will be calibrated and tested using manufacturer's recommended procedures and radioactive calibration test sources.

3. Containment Area Radiation Monitors are located inside containment. They are initially and periodically tested using a commercial gamma calibration facility installed in the station auxiliary building.

4. Containment air pressure is monitored as follows. A bellows assembly located within the containment has a port open to containment atmosphere. The other side of the bellows constitutes part of the pressure boundary of a sealed liquid system which penetrates the containment boundary and connects to a pressure transmitter. Four such systems are provided.

   Calibration is accomplished by connecting a test pressure source to the open port on the bellows assembly.

5. Dewpoint temperature instruments are calibrated as discussed in the response to Queston 212.92.

6. Radiation Monitors for intersystem leakage are located outside of containment and are calibrated and tested using manufacturers recommended procedures and test sources.

7. Monitors for S/G blowdown pH measurements will also be used to detect reactor coolant to steam generator leakage. The monitors will be calibrated using solutions of known pH.