It should additionally be noted that the enclosed trip report relates the staff's findings which resolve SER Confirmatory Issues (28) and (31), which we propose to document in a future Perry SER supplement. (See Page 27 and Page 13 of Enclosure 2, respectively).

It is requested that CEI formally document any corrective actions identified in the enclosed report not yet communicated for staff review/confirmation, within 30 days of Unit 1 fuel load.

Sincerely,

(S)

B. J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing

Enclosures: As stated

cc: See next page

DISTRIBUTION:

Docket File	JStefano	JMauck
NRCPDR	OELD	
LPDR	ACRS (16)	
NSIC	EJordan	
PRC System	JPartlow	
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MRushbrook	FRosa	

LB#1:DL	ICSB:DSI	LB#1:DL PWO for BJY
JStefano:kab	FRosa	BJYoungblood
05/29/85	05/29/85	05/30/85

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

MAY 31 1985

Docket Nos.: 50-440

Mr. Murray R. Edelman, Vice President
Nuclear Operations Group
The Cleveland Electric Illuminating Company
P. O. Box 5000
Cleveland, Ohio 44101

Dear Mr. Edelman:

Subject: Report of Plant Site Visit to Verify Installation of Instrumentation and Control System Design in the Perry Nuclear Power Plant, Unit 1

Transmitted herewith is a report of the April 23-25, 1985 visit to the Perry plant site by Mr. Jerry Mauck, the purpose of which was to verify that the instrumentation and control system design reflected in electrical schematics/ elementary drawings submitted for staff review, have in fact been installed in Perry, Unit 1. Areas of inspection concentrated on were selected in resolving relevant confirmatory issues, past and present, listed in Section 1.10 of the Perry SER (NUREG-0887), through Supplement No. 6 of the SER issued in April 1985. The agenda followed during the site visit may be found in Enclosure 1 to this letter. Enclosure 2 contains the trip report detailing the results of the areas reviewed during the site visit.

In general, it has been verified that the physical arrangement and installation of electrical, instrumentation and control equipment appear to be in accordance with applicable design criteria. However, one area of concern was identified during the site visit (reference: Enclosure 2, Pg. 21-22, Item d) regarding the physical separation between HPCS Division 3 and ATWS Division 3 which is designated Division 3 but is powered by the Division 1 ATWS system. According to drawings furnished by CEI, the HPCS Division 3 is designed to be separated from ATWS Division 3 by the use of conduits inside the Division 3 ducts and cells. However, it was found that the Division 3 cabling was not separated. The CEI staff indicated that this was in error and that the Division 3 ATWS cabling will be placed in conduits to provide the necessary separation from HPCS Division 3. This is acceptable to the staff and NRC confirmation of this corrective action will need to be performed prior to Unit 1 licensing.

It should additionally be noted that the enclosed trip report relates the staff's findings which resolve SER Confirmatory Issues (28) and (31), which we propose to document in a future Perry SER supplement. (See Page 27 and Page 13 of Enclosure 2, respectively).

It is requested that CEI formally document any corrective actions identified in the enclosed report not yet communicated for staff review/confirmation, within 30 days of Unit 1 fuel load.

Sincerely,

Paul W. O'Connor

for B. J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing

Enclosures: As stated

cc: See next page

PERRY

MAY 31 1995

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ENCLOSURE 1

INSTRUMENTATION AND CONTROL SYSTEMS BRANCH
SITE VISIT AGENDA FOR PERRY

1. Control Room

a. Review general layout of the control room.

b.* Review the RPS and ESF instrument cabinet wiring (identification of safety related and associated circuits, physical separation provided between redundant safety related circuits and between safety related and non-safety related circuits, isolation provided for interdivisional wiring, etc.).

c.* Review the internal wiring of the main control boards (physical separation between redundant safety related circuits and between safety related or non-safety related circuits, e.g., control and annunciator circuits).

d. Review the ERIS isolation devices and the associated equipment within the PGCC termination cabinets, and the annunciation provided upon self-test detected failures.

e.* Review the PGCC floor sections (metal barriers) used to provide physical separation between redundant safety related circuits and between safety related and non-safety related circuits.

f. Review the turbine first stage pressure indication provided at the trip unit modules used to bypass the end-of-cycle recirculation pump trip (RPT). Review the bypass status lights and the annunciation provided when either RPT logic division is bypassed.

g.* Review the safety relief valve position indication resulting from TMI Action Item II.D.3. In addition, review the calibration procedure for the SRV pressure switches (SSER 2, 7.5.2.1).

h. Review the containment pressure, water level, and hydrogen concentration instrumentation required by TMI Action Plan Item II.F.1 (4), (5), & (6).

i. Review the bypassed and inoperable status indication provided for the RPS, ESF systems, and other systems required for safety.

j. Review all ranges of reactor vessel water level instrumentation provided (indicators and recorders and their safety classification).

k. Review indication/annunciation for the following:

1. Transfer of control to the remote shutdown panel(s).

2. Reactor vessel low level & drywell high pressure.

3. ECCS low pressure permissive logic satisfied.

4. HPCS manual override (prevents auto restart at level 2).

5. SDV high level trip bypassed.

6. SLCS tank low temperature.

7. Unit Cooler low discharge flow, auto trip, reactor plant vent system inoperative, etc.

8. ADS manual inhibit switch operation.

2. Shutdown from Outside the Control Room

a.* Walk from the control room to the remote shutdown panels along the path to be taken by the operators in the event of control room evacuation.

b.* Review the instrumentation provided at the remote shutdown panels, and the locations of the transfer switches.

c.* Review the remote shutdown panel internal wiring (separation between safety related and non-safety related circuits).

d.* Review how a reactor trip may be accomplished from outside the control room.

e. Review remote shutdown panel accessibility, and the ventilation provided for the remote shutdown panel areas.

3. Reactor Building, Auxiliary Building, and Turbine Building

a. Review the safety relief valve (SRV) pressure sensors installed on the SRV discharge lines.

b.* Review the RPS MG sets, the associated electrical protection assemblies (EPAs), the EPAs provided between the RPS alternate sources and the RPS, and distribution panels P001 & P002.

c. Review the scram discharge instrument volume and associated instrumentation.

e. Review the ESF pump rooms (HPCS, RCIC, RHR, LPCS).

f.* Review the instrumentation (instrument lines, transmitters, and associated circuits) used to provide the low reactor pressure permissive interlock function for the redundant low pressure ECCS systems (for both injection valves and the suction valves from the recirculation loop). In addition, review the final HPCS initiation circuitry design (SSER 2, 7.3.2.2).

g. Review the following plant equipment:

1.* ADS solenoids.

2.* MSIV solenoids.

3. Diesel generators and local control capability.

4. SLCS pumps, explosive squib valves, and storage tank.

5. RCIS BJMs, transponders, and the control rod drive mechanisms.

6. TIP system.

7. Main steamline flow and radiation sensors.

8. MSIV LCS valves.

4. Circuit Traces

a.* Trace the circuitry (from sensors to protection system cabinets) used to transfer HPCS and RCIC pump suction to the suppression pool on CST low level.

b.* Trace redundant RPS circuits from the control room to the scram pilot valve solenoids at the individual HCUs.

5. Local Instrument Racks/Piping

a.* Review the physical separation between and the routing of redundant reactor vessel level instrumentation (from vessel taps to transmitters).

b. Review the turbine first stage pressure instrument taps and transmitters.

6. Capability for Testing

a.* Walk through the planned testing procedures (channel functional tests, logic tests, etc.) for a typical RPS/ESF initiation instrument and logic channels.

*These items should receive priority.

ENCLOSURE 2

ICSB TRIP REPORT
SITE VISIT - PERRY NUCLEAR POWER PLANT, UNIT 1
APRIL 23, 24, & 25, 1985

INTRODUCTION AND SUMMARY

On April 23, 24, & 25, 1985, the Instrumentation & Control Systems Branch (ICSB) conducted a site visit at the Perry nuclear power plant. The primary purpose of the site visit was to verify that the installation of electrical instrumentation and control equipment conformed to applicable design criteria regarding physical separation between redundant safety related circuits, and between safety related and non-safety related circuits (see Section 7.1.3 of the Perry SER, NUREG-0887). In addition, the Perry design was reviewed to verify that the actual installation of instrumentation and control systems was consistent with the staff's understanding of the design based on the review of electrical schematic/elementary diagrams and Chapter 7 (Instrumentation & Controls) of the FSAR. Additional areas of review included control room indication and annunciation, remote shutdown panels, instrument sensing lines, instrument racks, and capability for testing.

The results of the ICSB site visit are provided in the "Findings and Conclusions" section below. Each agenda item is listed in order, followed by a discussion of the design installation, based on observations made by the staff. Applicable sections of the Perry SER are referenced where appropriate. In general, the physical arrangement and installation of electrical, instrumentation, and control equipment appeared to be in accordance with the applicable design criteria. However, specific concerns

along with their potential resolution, were identified by the staff. We believe that followup actions should be pursued by Region III personnel.

Therefore, the ICSB will request the Perry Resident Inspectors' office to take followup actions for the items listed below. The specific sections of this report which address each of these items is given in parentheses.

1. Verify that Division 3 ATWS cabling is routed in separate conduits from the division 3 HPCS cabling. (2d)

2. Verify that Division 2 cabling is not physically touching Division 1 cabling and is in conduit that provides at least 1 inch air space in panel H13-P691. The reverse is true for panel H13-P692. (1b)

3. Verify that cover plate on cell 13-15 has been installed as specified in the control room cable routing diagram. (1e)

4. Verify that all nomenclature for the LPCS and RHR injection valve pressure permissive instrumentation is correct. (3f)

5. Verify that all nomenclature for equipment associated with the outboard main steam isolation valves is correct. (3g2)

6. Verify that the location of the Class 1E and non-Class 1E boundary for the RPS MG set control system is located at the EPAs. In addition, verify the location of the divisional and non-divisional boundary for the RPS MG set control system. (3b)

7. Verify that heat tracing has been installed on the safety related sensing lines located in the outdoor bunker that is adjacent to the condensate storage tank. (4a)

FINDINGS AND CONCLUSIONS

1. Control Room

a. Review general layout of the control room.

Discussion: The staff reviewed the general layout of the control room, including termination cabinets, instrument cabinets, and main control board indication, annunciation, and controls. Specific aspects of the Perry control room design are discussed in items b through k below.

b. Review the RPS and ESF instrument cabinet wiring (identification of safety related and associated circuits, physical separation provided and non-safety related circuits, isolation provided for interdivisional wiring, etc.).

Discussion: The internal cabinet wiring was reviewed in detail for the following control room panels:

. 1H13*B865 BOP SAFETY RELATED INST PNL DIV 1

. 1H13*P806 DIV 1 BOP AUXILIARY RELAY PNL

. 1H13*P691 REACTOR PROTECTION SYSTEM LOGIC DIV 1

. 1H13*P692 REACTOR PROTECTION SYSTEM LOGIC DIV 2

In general, internal cabinet wiring was found to conform to the separation criteria defined in Sections 5.6 (Control Switchboards) and 5.7 (Instrumentation Cabinets) of IEEE Standard 384 (IEEE Standard Criteria for Independence of Class 1E Equipment and Circuits), as stated in Section 7.2.3 of the Perry SER. Physical separation was provided by either metal barriers (plates, conduits, or raceways) or a 6 inch minimum separation distance.

With the exceptions discussed below, separation between wiring from redundant divisions within the reactor protection system (RPS) cabinets was found to conform to the applicable criteria. Wiring from all four RPS divisions was present in each of the four RPS cabinets. Separation was provided by conduit, a 6-inch separation distance, or relays. Two instances were found inside panels H13*691 and 692 where less than 6 inches of separation distance was provided between different divisional cables. These two deficiencies are associated with the source range monitors and are as follows. In each cabinet, divisional wiring has been run in conduits to a close proximity of its termination point (i.e., k13A and k21A). However, upon exiting the conduit in panel H13-691, the division 2 (blue wire) wiring is run along beside and in

some cases actually touches the division 1 wiring. The reverse is true for panel H13-692.

FSAR tables 1.8-1 and 8.1-2 cites IEEE Std. 384-1974 (Reference 1) and Regulatory Guide 1.75 Revision 2 (Reference 2) as design commitments for maintaining electrical independence of class 1E systems. Where analysis is not performed to establish the minimum separation distance, section 5.6.2 of IEEE Std. 384-1974 requires a minimum separation distance of 6 inches or barriers to be installed between redundant class 1E or between class 1E and non-class 1E wiring and equipment within panels. The minimum separation distance between wiring relative to a single barrier within panels is not discussed in IEEE Std. 384-1974, but guidance for an analogous configuration can be obtained from section 5.1 which states that the minimum distance between redundant enclosed raceways in plant areas shall be 1 inch.

The applicant presented a General Electric Engineering test report to demonstrate acceptability of the design. However, a staff review of this report has failed to demonstrate the acceptability of this interdivisional non-separation.

Therefore, we are requesting that the resident inspector at Perry verify that acceptable separation is provided between redundant safety related circuits in panels H13-P691 and P692.

The instrument cabinet wiring reviewed by the staff was found to conform to the requirements of Section 4.6 (Channel Independence) of IEEE Std. 279, with the exception of those cables discussed above. All associated circuits are identified and treated as Class 1E. Based on its site audit review, the staff concludes that pending correction of the separation deficiencies discussed above, the control room instrument cabinet wiring at Perry conforms to the applicable criteria listed in Chapter 7 of the Standard Review Plan (SRP), and therefore, is acceptable.

c. Review the internal wiring of the main control boards (physical separation between redundant safety related circuits and between safety related and non-safety related circuits, e.g., control and annunciator circuits).

Discussion: The internal wiring was reviewed in detail for the following control boards:

- 1H13*P601 ECCS BENCHBOARD
- 1H13*P601 REACTOR CORE COOLING BENCHBOARD
- 1H13*P680 CONTROL CONSOLE
- 1H13*P877 STANDBY DIESEL GENERATOR CONTROL AND DISTRIBUTION PANEL DIV 1, DIV 2

Control console 1H13*P680 contains mostly non-divisional wiring. Because of the high concentration of cables in this console, the tracing of safety related cables was difficult. The staff was able to partially

trace RPS divisional circuits associated with the reactor mode switch and the manual reactor trip (scram) pushbutton switches. The RPS divisional circuits were run in flexible conduit which terminated at metal enclosures housing the manual scram switch contact sections, and the individual mode switch sections, thus providing separation from non-divisional cabling and safety related cabling from redundant divisions. The separation provided within the console appeared to be acceptable.

ESF Division 1 and Division 2 wiring within the standby diesel generator board was separated by metal barriers and/or flexible conduit. Non-divisional wiring was separated from divisional wiring by 6 inches of air space.

Wiring for the Division 3 HPCS diesel generator is located in a single bay within 1H13*P601, section 16B. There was no Division 1 or Division 2 wiring located within the bay. Some non-divisional wiring was run in the cabinet but at least 6 inches of air space was maintained between divisional and non-divisional wiring.

Overall, the separation provided between redundant safety related circuits, and between safety related and non-safety related circuits within 1H13*P601 appeared to be adequate. Separation is provided by a combination of metal barriers, conduit, and 6-inch minimum separation distance. Non-divisional annunciator circuit wiring was routed through open raceways at the top of the control board. The staff concludes that the physical separation provided between redundant RPS and ESF circuits installed internal to the main control boards at Perry, complies with the applicable regulations concerning channel independence, and therefore, is acceptable.

d. Review the ERIS isolation devices and the associated equipment within the PGCC termination cabinets, and the annunciation provided upon self-test detected failures.

Discussion: The staff reviewed the emergency response and information system (ERIS) remote input modules (RIMs) used to provide isolation between safety related circuits and non-safety related ERIS circuits. The data acquisition system (DAS) portion of the ERIS executes self-test routines which detect both hardware and software failures. It is the staff's understanding that printouts and outputted alarms from ERIS are provided in the computer room (not in the main control room) upon DAS self-test. This room is continuously monitored. The ERIS interface cabinets were located at elevation 638. The Division 1 cabinets are H22-P110A2, P-110A-1, P111B, and P111A. The Division 2 cabinets

are H22-P112A and P112B and the Division 3 and 4 cabinet is P113. The non-safety related cabinets are H22-P-110B-1 and 2. Cabinet P-111B contained all division 1 (yellow) input cables of which most come from the PGCC termination cabinets. The actual isolation devices are in the GEDAC modules and at this point the safety related division 1 cables are taken through fiber optic devices and then routed to non-safety related inputs such as the process computer. The staff review of the ERIS cabinets including the isolation devices showed that divisional cables and non-divisional cables were separated and color coded for easy identification of the divisions.

e. Review the PGCC flow sections (metal barriers) used to provide physical separation between redundant safety related circuits and between safety related and non-safety related circuits.

Discussion: The staff reviewed the power generation control complex (PGCC) cable routing diagrams which provided a cell designation for the PGCC floor sections. The control room is divided into "units" which are comprised of one or more floor sections with similarly sized cable ducts. Cable ducts traversing the floor in the side to side direction are called lateral ducts and are located in the floor underneath the longitudinal ducts which traverse the floor section in the front to back direction. Each duct is divided into cells at the intersection of a lateral and a longitudinal duct. A cell is labeled by its latitude and longitudinal

coordinates, which are referenced around the parameter of each unit. We selected several different floor sections located in front of control room panels P691, P692, and P872 for our audit review. Where cables from redundant safety divisions and non-divisional cables were located in adjacent raceways, and/or raceways that crossed cable routing was consistent, with the exception discussed below, with the PGCC floor plan cable routing diagrams, and all cables within a given raceway and cell were associated with a single division.

At cell location 13-15, a cover plate was missing, therefore causing Division 1 (yellow) and Division 2 (blue) cabling to be located in the same cell. The applicant stated that General Electric drawing 865E749 sheet 2 shows that a cover plate is required at this location. Furthermore, the applicant stated that a 100% walk-through for cover plate installation is to be done for the fire protection review before fuel load.

Based on the audit review of cable routing within the PGCC floor sections at Perry, the staff has concluded that the installation of cables will be in conformance with the applicable design criteria. However, we are requesting that the Perry Resident Inspectors' Office verify that the cover plate for cell 13-15 is installed.

f. Review the turbine first stage pressure indication provided at the trip unit modules used to bypass the end-of-cycle recirculation pump trip (RPT). Review the bypass status lights and the annunciation provided when either RPT logic division is bypassed.

Discussion: The staff reviewed the indication provided at the individual trip units, C71-N652A,B,C, and D, located at the RPS instrument cabinets (H13-P691,2,3, and 4 respectively). The trip unit panel meters display the value of the measured parameter which can be scaled in units of the process variable. The meters are not considered an integral part of the safety system channels, since they are not in series with the current loops. The meters monitor the normalized voltage at the output of the input buffer amplifiers (this voltage varies from 1 to 5 volts for a corresponding 4 to 20 mA signal from the corresponding transmitters). The staff has determined that these meters are adequate for performing instrument channel checks to periodically verify that the output values of all four turbine first stage pressure channels are within an acceptable band. A deviation of one output value from the remaining three is indicative of a channel malfunction.

The staff reviewed the annunciation provided upon bypass of the RPT logic. Two annunciator points, one per division, are provided on the control console. No concerns were identified.

g. Review the safety relief valve position indication resulting from TMI Action Plan Item II.D.3. In addition, review the calibration procedure for the SRV pressure switches (SSER 2, 7.5.2.1).

Discussion: The Perry design features a single-channel system per SRV consisting of a pressure switch (General Electric drawing 219B4684) which is located at 620'6" elevation on a local instrument rack. This switch is mounted to a sensing line that routes inside the drywell to the SRV tailpipe located at elevation 635'.

The electrical output of the pressure switch is inputed to the position monitoring electronics (Panels 1H22-P090-1,2 and 3) which are located adjacent to the ATWS UPS (discussed above). The position monitoring electronics consist of 19 separate cards with five relays (k1-k5) mounted on each card. The outputs of these cards are routed to the control room where inputs to annunciators (one per division on panel 601 Section 19A) and indicators (one per SRV) are operated.

In addition to the pressure switches, thermocouples are also located in the discharge pipe of each safety/relief valve. The temperatures are monitored by a multipoint recorder that will provide an alarm upon detecting an excessive temperature signaling that one of the safety/relief valve seats has started to leak.

The staff finds that this installation meets the requirements of NUREG-0737 and is, therefore, acceptable.

The staff was then provided the surveillance instruction for calibration of these pressure switches titled "Safety Valve Tail Pipe Switch 1B21-N410A V Channel" (SVI-B21-J0368). This instruction stated that the Safety/Relief Valve Tail Pipe switches are functionally tested and calibrated monthly by simulating a high Tail Pipe pressure and verifying by valve status lights and computer points that the system is functioning properly. We concluded that this instruction satisfies the functional and calibration surveillance requirement of Tech. Spec. 3/4.4.2 table 4.4.2.1.1.a and 4.4.2.1.b.

In addition, based on our review of the calibration documentation, we concluded that the confirmatory item (31) discussed in Perry SER (NUREG-0887 dated May 1982) Section 7.5.2.1 is resolved.

h. Review the containment pressure, water level, and hydrogen concentration instrumentation required by TMI Action Plan Items II.F.1 (4), (5) and (6).

Discussion: The staff reviewed the ranges of indicators and recorders provided in the control room to monitor containment pressure, water level, and hydrogen concentration. For containment pressure, two 2-pen recorders (D23-R250A and B) were provided on panel H13-P883. Each recorder has a 0-60 psig wide range (blue pen) and a 0-20 psig narrow range (red pen). In addition, panel H13-P601 sections 17B and 20B contain two pressure indicators (D23-R024A and D23-R024B) whose range are 10 inches Hg to 20 psig.

There are two redundant sets of three suppression pool level transmitters and three instrumentation channels. Two channels of each set are narrow (16 to 19 feet) and extended wide (2 to 24 feet) range. The third of each set provides indication of containment water level from 16 to 96 feet.

Four hydrogen recorders (M51-R090-1,2 and 3) are to be installed in control room panel H13-P800. There will be one narrow range (0-6% H2) and one wide range (0-30% H2) per division. The overall adequacy of the containment pressure, water level, and hydrogen concentration instrumentation at Perry was determined acceptable based on the staff's review of the applicant's response to RG 1.97, Revision 2.

i. Review the bypassed and inoperable status indication provided for the RPS, ESF systems, and other systems required for safety.

Discussion: At the site, the staff confirmed its understanding of the inoperable and bypass status indication system. The staff verified that for a typical safety system, the following bypasses or inoperabilities will cause actuation of system level (and component level) annunciation:

1. Pump motor breaker not in OPERATE position
2. Loss of pump motor control power
3. Loss of motor operated valve control power/motive power

4. Logic power failure
5. Logic in test
6. System lineup improper
7. Bypass of test switches actuated

Auxiliary supporting system inoperability or bypass resulting in the loss of other safety-related systems will cause actuation of system level annunciators for the auxiliary supporting system as well as those safety-related systems affected.

The staff verified, as discussed in the SER, that the inoperable and bypass status indication system is designed to satisfy the requirements of IEEE Standard 279, paragraph 4.13, and Regulatory Guide 1.47.

j. Review all ranges of reactor vessel water level instrumentation provided (indicators and recorders and their safety classification).

Discussion: The control room indication of reactor vessel water level at Perry includes the following:

(1) Panel H13-P601, Section 20B

(a) fuel zone meter (B21-R610C)

-150-0-50 inches

(b) wide range recorder (Div. 1)

5-230 inches (blue pen)

(c) level recorder

5-230 inches (blue pen),

-150-0-150 inches (red pen)

(2) Panel H13-P601, Section 17B

(a) reactor shutdown meter (B21-R605)

165-570 inches

(b) fuel zone meter (B21-R610D)

-150-0-50 inches

(c) wide range recorder (B21-R-623B)

5-230 inches (blue pen)

(3) Panel H13-P680 Section 3B (Non-Safety Related)

(a) narrow range meters (606A,B and C)

165-230 inches

(b) wide range meter* (B21 R604)

5-230 inches

*being changed to a recorder (B21-R622)

(c) wide and upset range recorder (C34 R608)

165-230 inches (red pen)

165-350 inches (blue pen)

(d) Digital water level* (Section 10A)

*selectable to wide, narrow or shutdown range.

The ranges of the reactor vessel water level instruments appeared to be consistent with information provided in the Perry FSAR. The safety classification and associated divisions were clearly marked on the instrument labels. No concerns were identified.

k. Review indication/annunciation for the following:

1. Transfer of control to the remote shutdown panel(s).
2. Reactor vessel low level & drywell high pressure.
3. ECCS low pressure permissive logic satisfied.
4. HPCS manual override (prevents auto restart at level 2).
5. SDV high level trip bypassed.
6. SLCS tank low temperature.
7. Unit Cooler low discharge flow, auto trip, reactor plant vent system inoperative, etc.
8. ADS manual inhibit switch operation.

Discussion: The staff verified that control room annunciation is provided for the items listed above.

2. Shutdown from Outside the Control Room

a. Walk from the control room to the remote shutdown panels along the path to be taken by the operators in the event of control room evacuation.

Discussion: The staff walked from the control room to the Division 1 and Division 2 remote shutdown panels (located in the Division 1 and 2 switchgear and motor control centers respectively). The remote shutdown panels (RSPs) appeared to be reasonably accessible from the control room. The time it would actually take to reach the RSPs could not be determined since the final security systems for the control building and administrative controls for RSP access had not been implemented.

b. Review the instrumentation provided at the remote shutdown panels, and the locations of the transfer switches.

Discussion: All transfer switches are located at the Division 1 RSP (i.e., it is not necessary to actuate switches at other locations in the plant in order to take control of equipment from the RSPs, or to isolate the equipment from circuits located in the control room). The applicant indicated that procedures will instruct the operators to operate all transfer switches upon reaching the RSPs in order to divorce control of equipment from the control room as quickly as possible.

The following RSP indicators were identified (labeled) as safety related:

Division 1 panel 1C61*P001

. Reactor vessel pressure
. Reactor vessel level
. Drywell pressure and temperature
. Suppression pool temperature
. Suppression pool level
. RHR "A" flow
. RHR "A" heat exchanger cooling water flow
. RCIC flow
. RCIC turbine speed

Division 2 panel 1C61*P002

. Reactor vessel pressure
. Reactor vessel level
. RHR "B" flow
. RHR "B" heat exchanger cooling water flow
. Suppression pool temperature
. Suppression pool level
. Drywell pressure
. Drywell temperature

The above indications are consistent with information provided in the Perry FSAR (Section 7.4.1.4), and an Auxiliary Systems Branch (ASB) memorandum dated September 21, 1981 (from N. Fioravante to O. Parr) concerning instrumentation required for safe shutdown.

c. Review the remote shutdown panel internal wiring (separation between safety related and non-safety related circuits).

Discussion: Controls are provided for four Division 2 valves at the Division 1 RSP (RCIC isolation valves E51-F063 & F076, and RHR valves E12-F006B & F009). No separation concerns were identified between divisional circuits. Adequate separation is also maintained between divisional and non-divisional circuits. Isolation between the safety related RCIC gland seal compressor control circuits and the compressor's non-divisional power supply is provided. The ventilation system for the control room is M23.

The Division 2 RSP wiring was reviewed. All cabling appeared to be Division 2.

Based on its review, the staff concludes that the separation provided between redundant divisional circuits, and between divisional and non-divisional circuits at the RSPs at Perry is acceptable.

d. Review how a reactor trip may be accomplished from outside the control room.

Discussion: It is our understanding that the preferred method of scramming from outside the control room is by securing power to the APRMs. This is done by opening the APRM power breakers (EV-1A for Division 1 and EV-1B for Division 2) at the ATWS Distribution Panel (1R14-5015 and 1R14-5014) which is one floor below the control room and is non-keylocked. This method is preferred in that the MSIVs will remain open and the condenser and turbine will be retained as a heat sink. We did not identify any concerns associated with this method of accomplishing a reactor trip from outside the control room. However, we will expect certain surveillance specifications to be placed on these switches in the Perry Technical Specifications.

During the review of this panel, we noticed that a division 4 conduit was routed from the division 2 ATWS UPS panel. The applicant stated that this was the method they had chosen to create the ATWS division 4 so that it would be diverse (Non-fail safe and Class 1E) from RPS division 4. In addition, we learned that a division 3 ATWS had been created from the division 1 ATWS UPS and that the ATWS Class 1E UPS was the power source for the APRMs. This led to our concern that HPCS division 3 would then be routed along with ATWS division 3 which in reality was ATWS division 1 power. The applicant stated that according to the ATWS cable routing

criteria the ATWS division 3 has to be run in conduits such that it remains separated from HPCS division 3. However, after removing the floor panels in the vicinity of control room panel H13-P671, the staff discovered that only portions of the ATWS division 3 was conduited and therefore separated from HPCS division 3. The applicant stated that this was an apparent discrepancy in the cable routing and that a change order would be issued to correct the discrepancy.

We will request that the Perry Resident Inspectors' Office verify that the ATWS division 3 cabling is conduited and, therefore, separated from the HPCS division 3 cabling.

e. Review remote shutdown panel accessibility, and the ventilation provided for the remote shutdown panel areas.

Discussion: Division 1 RSP accessibility is with the use of keycard entries (same card) into the Division 1 switchgear and MCC room and then into the Division 1 RSP room. RSP Division 2 accessibility is with the use of a keycard (same one as above) into the Division 2 switchgear and MCC room. There is no RSP Division 2 room. RSP ventilation is discussed above.

3. Reactor Building, Auxiliary Building, and Turbine Building

a. Review the safety relief valve (SRV) pressure monitors installed on the SRV discharge lines.

Discussion: The SRV pressure monitoring instrumentation was reviewed and is discussed in item 1g above.

b. Review the RPS MG sets, the associated electrical protection assemblies (EPAs), the EPAs provided between the RPS alternate sources and the RPS, and distribution panels P001 & P002.

Discussion: The RPS sets, EPAs, and distribution panels are located at elevation 620 next to the motor control center and switchgear room. Redundant EPAs were provided between the RPS buses (P001 and P002) and both the MG sets and the alternate supplies. The staff identified conduits associated with each RPS input channel (i.e., A, B, C, and D) leaving each distribution panel (P001 and P002).

In addition, the staff identified the two EPA assemblies associated with the C71-P002 distribution panel and noted that they were packaged in wall-mounted enclosures on a seismic category I structure. After reviewing the RPS power supply equipment located in this room, we concluded that the design was consistent with the Perry RPS MG set control system elementary diagram. However, we are concerned regarding the Class 1E-

non-Class 1E boundary for this system. It is our understanding based on our Perry FSAR review and other recently licensed BWR reviews that this boundary should be at the EPAs. This would result in all equipment downstream of and including the EPAs to be Class 1E. As a result of our site visit, we have been led to believe that the Class 1E boundary begins with the PGCC termination cabinets and that the EPAs are the only Class 1E equipment associated with the MG set control system. Therefore, we request that the applicant verify the location of the non-Class 1E and Class 1E boundary and the divisional and non-divisional boundary for the MG set control system.

c. Review the scram discharge instrument volume and associated instrumentation.

Discussion: The staff reviewed the scram discharge instrument volume located on the east side (110°) of containment. The level in this instrument volume is monitored by two non-indicating float type level switches (LSN013C and D) and by three level transmitter (LTN012 A and B, LTN017A) activated trip units. Two level switches and two level transmitter trip units are combined in a one-out-of two twice logic that will provide redundant and diverse inputs to the RPS. The other level transmitter (LTN017A) is used for the rod withdrawal block circuitry. Based on our audit review, the staff concluded that divisional cables,

conduits, sensing lines and cable were sufficiently separated and color coded for easy identification of the associated division and is, therefore, acceptable.

d. Review the 120 Vac and 125 Vdc emergency buses (chargers, batteries, inverters, etc.).

e. Review the ESF pump rooms (HPCS, RCIC, RHR, LPCS).

Discussion: The staff reviewed the equipment identified in items 3d and e. No concerns were identified.

f. Review the instrumentation (instrument lines, transmitters, and associated circuits) used to provide the low reactor pressure permissive interlock function for the redundant low pressure ECCS systems (for both injection valves and the suction valves from the recirculation loop). In addition, review the final HPCS initiation circuitry design (SSER 2, 7.3.2.2).

Discussion: The staff reviewed the pertinent equipment necessary for the low reactor pressure permissive interlocks for LPCS and RHR located in the control room. The staff noted that the low pressure permissive for LPCS is labeled E21 F005 and is located on control panel P601 Sect. 21-C. The low pressure permissive for the RHR injection valve F042A is located on control panel 601 section 20-C. The low pressure permissives for the RHR injection valves and RHR injection valves F042B and C

are located on control panel P601 section 17C. They are all blue permissives.

We then reviewed the local instrument racks associated with the division 1 injection valves (LPCS-H22 P-001 and RHR-H22 P018). The LPCS injection valve (E21-N050) is in the division 1 RHR upper level pump room. We noted a discrepancy at E21-N050 regarding the nomenclature for the pressure permissive for this valve. Presently, the pressure permissive is erroneously identified as a drain line to valve inlet dp. The applicant stated that this nomenclature would be corrected and the accuracy of the nomenclature for the remaining low pressure permissives (both RHR and LPCS) would be reviewed and corrected if necessary. No other concerns were identified by the staff during this audit review.

We are requesting that the Perry Resident Inspectors' Office verify the accuracy of all the nomenclature associated with the low pressure permissive interlocks for the LPCS and RHR injection valves.

Perry SSER 2, Section 7.3.2.2 stated that a confirmatory site audit of the HPCS initiation circuitry design would be conducted to verify the acceptability of the installed design. During this part of the site audit, we noted that the logic for the high (level 8) reactor vessel water level closure of the HPCS injection valve had been incorrectly stated in Perry SSER 4. The correct logic for the level 8 trip is one-out-of-two taken twice. In addition, it should be noted that for the

operator to defeat the level 8 trip, he would have to maintain switch S6 in a depressed mode (closed-spring return). Based on our review of the installed HPCS initiation circuitry and the HPCS relay logic drawing (B-208-065, Revision 3), we conclude that the HPCS initiation design is acceptable and that confirmatory item (28) discussed in Perry SSER 2 (NUREG-0887 dated January 1983), Section 7.3.2.2 is resolved.

g. Review the following plant equipment:

1. ADS solenoids.
2. MSIV solenoids.
3. Diesel generators and local control capability.
4. SLCS pumps, explosive squib valves, and storage tank.
5. RCIS BJMs, transponders, and the control rod drive mechanisms.
6. TIP system.
7. Main steamline flow and radiation sensors.
8. MSIV-LCS valves.

Discussion: Time did not permit the staff to review the equipment identified in items 3, 6, 7, and 8. The items reviewed are discussed below.

Our review of the typical ADS solenoids showed that the A solenoid and B solenoid were canned separately with individual flexible conduits containing the I&C wires going to each solenoid (ADS logic channel B to

the solenoid and ADS logic channel A to the A solenoid). No concerns were identified.

For the Main Steam Line Isolation valve, we randomly selected MSIV F022A (inboard) and F028A (outboard) for our review. We noted the following: (1) the inboard instrumentation is powered by Division 2 (blue) and that the outboard instrumentation is powered by Division 1 (yellow), (2) There is one RPS division 1 limit switch and one RPS division 2 limit switch and three division 1 limit switches for the outboard MSIV isolation valves. (3) all of the limit switches are stem mounted and separation was provided, (4) both the A and B solenoids are mounted at the same point for each MSIV (i.e., separation between solenoids is not provided) and (5) the wiring for the A and B solenoids was in separate conduits. During our review of the Outboard MSIVs, it was apparent that the nomenclature depicting the particular steam line that equipment was mounted on was in error. To resolve this concern, we are requesting that the resident inspector verify that, before fuel load, the applicant has provided consistent nomenclature for the equipment associated with the MSIVs.

The staff reviewed the SLCS Division 1 and Division 2 pumps and valves (item 4) located at elevation 642. Divisional circuits were well separated and were well marked for identification. Non-divisional wiring for thermocouples mounted at the SLCS pump motors was adequately separated from divisional circuits.

The SLCS storage tank has a 10KW in-tank operating heater which is initiated automatically by an in-tank temperature switch when solution temperature falls below 75°F. Power source for heater and control is non-1E 480V AC. A separate in-tank temperature switch is provided for SLC storage tank temperature high/low alarm on the ECCS benchboard control room annunciator. The sodium pentaborate line between the storage tank and the injection valves is heat traced to prevent precipitation. Low line temperature is alarmed in the control room. Power source for the heat tracing is non-1E 120 V AC.

The staff reviewed the RCIS bi-junction modules (BJMs) and transponders (item 5) located at the individual control rod hydraulic control units (HCUs). Two metal enclosures are provided at each HCU, one for the non-safety related RCIS (bottom enclosure), and one for the safety related RPS (top enclosure). Each RPS enclosure contains two terminal strips, one with wiring for RPS scram pilot valve solenoid A, the other for solenoid B. The solenoid lead wires are run in separate flexible conduits from the terminal strips to the solenoids. The terminal strips are not separated. Power for the A and B solenoids at a given HCU is provided via a single conduit (contains 10 wires) terminating at the RPS enclosure. Separation is provided between conduits. Two toggle switches are provided on each RPS enclosure, one for each solenoid. Each switch has a "NORMAL" and "TEST" position.

A single conduit containing wires from each terminal strip runs from the RPS enclosure to the RCIS enclosure at each HCU. Two additional flexible conduits are connected to each RCIS enclosure, one conduit running to the RCIS enclosure of each adjacent HCU. A conduit is connected between the end HCU of each row and the BJM provided for that row. Each scram accumulator has local pressure indication (0 to 3000 psig). The inlet and outlet scram valves are provided with limit switches.

4. Circuit Traces

a. Trace the circuitry (from sensors to protection system cabinets) used to transfer HPCS and RCIC pump suction to the suppression pool on CST low level.

Discussion: The purpose of this review was to evaluate the drawings, documentation, and methods used for cable routing and table tabulation, and to evaluate the installed cabling in comparison to the design documents. We reviewed the applicable conduit and tray drawings and performed a field walkdown of the installed cables.

We randomly selected the condensate storage tank level instrumentation which is located in a bunker beside the condensate storage tank for this walkdown. Heat tracing was installed on all of the switchover sensing lines but had been removed so that a leaking problem could be traced within the transmitter housings or the adjacent portion of the sensing

lines. The applicant stated that this heat tracing would be reinstalled upon completion of this task.

The wiring for the HPCS switchover was then traced into a conduit that exited the top of the bunker along the side of the CST and then entered an underground duct bank. This conduit enters the auxiliary building at the 599' elevation and is labeled 1R33 962C and, at this point, enters junction box JB11648. The conduit continues along the ceiling of the auxiliary building (elevation 599') and eventually enters the nuclear closed cooling heat exchanger room and exits this room and enters the cable chase room and finally up into the cable spreading room. From this point, the conduit is routed to a termination cabinet in the control room.

The staff concluded that the Divisional cable was adequately separated and marked throughout the cable run and that the cable routing and tabulation was according to design documents and, therefore, acceptable.

b. Trace redundant RPS circuits from the control room to the scram pilot valve solenoids at the individual HCUs.

Discussion: Because of time constraints we were not able to perform this circuit trace. However, we did review the rod control and information system multiplexer cabinet (1H22-P0071) located at elevation 620 in the reactor building and its associated input and output cabling. No separation concerns were identified. The BJMs, transponders and HCUs were reviewed separately (see item 3g5 above).

5. Local Instrument Racks/Piping

a. Review the physical separation between the routing of redundant reactor vessel level instrumentation (from vessel taps to transmitters).

Discussion: The purpose of this review was to evaluate the methods used for sensing line routing, transmitter mounting and cable routing and perform a field walkdown of the installed equipment. We randomly selected level transmitter B21-N081A. One sensing line (reference) was routed to condensing chamber D004A and then into the vessel. The variable leg sensing line was routed directly to the vessel (15°-20°). The total drop in elevation from the penetration to the reactor vessel for these sensing lines was approximately one to two feet. We then reviewed the local instrument racks and noted that the transmitter leads are routed to divisional junction boxes at the top of the instrument racks. Circuits leaving the junction boxes are run in conduit. Inside the junction boxes, all cables were marked and tagged. At the racks reviewed, adequate separation was provided between instruments and cables from redundant divisions, and between divisional and non-divisional equipment. Divisional cables and junction boxes were color coded for identification. No concerns were identified.

Based on the audit review, the staff concludes that the separation provided between redundant divisions and between divisional and non-divisional equipment and cabling at instrument racks at Perry is acceptable.

b. Review the turbine first stage pressure instrument taps and transmitters.

Discussion: The staff reviewed the turbine first stage pressure instrumentation used to: 1) bypass the ATWS recirculation pump trip function and reactor scram on turbine stop valve closure and turbine control valve fast closure (transmitters C71*N052A&C powered from RPS bus A, and transmitters C71*N052B&D powered from RPS bus B); and 2) provide inputs to the rod pattern control system (RPCS) portion of the RCIS (Division 1 transmitters C11*N054A&C and Division 2 transmitters C11*N054B&D). The Division 1 transmitters and those powered from RPS bus A are located at one instrument rack (1H51-P1141) in the turbine building, and the Division 2 transmitters and those powered from RPS bus B are on a separate rack, also in the turbine building. The N052 and N054 transmitters share a common sensing line at each rack. All transmitter cabling was run in conduit. No separation concerns were identified.

The staff also reviewed the limit switches associated with the stop valves. As an example, for stop valve F200B there is a division 3 and a division 4 stem mounted limit switch that provide signals to the

RPS. Again, all cabling was run in conduit and no separation concerns were identified.

6. Capability for Testing

a. Walk through the planned testing procedures (channel functional tests, logic tests, etc.) for a typical RPS/ESF initiation instrument and logic channels.

Discussion: The staff walked through a surveillance procedure for reactor vessel level 3 and level 8 reactor protection system and residual heat removal shutdown isolation channel A functional test (1B21-N680A). This would be accomplished by simulating a reactor vessel level input and verifying that the trip units actuate properly and the proper sequence of events occur. The location of this walk through test was control room panel H13-P691 Division 1 RPS Instrumentation and Auxiliary Relay Panel. A Rosemount Readout Assembly, Model 510DU, was used to simulate the test signal. During this surveillance procedure the following annunciators and status lights will be verified to come on and/or go off intermittently while performing the functional check.

a. Annunciator RPS RX LEVEL HI L8 (Panel 1H13-P680-05A, alarm B5)

b. Annunciator RPS LOGIC RX LEVEL LO L3 (Panel 1H13-P680-05A, alarm B4)

c. Annunciator 1/2 SCRAM A/C (Panel 1H13-P680-5A, alarm A9)

d. Annunciator RPS A TRIP UNIT IN CAL/FAIL
(Panel 1H13-P630-05A, alarm D2)

e. Annunciator NS4 OTBD ISOLATION OUT OF SERVICE
(Panel 1H13-P601-19A, alarm C3)

f. Annunciator RPS A & C OUT OF SERVICE
(Panel 1H13-P680-05A, alarm C4)

g. Status light RPS LOGIC A ENERGIZED (Panel 1H13-P691)

h. Status light RPS CH A SCRAM SOL VALVES GR1A,
(Panel 1H13-P680)

i. Status light RPS CH B SCRAM SOL VALVES GR2A,
(Panel 1H13-P680)

j. Status light RPS CH C SCRAM SOL VALVES GR3A,
(Panel 1H13-P680)

k. Status light RPS CH D SCRAM SOL VALVES GR4A,
(Panel 1H13-P680)

In addition to the above, the as found and as left trip point readings for the channel in test are recorded. The criteria for their adjustment was reviewed by the staff.

During our review of this surveillance procedure we observed a few minor typographical errors and two instruction steps (4.3.6 and 4.3.7) whose wording was somewhat ambiguous regarding instrument knob designations. The applicant agreed to correct the ambiguity and the typographical errors as noted during our review. The staff was concerned as to the wording of one of the acceptance criteria in that if the as left values are not within the allowable band and cannot be brought back within this band, the only action required to be taken is a notification of the Unit and I&C supervisor of the channel's improper calibration. The staff believes that if a channel cannot be calibrated for the NTSP or within the conservative side of the NTSP, the channel should be declared inoperable. However, this concern is considered to be part of the setpoint methodology review that is being undertaken by the LRG Setpoint Methodology Group (SMG) of which the applicant is a member (letter dated October 9, 1984 from Murray R. Edelman to B. J. Youngblood). Therefore, we believe that this concern will be resolved upon staff resolution of the setpoint methodology concern for protection system instrumentation.