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AUTH.NAME AUTHOR AFFILIATION
PARKER,W.O. Duke Power Co.
RECIP.NAME RECIPIENT AFFILIATION
DENTON,H.R. Office of Nuclear Reactor Regulation, Director
STOLZ,J.F. Operating Reactors Branch 4

SUBJECT: Forwards addl info re review completion of NUREG-0737,Item II.B.1,concerning RCS high point vent sys.

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DUKE POWER COMPANY
POWER BUILDING
422 SOUTH CHURCH STREET, CHARLOTTE, N. C. 28242

WILLIAM O. PARKER, JR.
VICE PRESIDENT
STEAM PRODUCTION

TELEPHONE: AREA 704
373-4083

March 26, 1982

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

Attention: Mr. J. F. Stolz, Chief
Operating Reactors Branch No. 4

Subject: Oconee Nuclear Station
Docket Nos. 50-269, -270, -287

Dear Sir:

By letter dated January 18, 1982, the Staff requested additional information to complete its review of NUREG-0737, Item II.B.1, Reactor Coolant System Vents. In this regard, please find attached our response for Oconee Nuclear Station.

Very truly yours,

William O. Parker, Jr.

RLG/php
Attachment

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DUKE POWER COMPANY
OCONEE NUCLEAR STATION

Response to NRC Request for Information
RCS High Point Vent System

DUKE POWER COMPANY
OCONEE NUCLEAR STATION

Response to NRC Request for Information
RCS High Point Vent System

In answering the NRC questions concerning high point vent operating guidelines, it is necessary first to reestablish the main design purpose that high point vents (HPV) satisfy. As noted in NUREG-0737, II.B.1, substantial quantities of noncondensable gases may be generated in events beyond the present design basis and a capability to vent these gases is thought to be necessary to deal with them. As a result of NRC actions, high point vents have been added to the reactor coolant system hot legs and the reactor vessel head. The design and installation of these vents follow the rigorous quality assurance requirements that the primary system and interfaces must meet.

It should be noted that the answers concerning operation relate to a generic vent system and to a possible use of the vents for both the release of noncondensable gases and system recovery following a small break loss of coolant accident (SBLOCA). Their use is not required since the design basis accident (DBA) analysis has been performed without the use of reactor coolant pumps (RCP) and high point vents. The HPVs will be used, as will the RCPs, to enhance the operator's capability to return to natural circulation cooling. Should either of these options be unsuccessful, core cooling will be maintained by high pressure injection or once through cooling.

In developing operating guidelines for HPVs, it was and remains prudent to not only evaluate the conditions for which the HPVs were designed, but also under what conditions the HPVs would be an asset in establishing control of plant responses. This evaluation included conditions where a steam bubble may be present in one or more locations in the primary system.

DUKE POWER COMPANY
OCONEE NUCLEAR STATION

Response to NRC Request for Additional Information
Reactor Coolant System High Point Vent System

1. In addition to the operating guidelines for the high point vent system provided as part of your response to NUREG-0737 Item II.B.1, provide additional information regarding the following:

   a. Criteria or pertinent information concerning a decision to terminate venting due to containment hydrogen concentration limits or allowable pressurizer level limits (reference NUREG-0737 Item II.B.1 Clarification A.(2)).

   b. Methodology describing the determination of the location and size of a noncondensible gas bubble in the reactor coolant system (references NUREG-0737 Item II.B.1 Position (2) and Clarification A.(2)).

   c. Operating guidelines for venting of the pressurizer in order to maintain system pressure and volume control (reference NUREG-0737 Item II.B.1 Clarification C.(3)).

Response:

1. a. NUREG-0737, Item II.B.1 Clarification A(2) states:

"Procedures addressing the use of the reactor coolant system vents should define the conditions under which the vents should be used as well as the conditions under which the vents should not be used. The procedures should be directed toward achieving a substantial increase in the plant being able to maintain core cooling without loss of containment integrity for events beyond the design basis. The use of vents for accidents within the normal design basis must not result in a violation of the requirements of 10 CFR 50.44 or 10 CFR 50.46."

In response to Request Item 1a, maintenance of pressurizer level is not a prerequisite for maintaining core cooling. The guidelines for use of the RCS high point vents will be incorporated in the Abnormal Transient Operating Guidelines (ATOG), Action Plan Item I.C.1., which are currently under active Staff review. ATOG provides the necessary guidance to assure core cooling.

With regard to the maintenance of containment integrity, the hydrogen level in the Reactor Building (RB) is continually

monitored during both normal operations and accident conditions. An existing plant operating procedure defines the actions required to place the RB Hydrogen Purge System in operation.

1. b. The determination of whether a bubble in the primary system is mainly composed of noncondensable gas or of steam is not of particular significance. Either type of bubble can hinder the reestablishment of or interrupt natural circulation cooling if the bubble becomes too large. If the transient progresses to an inadequate core cooling (ICC) situation, then noncondensable gases will probably be contained in the bubble. For plant transients in which a bubble develops in the RCS and plant parameters indicate the core is being cooled, the bubble will primarily be composed of steam.

The determination of the location and size of a bubble can be made by monitoring plant process parameters, mainly primary and secondary system temperatures and pressures, during the transient. If a bubble develops in the hot leg of such a size as to decouple the primary and secondary systems, thereby initiating an interruption of heat removal via the steam generator, the operator is directed to bump the pumps and/or use the high point vents to remove the bubble and reestablish natural circulation. Decoupling of the steam generator is noted by the difference in temperature between the cold leg RTD and the steam generator saturation temperature. In addition, the steam generator pressure will decrease and, for small breaks wherein the steam generators play an active role, the primary side pressure will increase. The decoupling can be further confirmed by depressurizing the steam generator and noting no accompanying change in the primary system.

Following the removal of the bubble in the hot leg and the establishment of natural circulation, the operator is expected to be able to recognize a reactor vessel head bubble by monitoring pressurizer spray effects on pressurizer level. Methods for removal of a bubble in the reactor vessel head are provided in Section 3.2 and 3.3 of the guidelines.

1. c. The PORV is the means by which the pressurizer would be vented in order to maintain system pressure and volume control. The use of the PORV in conjunction with HPI for depressurization and volume control for transients wherein the steam generator heat sink is not available is being incorporated into ATOG.

2. The guidelines state that the operator will open the hot leg high point vents when the refill phase of the accident commences. In practice, the operator has no means to determine whether steam or saturated water is present in the hot legs, and will probably not notice a difference between natural circulation and steam condensing heat transfer modes. A transition from one heat transfer mode to another may be obscured by temporary operation of the pressure vessel internal vent valves between the cold and hot legs. Discuss in detail how timely venting can be assured and present the necessary diagnostic and operational steps in explicit guideline form.

Response:

For the SBLOCA cases wherein the steam generators play an active role in removing a portion of the core decay heat, the high point vents can be utilized, if the RC pumps are not available, to remove trapped gases in the hot leg and to return the primary system to subcooled natural circulation. In examining the usage of the vents, as documented in the generic guidelines previously provided, it was found that the period of the transient for which the utilization of the vents will be most effective is the refill period. During the refill period of the transient, the level in the primary system will rise above the elevation of the auxiliary feedwater inlet nozzle. This will result in a cessation of the boiler-condenser (steam condensing) heat transfer mode. Since the SG will cease to be an effective heat sink for the primary system, the RCS pressure will increase, thereby indicating a "decoupling" of the primary and secondary systems.

Timely operation of the vents is assured in the following manner. First, vent operation is initiated only on a recognized need, i.e., lack of primary and secondary system coupling. Second, vent operation, once instigated, is continued until subcooled natural circulation is established. Subcooled natural circulation can be determined from system parameter displays and is measurably different from two phase natural circulation or boiler condenser by the subcooled nature of the hot leg temperature. The slight excess discharge of inventory through the vents, caused by leaving the vents open until acceptable subcooling is reached, is necessary to assure full development of the desired cooling mode. This excess discharge does not pose significant adverse consequences as a leak already exists somewhere in the system. In this situation, timely operation of the vents means positive assurance that, following the initiation of the refill mode, the transition to solid natural circulation is permanent.

The operator, in fact, may not determine whether the plant is in the two-phase natural circulation cooling mode or the boiler-condenser mode of operation. However, as long as coupling is maintained, the operator can initiate the cooldown with the steam generator. The operator will be able to determine if decoupling occurs as described earlier. The operator

will then reestablish natural circulation by bumping the pumps as the preferred method and/or using the high point vents if pumps are not available.

The detailed, explicit operator guidelines for utilizing the HPVs are being developed at this time. These guidelines will be created in the ATOG format for future inclusion into ATOG procedures.

3. Section 3.3 states that once natural circulation is established and temperatures in the hot and cold legs are between 50°F and 100°F subcooled, the operator is to depressurize the plant with the PORV. We assume this applies to plants without vessel head vents. Moreover, this depressurization rate is based on assuring that the rate of expanding steam from the vessel head into the hot legs is less than the relieving capability of the hot leg high point vents in order to preclude a net accumulation of steam at the top of the hot legs and interruption of natural circulation. The staff disagrees with this method of depressurization for the following reason:

> The depressurization rates provided in Figure 2 appear to be based on computer analyses. B&W and their customers have yet to satisfactorily demonstrate to the staff the adequacy of their analysis models to properly predict the transport of steam in the vessel and primary coolant loops under transient and accident conditions, including post-LOCA. As such, we believe the uncertainties in the depressurization rates to be unquantified, and the consequences of incorrect depressurization significant.

We, therefore, request that you identify a method of depressurizing the primary system which does not rely on computer calculated curves and does not involve a risk of interruption of natural circulation.

Response:

Section 3.3 of the generic guidelines describes the removal of noncondensable gases or steam in the reactor vessel head for plants without reactor vessel head vents. The depressurization rates shown in Figure 2 of the generic guidelines are not based on computer analyses. Rather, the curves were developed using hand calculations in the following manner: It was assumed that the plant is in subcooled natural circulation with the reactor vessel head filled with hydrogen down to the outlet nozzles. At any given pressure the volumetric capability (ft^3/sec) of the high point vents to remove the hydrogen gas can be calculated. This sets the allowed expansion rate of the hydrogen gas in the reactor vessel head to the hot leg. The ideal gas law was then utilized to translate the gas expansion rate into the maximum allowable depressurization rate which assures natural circulation would not be interrupted. The depressurization rates of the PORV and pressurizer vent, if installed, were calculated based upon a steam discharge. It should be noted that the expanding hydrogen gas bubble in the reactor vessel head is assumed to accumulate only in the hot leg high point vent region and none of the gas goes to the pressurizer. This leads to the worst case noncondensable gas accumulation rate in the high points of the hot leg. Thus, if the depressurization rate is controlled within the maximum rate then natural circulation should not be interrupted. If natural circulation is interrupted during the venting of the vessel head the operator is

instructed to stop the depressurization and to re-vent the hot leg to reestablish natural circulation. Since core cooling would be maintained even with an interruption in natural circulation, the effect of loosing natural circulation momentarily has little safety significance.

The hand calculations described above are for a noncondensable gas bubble in the reactor vessel head as opposed to a steam bubble. Since the hot legs will be significantly subcooled relative to the reactor vessel head (50°F), any steam entering the hot leg from the reactor vessel head area would be condensed. In addition, if the subcooled margin is lost, the depressurization will be stopped until adequate subcooled margin is restored. Thus, the above described procedure is equally effective for a steam bubble in the reactor vessel head.

4. During conditions of inadequate core cooling, the operator is instructed to open the high point vents. Another instruction is to start the RCPs. If the pumps are started, can a slug of water impact the reactor vessel head or hot leg piping at the high point vent location? If so, is the vent system designed to withstand the dynamic loads associated with these water slugs? If not, what precautionary measures are provided or will be provided to preclude pump start with the vents open?

Response:

A stress analysis was performed on each vent line which included dynamic, seismic, deadweight and thermal loadings. It is considered that any loads due to pump start would be bounded by those assumed in the stress analysis.

5. Recently, a number of plants with B&W designed NSSSs have experienced bubble formation in the hot leg piping while in the shutdown cooling mode. This has been caused by the flashing of stagnant hot water in the hot legs during depressurizing operations by the operator. (The hot water was possible due to outsurges from the pressurizer.)

What instructions are provided to the operator regarding the use of the vents to remove trapped steam under these conditions? In particular, should the vents be used or not? Consider that the containment may not be isolated and personnel may be in containment. If vent operation under these conditions must be avoided, what provisions have been made to preclude vent operation?

Response:

In this case, where the plant is in the shutdown cooling mode and water has flashed to steam in the hot leg during depressurization, there is no problem of any safety significance. This condition would be noted by a rise in the pressurizer level and a subsequent loss of subcooling margin. If all other plant process instrumentation and incore instrumentation is normal relative to the shutdown cooling mode, the operator would limit the cooldown rate by procedures already in place until he demonstrates the pressurizer is the controlling pressure element in the primary system. The operator is not directed to use the high point vents for the condition described by the Staff. Unless deteriorating conditions in the primary system were indicated, the use of HPVs during these circumstances is not needed.

Appropriate administrative procedures have been established to limit use of RCS high point vents in containment while personnel are present. If personnel were in containment and a bubble was determined to be present in the hot leg during the shutdown cooling mode, there is no reason to startle or alert personnel unnecessarily. Reestablishing the pressurizer as the primary system pressure controlling element does not require breaching primary integrity. If primary conditions deteriorate and the use of the vents is desired, personnel would be cleared from containment and other necessary actions would be taken to maintain the integrity of the containment prior to the use of the RCS high point vent system.

6. State which of the following two categories applies to the size (including orifices) of the reactor vessel head vent and provide the requested information as applicable:

   a. Smaller than the size corresponding to the definition of a loss-of-coolant accident (LOCA) (10 CFR Part 50, Appendix A). Provide the pertinent design parameters of the reactor coolant makeup system and a calculation of the maximum rate of loss of reactor coolant from the largest reactor vessel head vent break that can be postulated.

   b. Within the LOCA definition. Verify that an analysis has been performed showing compliance with 10 CFR 50.46, or that the size has been considered in a previous LOCA analysis and found to be acceptable (reference NUREG-0737 Item II.B.1 Clarifications A.(4) and (7)).

Response:

The reactor vessel head vent is installed using an existing CRDM vent and a modified insert. The hot leg high point vents are installed by tying into existing high point vent lines. Inasmuch as the new system utilizes existing reactor coolant system penetrations, it is considered that the original analysis contained in the FSAR remains valid.

7. The following items apply to the portions of the RCS high point vent system that form a part of the reactor coolant pressure boundary, up to and including the second normally closed valve, added as a result of the TMI Action Plan (reference NUREG-0737 Item II.B.1 Clarification A.(7)):

   a. Provide the design temperature and pressure of the piping, valves, and components.

   b. Verify that the piping, valves, components, and supports are classified Seismic Category I and Safety Class 2 (Safety Class I where the size corresponds to the 10 CFR Part 50, Appendix A definition of a loss-of-coolant accident).

   c. Describe the instrumentation that has been provided to detect and measure RCS high point vent system isolation valve seat leakage (reference Appendix A to 10 CFR Part 50, General Design Criterion 30).

   d. Describe the materials of construction and verify that they are compatible with the reactor coolant chemistry and will be fabricated and tested in accordance with SRP Section 5.2.3, "Reactor Coolant Pressure Boundary Materials."

   e. Demonstrate that internal missiles and the dynamic effects associated with the postulated rupture of piping will not prevent the essential operation of the RCS high point vent system, including the PORV pressurizer vent (i.e., at least one vent path remains functional) (reference Appendix A to 10 CFR Part 50, General Design Criterion 4).

Response:

7. a. Design Temperature 650°F
Design Pressure 2500 PSIG

7. b. All piping associated with the vent is Class I (Duke Class A). All Class I piping 1" and smaller is downgraded to Class III (see Section 1C.3, Vol. 1, of the FSAR).

7. c. Inasmuch as the RCS high point vent system is an integral part of the reactor coolant system, any leakage would be determined in the manner presently in use as described in Oconee Technical Specification 3.1.6.

7. d. All piping and components are Type 304 Stainless Steel to ASME Section III.

7. e. The different vent paths are separated so that a single missile could not damage all multiple paths.

8. Verify that the following RCS high point vent system failures have been analyzed and found not to prevent the essential operation of safety-related systems required for safe reactor shutdown or mitigation of the consequences of a design basis accident:

   a. Seismic failure of RCS high point vent system components that are not designed to withstand the safe shutdown earthquake.

   b. Postulated missiles generated by failure of RCS high point vent system components.

   c. Dynamic effects associated with the postulated rupture of RCS high point vent piping greater than one-inch nominal size.

   d. Fluid sprays from RCS high point vent system component failures. Sprays from normally unpressurized portions of the RCS high point vent system that are Seismic Category I, and Safety Class 1, 2, or 3 and have instrumentation for detection of leakage from upstream isolation valves need not be considered.

Response:

8. a. All components are seismically designed to withstand the SSE.

8. b. Engineered safety features and associated systems are protected from missiles which might result from a loss of coolant accident. Protection is provided by concrete shielding and/or segregation of redundant components (Sections 4.2.1.2 and 4.2.7, Vol. 2, FSAR). Any additional potential missiles attributable to the HPV system are bounded both in energy and location by previously analyzed missiles.

8. c. All pressure retaining piping is 1" or smaller.

8. d. Fluid sprays from valve failures were not considered since all valves used in the system are of packless design. The RV head attachment is identical to the cap on all the CRDMs and the two flanges on the removable section of pipe are located in the same area so no unanalyzed spray source is created.

9. Describe the design features or administrative procedures, such as key locked closed valves, alarms, or removal of power during operation, that will be employed to prevent inadvertent actuation of an RCS high point vent path (reference NUREG-0737 Item II.B.1 Clarification A.(7)).

Response:

Administrative procedures have been and will be used to prevent inadvertent actuation of the vent paths. Currently, although the vent system is installed, it is considered an inoperable system and is so controlled by station procedures. It will remain so until the vent system design and operation is approved by the NRC. At that time, the vent system will be included in operational procedures and maintained inoperable by the removal of power from the vent valves.

Administrative procedures employed to prevent inadvertent actuation of an RCS high point vent path are described below. Since the design of all three Oconee units is identical, descriptions are written without unit designations and apply equally to all three units. The accompanying diagrams are unitized to clearly show the appropriate unit designations.

Hot Leg Loop "A" Vent Valves RC155 & RC156, Hot Leg Loop "B" Vent Valves RC157 & RC158, Reactor Vessel Head Vent Valves RC159 & RC160

The electrical control circuits for these valves are designed such that control power is normally removed from the circuit. Two separate operator actions are required to apply control power to the circuit and to energize the valve solenoid in order to open any single valve. Each RCS high point vent flow path consists of two valves in series so that four separate operator actions are required to open any one flow path.

Refer to the drawings provided as attachment 2 of the June 29, 1981 submittal with the following additional clarification.

A separate, dual function control switch (device "CS") is provided for each valve. This swith contains a maintained contact "ON-OFF" function and a momentary contact "OPEN" function. Although both functions are contained on a single switch operator housing, they are mechanically and electrically separate and independent so that, in effect, they provide redundant control capabilities.

The maintained contact "ON-OFF" function is normally set to the "OFF" position. In this position, electrical power is removed from the valve control circuit so that the solenoid coil cannot be energized to open the valve. The momentary contact "OPEN" function is normally held in the unactuated state by the spring return feature of the pushbutton operator. In this position, the control circuit is open so that the solenoid coil is not energized and the valve is closed. Thus, electrical power to the solenoid valve coil is interrupted at two points, and separate operator

actions are required at each point of interruption to complete the electrical circuit to the solenoid coil.

To open a valve, the operator places the respective maintained contact switch in the "ON" position and depresses the associated momentary contact "OPEN" pushbutton, completing the electrical control circuit to the solenoid coil energizing the solenoid valve.

Each valve control switch contains safety-grade valve position indicating lights in addition to the dual control functions previously described. Thus, the operator has at all times immediate verification of vent valve position which is intimately and conclusively associated with the valve control function. The indicating lights are directly operated by limit switches which sense the position of the valve stem in the solenoid valve actuator.

All portions of the control and indication circuits are designated and qualified as Class 1E Nuclear Safety Related and meet all seismic qualifications. All control and indication functions are located remotely on the unit main control boards in the respective unit control rooms. The control switches for the two series valves in each vent flow path are located immediately adjacent to each other so that an operator can quickly set up and operate any vent path and verify valve operation from a single operating position, yet the system remains resistant to inadvertent actuation.

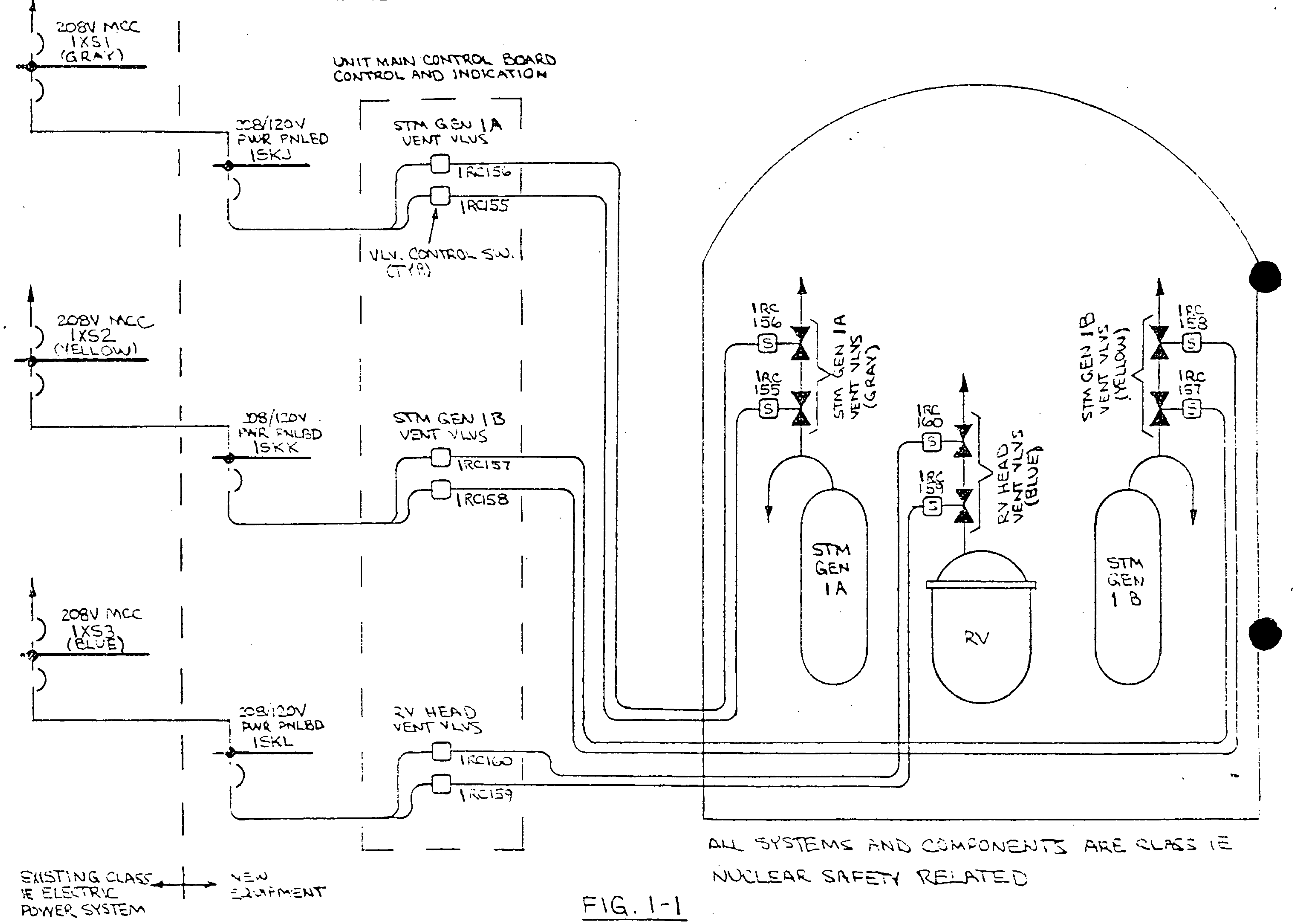
Additional verification and hard-copy logging of vent valve operation is provided by the operator aid computer in the control room, a non-safety device which receives valve position limit switch indication directly from the valve operator itself through a qualified 1E to non-1E isolation device.

Pressurizer Vent Valves RC66 (PORV) and RC4 (Block Valve)

The block valve is a normally open motor operated valve. The PORV is normally closed and is automatically operated in response to RCS system pressure signals. The PORV can be manually operated from the ICS Cabinets. This is not a normal operating position and operator access is limited by administrative controls, providing resistance to inadvertent operation of the pressurizer relief system.

As a further measure against inadvertent actuation, direct indication of PORV position, with control room alarm, has been provided in response to NUREG-0578. This indication system has been judged to be in compliance with requirements as stated in "Evaluation of Licensee's Compliance with Category 'A' Items of NRC Recommendations Resulting from TMI-2 Lessons Learned", dated April 7, 1980.

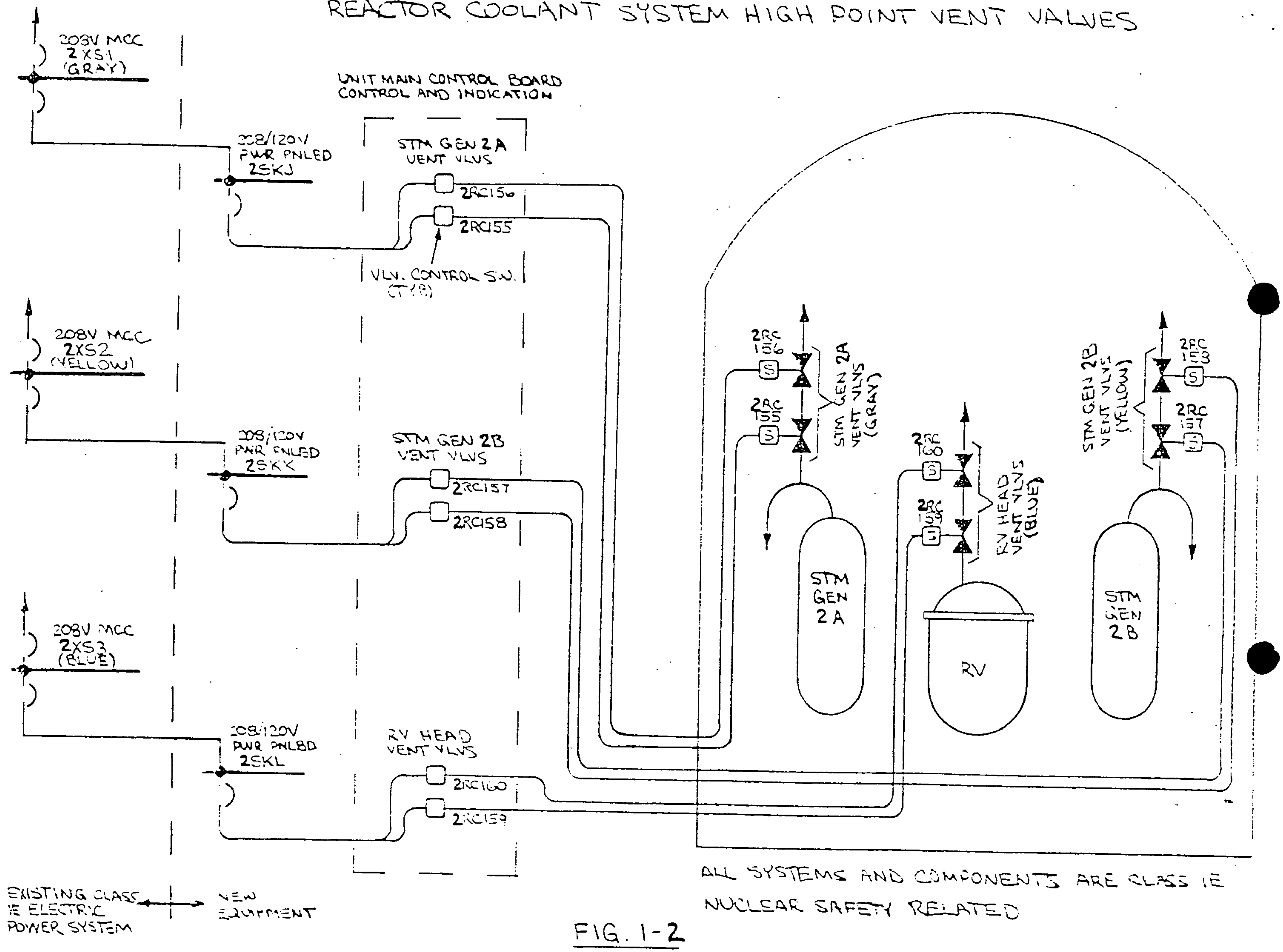
OCONEE UNIT 1 - SYSTEM BLOCK DIAG.
REACTOR COOLANT SYSTEM HIGH POINT VENT VALVES



ALL SYSTEMS AND COMPONENTS ARE CLASS 1E NUCLEAR SAFETY RELATED

FIG. 1-1

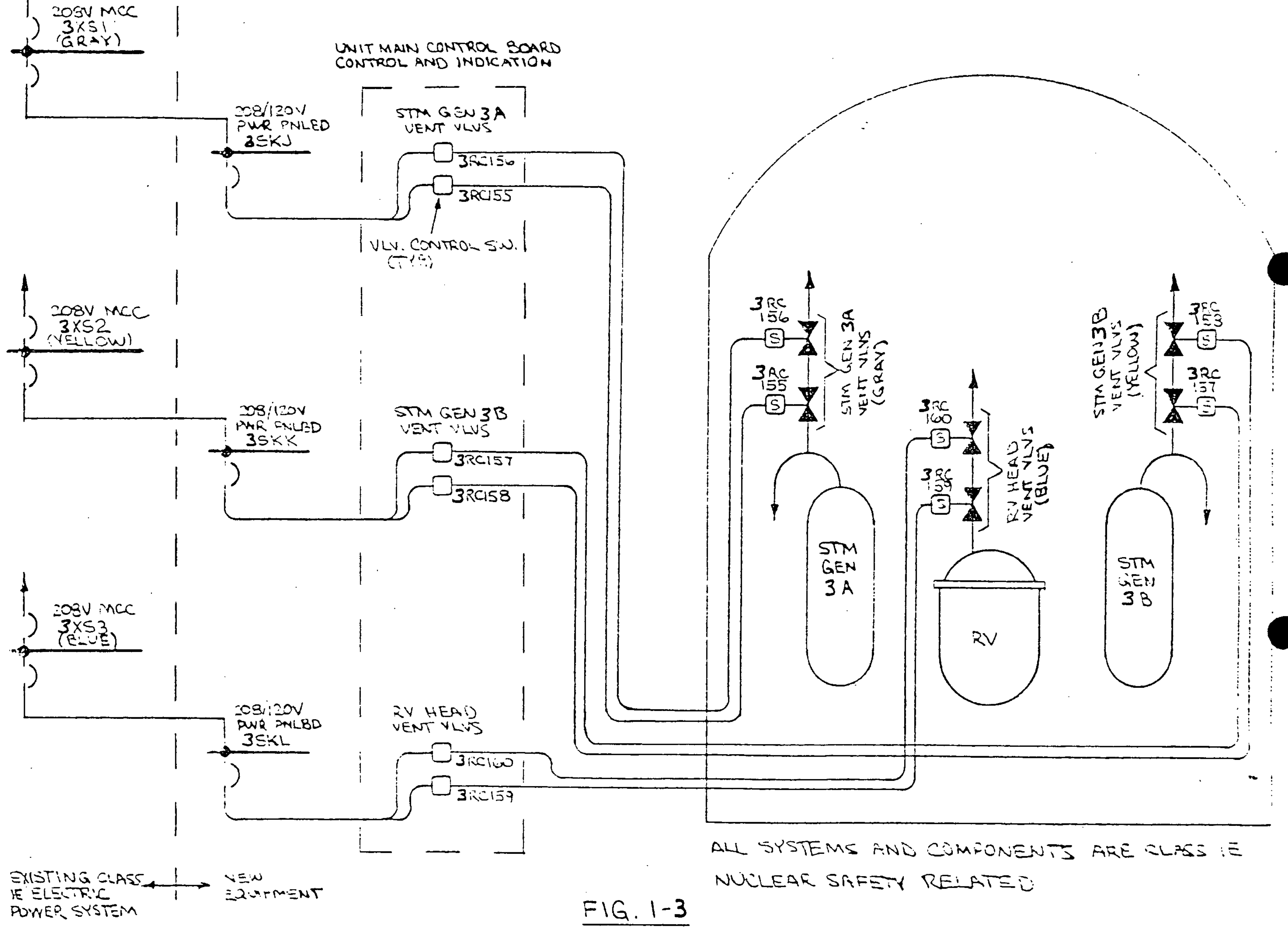
OCONEE UNIT 2 - SYSTEM BLOCK DIAG.
REACTOR COOLANT SYSTEM HIGH POINT VENT VALVES



ALL SYSTEMS AND COMPONENTS ARE CLASS IE NUCLEAR SAFETY RELATED

FIG. 1-2

OCONEE UNIT 3 - SYSTEM BLOCK DIAG.
REACTOR COOLANT SYSTEM HIGH POINT VENT VALUES



ALL SYSTEMS AND COMPONENTS ARE CLASS IE NUCLEAR SAFETY RELATED

FIG. 1-3

10. Verify that the RCS high point vent system discharges into areas in which any nearby structures, systems, and components essential to safe shutdown of the reactor or mitigation of a design basis accident are capable of withstanding the effects of the anticipated mixtures of steam, liquid, and noncondensable gas discharging from the RCS high point vent system.

Response:

The system discharges in the basement of the Reactor Building into the discharge air stream of the Reactor Building Coolers. The discharge will be steam or noncondensable gas. The piping was designed so that the discharge was not directed toward any Safety Related Component.

11. Although exercising the RCS high point vent system valves (including the valves on the pressurizer vent) during cold shutdown is acceptable, verify that all operability testing provisions of subsection IWV of Section XI of the ASME Code for Category B valves will be performed (reference NUREG-0737 Item II.B.1 Clarification A.(11)).

Response:

Subsection IWV of Section XI of the ASME Code requires that Category B valves be exercised. Because it is not practical to exercise these valves at pressure and temperature, they will only be exercised at cold shutdown, as allowed by IWV-3412(a). Failure of a valve in an open position would degrade the RCS pressure boundary and could possible delay startup from a short duration outage. Inasmuch as these valves are not necessary to assure safe operation of the plant, these valves will be full stroke exercised during each scheduled refueling outage. The necessary movement is determined by observing Control Room indication of stem position. Stem position is indicated by reed switches installed in the valve. As these valves are considered to be fail-safe, the observation required by IWV-3415 will be included in the exercise test procedure.

12. Verify that all displays (including alarms) and controls, added to the control room as a result of the TMI Action Plan requirement for reactor coolant system vents, have been or will be considered in the human factors analysis required by NUREG-1737 Item I.D.1, "Control Room Design Reviews."

Response:

Displays and controls added to the Control Room by the installation of the RCS High Point Vent System will be considered in the human factors analysis during the Control Room Design Review.

13. Statements in your June 29, 1981 and January 2, 1980 submittals are ambiguous concerning power supplies for the RCS high point vent system valves. Provide the power source for each valve in order to verify that both valves in a vent path are provided with power from the same emergency power train, and that different vent paths are powered from different emergency power trains to provide a degree of redundance (reference NUREG-0737 Item II.B.1 Changes (4)).

Response:

The submittal of June 29, 1981 provided in Attachment 2 detailed drawings of the emergency power trains to each vent system of each unit. Oconee FSAR Chapter 8 provides a discussion of the emergency power system at Oconee in sufficient detail through the 600V load centers. The following table details the emergency power paths from the 4160V switchgear through the vent valves. The reference drawings were provided in Attachment 2 of the June 29, 1981 submittal. Both valves in a vent path are provided with power from the same emergency power train.

				Reference
4160V SWGR	1TC	1TE	1TD	0-703-6; FSAR 8-3
600V Load Center	1X8	1X10	1X9	0-703-G; FSAR Figure 8-4
600V MCC	1XS1	1XS3	1XS2	0-703-G
208V MCC	1XS1	1XS3	1XS2	0-703-G
120VAC PNLBD	1SKJ Gray	1SKL Blue	1SKK Yellow	0-704-E
Valves	RC-155 RC-166	RC-159 RC-160	RC-157 RC-158	PO-100-A
RCS Component	'A' Hot Leg	RV	'B' Hot Leg	PO-100-A

The following is a description of the power supplies to the Pressurizer Vent Valve RC66 (PORV) and RC4 (Block Valve).

PORV RC66 receives electrical power from 125V DC Power Panelboard DIB, a Class 1E power source.

Block Valve RC4 receives electrical power from 600V MCC XP (Unit 1) or XO (Units 2&3), which are non-load shed power sources which derive their power from 4KV switchgear TE (Unit 1) or TD (Units 2&3), which are units of the Class 1E electric power system.

The power supply provisions have been judged to be in compliance with requirements as stated in "Evaluation of Licensee's Compliance with Category 'A' Items of NRC Recommendations Resulting from TMI-2 Lessons Learned", dated April 7, 1980.

14. Since your submittal states that the existing power operated relief valve can be used as the required pressurizer vent, demonstrate that a positive indication of the block valve position will be provided in the control room (reference NUREG-0737 Item II.B.1 Clarification A.(5)).

Response:

NUREG-0737, Item II.B.1, Clarification A.(5) states that "positive indication of valve position should be provided in the control room." Further, NUREG-0737, Item II.D.3 states that

> "Reactor coolant system relief and safety valves shall be provided with a positive indication in the control room derived from a reliable valve position detection device or a reliable indication of flow in the discharge pipe."

Such a position indication was installed on each Oconee in the late 1979, early 1980 time frame and evaluated by the NRC in a Safety Evaluation Report that was transmitted to Duke by letter dated April 7, 1980.

Furthermore, the Pressurizer Relief Block Valves 1, 2, 3, RC4 have positive indication of valve position in the control room. These valves have electric motor operators (Limitorque) which have integral limit switches that are actuated by valve stem position. These limit switches are directly connected to valve position indicating lights in the valve control circuits. The indicating lights are located on the unit main control boards in the respective unit control rooms in immediate proximity to the related valve control switch.

As such, it is considered that positive indication of the pressurizer vent path has been provided and accepted by the NRC.

15. On page 5 of the Operating Guidelines, it states that when the RC pumps are not available following a SBLOCA for removing trapped gases from the RCS high points, the hot leg vents can be utilized. Moreover, the first sentence in section 3.1 (page 6) states that operator action will be required to open the vents during small break transients. It is our understanding that neither the RC pumps nor the high point vents are considered to be part of the engineered safety features (ECCS) and are not required to be operable following a LOCA. Previous ECCS analyses submitted on license applications for plants with B&W NSSSs were not performed beyond the start of primary system inventory recovery and it was assumed that single phase natural circulation would be reestablished without the aid of either the RC pumps or the high point vents.

Please state whether or not operation of the RC pumps and/or the high point vents are necessary in order to reestablish single phase natural circulation following a SBLOCA. If they are required, justify why they are not considered part of the engineered safety features, and required to meet the design requirements of ESFs. If they are not required, provide the supporting analyses for SBLOCAs which demonstrates that single phase natural circulation will be reestablished following recovery from a SBLOCA. Discuss how steam trapped in the RCS high points (vessel bend, hot leg "candy cane") will be condensed or removed and not inhibit natural circulation or long-term cooling of the core, per the requirements of 10 CFR 50.46(b)(5).

When considering the need of the high point vents take into account also the possibility of an early break isolation which takes place during the period between interruption of natural circulation and start of steam condensing heat transfer.

Response:

The long term cooling requirement of 10 CFR 50.46(b)(5) does not specify the reestablishment of single phase natural circulation as a design objective. Rather, it states that the . . . "core temperatures shall be maintained at an acceptable low value and decay heat shall be removed for the extended period of time required by the long-lived radioactivity remaining in the core." The long term cooling of the core, as required by 10 CFR 50.46(b)(5), is provided by assuring that the core remains covered by a two-phase mixture. To assure this capability in the long term, high pressure and low pressure injection systems have been designed to take suction from the reactor building sump, thereby assuring an indefinite supply of coolant. The SBLOCA evaluations demonstrate that the ECC systems satisfy this requirement. It has never been assumed that single phase natural circulation would be reestablished following design basis SBLOCAs.

Operation of the RC pumps and/or the high point vents is believed necessary in order to reestablish single phase natural circulation during certain small breaks. The range of break sizes, for which the reestablishment of single natural circulation would aid in bringing the plant to cold shutdown, is bounded by the largest break size for which natural circulation would not be lost (approximately 0.005 ft^2) and the smallest break size for which the RCS pressure spontaneously depressurizes to the LPI setpoint (approximately 0.05 ft^2). For breaks which are isolated during the period between the interruption of natural circulation and start of steam condensing heat transfer, the RC pumps and/or vents may be used to reestablish single phase natural circulation. However, if the steam bubble in the hot leg U-bend is small, it may be possible to reestablish natural circulation by pressurizing the system with the HPI. Alternatively, the plant would evolve to a high pressure and displace sufficient inventory through the PORV or code safety valves to establish boiler condenser heat removal.

Although the RC pumps and high point vents may be required for the establishment of single phase natural circulation, the long term cooling requirement of 10 CFR 50.46(b)(5) is met without utilizing the RC pumps or the high point vents. The present SBLOCA transients have been analyzed past the point at which the primary system pressure is controlled by the break, at pressures below the SG secondary pressure, or by the steam generator in a boiler-condenser mode of cooling; the core has been recooled and the ECC injection exceeds the core boil-off. Since the core decay heat continues to decrease thereafter, the ECC systems are thus assured of providing adequate makeup to keep the core covered provided that primary system pressure can be controlled. Pressure control is provided by the break, for the larger SBLOCAs and by use of the steam generator for the smaller breaks. Since the condensing surface in the SG is located at an elevation above the top of the core, primary system pressure will be controlled at a value which assures that the HPI will keep the core covered for the long term. Additionally, since the HPI and LPI system can be operated from the containment sump, following the emptying of the BWST, long term ECC injection is assured.

As seen from the foregoing discussions, long term cooling of the core for a SBLOCA is maintained without the need to establish single phase natural circulation. Thus, the RC pumps and the high point vents are not required to be part of the engineered safety features. It is our belief that the use of available plant equipment, whether or not it is "safety grade", which aids the operator in managing the plant during a transient or accident should be identified in the operator guidelines. Thus, the operator guidelines do contain instructions for utilizing the RC pumps and the high point vents for the purpose of returning the plant to single phase natural circulation.