UNION ELECTRIC

1901 Gratiot Street, St. Louis

Donald F. Schnell
Vice President

September 18, 1987

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Gentlemen: ULNRC-1614

DOCKET NUMBER 50-483
CALLAWAY PLANT
RESPONSE TO GENERIC LETTER 87-12
LOSS OF RESIDUAL HEAT REMOVAL (RHR) WHILE THE
REACTOR COOLANT SYSTEM (RCS) IS PARTIALLY FILLED

Union Electric Company received the subject NRC Generic Letter 87-12 in July 1987. The Generic Letter requested that Union Electric respond to nine specific requests for information regarding loss of decay heat removal while in operation with the RCS loops partially filled. An Enclosure to the Generic Letter also provided pertinent information and insights to plant operation with a partially filled RCS. This submittal provides the requested information in accordance with 10CFR50.54(f). The responses address each of the items of the requested information and also encompass Union Electric responses to the topics contained in the Enclosure.

Union Electric responses are based on current Callaway programs which are subject to change as plant procedures and practices are revised. Any such changes are reviewed to assure that they do not adversely impact plant safety (i.e., a review based on 10CFR50.59).

If additional information is required, please let us know.

Very truly yours,

for Donald F. Schnell

DJW/plh

Enclosure
Attachments

A061
1/1

STATE OF MISSOURI)
) S S
CITY OF ST. LOUIS)

Robert J. Schukai, of lawful age, being first duly sworn upon oath says that he is General Manager-Engineering (Nuclear) for Union Electric Company; that he has read the foregoing document and knows the content thereof; that he has executed the same for and on behalf of said company with full power and authority to do so; and that the facts therein stated are true and correct to the best of his knowledge, information and belief.

By Robert J. Schukai
Robert J. Schukai
General Manager-Engineering
Nuclear

SUBSCRIBED and sworn to before me this 18th day of September, 1987

Barbara J. Pfaff

BARBARA J. PFAFF
NOTARY PUBLIC, STATE OF MISSOURI
MY COMMISSION EXPIRES APRIL 22, 1989
ST. LOUIS COUNTY

cc: Gerald Charnoff, Esq.
Shaw, Pittman, Potts & Trowbridge
2300 N. Street, N.W.
Washington, D.C. 20037

Dr. J. O. Cermak
CFA, Inc.
4 Professional Drive (Suite 110)
Gaithersburg, MD 20879

W. L. Forney
Chief, Reactor Project Branch 1
U.S. Nuclear Regulatory Commission
Region III
799 Roosevelt Road
Glen Ellyn, Illinois 60137

Bruce Little
Callaway Resident Office
U.S. Nuclear Regulatory Commission
RR#1
Steedman, Missouri 65077

Tom Alexion (2)
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Mail Stop 316
7920 Norfolk Avenue
Bethesda, MD 20014

Manager, Electric Department
Missouri Public Service Commission
P.O. Box 360
Jefferson City, MO 65102

List of Attachments
To ULNRC -1614

Attachment 1	Table of Items Evaluated or Under Evaluation to Strenghten Operation During Partially Filled Conditions
Attachment 2	List and Brief Summary of Referenced Procedures
Attachment 3	Instrumentation and Alarms
Attachment 4	Description of Training Provided on Loss of RHR

RESPONSE TO GENERIC LETTER 87-12
LOSS OF RESIDUAL HEAT REMOVAL WHILE RCS PARTIALLY FILLED

As requested Union Electric is providing the NRC with a description of the operation of the Callaway Plant during the approach to a partially filled reactor coolant system (RCS) condition and during operation with a partially filled RCS. The following items re-state specific Generic Letter requests for information and are followed by the corresponding Union Electric responses. Attachment 2 provides a list and brief summary description of all referenced procedures.

Generic Letter Item 1

A detailed description of the circumstances and conditions under which your plant would be entered into and brought through a draindown process and operated with the RCS partially filled, including any interlocks that could cause a disturbance to the system. Examples of the type of information required are the time between full-power operation and reaching a partially filled condition (used to determine decay heat loads); requirements for minimum steam generator (SG) levels; changes in the status of equipment for maintenance and testing and coordination of such operations while the RCS is partially filled; restrictions regarding testing, operations, and maintenance that could perturb the nuclear steam supply system (NSSS); ability of the RCS to withstand pressurization if the reactor vessel head and steam generator manway are in place; requirements pertaining to isolation of containment; the time required to replace the equipment hatch should replacement be necessary; and requirements pertinent to reestablishing the integrity of the RCS pressure boundary.

Union Electric Response

1A. Time between full power operation and reaching a partially filled condition:

The minimum time required to reach a partially filled condition from 100% power is approximately 51 hours, as follows:

- Normal shutdown from 100% power down to 0% power would take 10 hours (The procedure OTG-ZZ-00004 includes a precaution and limitation in which the maximum rate of power decrease is limited to 10% per hour).

- The change from Mode 2 to Mode 3 (Hot Standby) would take approximately 1 hour. This is controlled by OTG-ZZ-00005.

- The cooldown from 550°F to 140°F would be approximately 16 hours. This is covered by the procedure OTG-ZZ-00006. As part of the cooldown in Mode 4 (Section 4.2 of OTG-ZZ-00006), the Residual Heat Removal (RHR) system is placed in service in the shutdown cooling mode of operation, per procedure OTN-EJ-00001.

- Further cooldown is covered in Procedure OTG-ZZ-00007 in which Step 4.1.19 instructs operator to begin draining the RCS per procedure OTN-BB-00002. This preparation for and draining to midloop would be accomplished in approximately 24 hours.

The following description covers the system interlocks provided during draindown and operation with the RCS partially filled. To protect the RHR system from excessive pressure and inadvertent flow paths, certain valves are interlocked. The following discussion concentrates on Train "A" of the system. The Train "B" discussion would be identical. RCS hot leg loop 1 to RHR pump "A" suction valves PV-8702A and HV-8701A are used to isolate the RCS from the RHR system. To open valves PV-8702A and HV-8701A, the following conditions must be met:

- Valve HV-8811A, containment sump to RHR pump "A" suction, must be closed.

- Valve HV-8812A, RWST to RHR Pump "A" suction, must be closed.

- Valve HV-8804A, RHR pump "A" discharge to the CCP's suction and SI pump "A" suction must be closed.

- RCS pressure sensed on PT-403 (RCS press.) <360 psig to open PV-8702A. (The setpoint value is <360 psig and the Technical Specification value is <425 psig.)

- RCS pressure sensed on PT-405 (RCS press.) <360 psig to open HV-8701A. (The setpoint value is <360 psig and the Technical Specification value is <425 psig.)

This interlock prevents the operator from inadvertently connecting the RCS to the Refueling Water Storage Tank (RWST), the containment recirculation sump, or the Chemical and Volume Control System. Valve HV-8701A will close automatically if RCS pressure increases to 682 psig. (The setpoint value is 682 psig and the Technical Specification value is 750 psig.) In Train B, the valve PV-8702B closes automatically if RCS pressure increases to the setpoint. This prevents overpressurizing the RHR system.

1B. Requirements for steam generator levels:

- Technical Specification 3.4.1.1 requires that all reactor coolant loops shall be in operation during Modes 1 and 2.

  NOTE: The Steam Generator Low Level Reactor Trip setpoint is 23.5%.

- Technical Specification 3.4.1.2 requires three Reactor Coolant Pump loops to be operable and at least two loops in operation during Mode 3.

- Technical Specification 3.4.1.3 requires that at least two loops listed below shall be operable and at least one loop shall be in operation during Mode 4.

  A, B, C or D RCS loops
  A or B RHR loops

- Technical Specification 3.4.1.4.1 requires the following during Mode 5 (with reactor coolant loops filled):

  At least one RHR loop shall be operable and in operation and either:

  a. One additional RHR loop shall be operable

     or

  b. The secondary side water level of at least two steam generators shall be greater than 10% wide range.

- Technical Specification 3.4.1.4.2 requires that two RHR loops shall be operable and at least one RHR loop in operation during Mode 5 (with reactor coolant loops not filled).

1C. Changes in the status of equipment for maintenance and testing and coordination of such operation while the RCS is partially filled:

- Workmen's Protection Assurance (WPA) and Maintenance activities must be authorized by the Shift Supervisor prior to any work being done.

- Valve operation is done by Equipment Operators (EOs) in accordance with approved procedures. They report to the Operating Supervisor/Shift Supervisor. Also, the Equipment Operator performs the Local Leak Rate Tests (LLRTs) under the supervision of an Operating Supervisor/Shift Supervisor.

- Interdepartmental outage meetings are held frequently to discuss planned activities and the status of work in progress.

- Shift briefings are held to discuss the current plant status and evolutions that are planned for the shift.

1D. Restrictions regarding testing, operations and maintenance that could disturb the NSSS:

- Testing, operation or maintenance is done in accordance with approved procedures in which "precautions and limitations" and "initial conditions" are met.

- Special restrictions are covered in night orders and standing orders.

1E. Ability of the RCS to withstand pressurization if the reactor vessel head and steam generator manway are in place:

This concern is applicable during Mode 3 when the temperature of any RCS cold leg is less than or equal to 368°F (Technical Specification value); or during Modes 4, 5, and 6 with the reactor vessel head on. Technical Specification 3.4.9.3 requires that at least one of the following Overpressure Protection Systems shall be operable:

a. Two residual heat removal (RHR) suction relief valves each with a Setpoint of 450 psig ±3%,

or

b. Two power-operated relief valves (PORVs) with Setpoints which do not exceed the limit established in Tech Spec Figure 3.4-4

or

c. The Reactor Coolant System (RCS) depressurized with an RCS vent of greater than or equal to 2 square inches.

1F. Requirements pertaining to isolation of containment:

Although there are no requirements pertaining to isolation of containment in Modes 5 and 6, Callaway uses the following guidance concerning the containment equipment hatch.

- The equipment hatch is not opened until the containment airborne radioactivity is approximately 1 Maximum Permissible Concentration (MPC) as specified in 10CFR20, Appendix B, Table 1, Column 1. Airborne concentrations can increase above 1 MPC without shutting the hatch provided shutdown purge supply is secured to maintain a negative pressure in containment. This ensures only monitored effluents are released.

- The Shutdown Purge Exhaust is operated continuously while the hatch is open. Activities which require the purge to be secured (e.g. Engineered Safety Features Actuation Systems Testing and LLRT's) are normally scheduled for periods when the hatch is closed.

- The equipment hatch is either closed whenever equipment is not being transferred or a temporary cover may be placed over the hatch when it is open. Closing the hatch whenever it is not in use is the preferred action.

- The hatch is normally closed during evolutions that have the potential to produce significant airborne activity such as steam generator work, venting of systems and major cavity decon activities.

- A continuous air monitor (CAM) is positioned in containment to monitor airborne concentration. If the CAM alarms, an evaluation will be made and the hatch may be closed.

1G. Time required to replace the equipment hatch if necessary:

- The time to close the equipment hatch and secure with four bolts is approximately 2.5 hours. This is done on direction from the Shift Supervisor.

1H. Requirements pertinent to re-establishing the integrity of the RCS boundary:

- Procedure OTO-BB-00003, Reactor Coolant System Excessive Leakage, describes the symptoms and required actions for a loss of RCS inventory due to a failure of the RHR system piping in Modes 4 & 5.

- Procedure OTN-BB-00001, Reactor Coolant System, provides instructions necessary for ensuring that the RCS is properly filled and vented following RCS draining.

Generic Letter Item 2

A detailed description of the instrumentation and alarms provided to the operators for controlling thermal and hydraulic aspects of the NSSS during operation with the RCS partially filled. You should describe temporary connections, piping, and instrumentation used for this RCS condition and the quality control process to ensure proper functioning of such connections, piping, and instrumentation, including assurance that they do not contribute to loss of RCS inventory or otherwise lead to perturbation of the NSSS while the RCS is partially filled. You should also provide a description of your ability to monitor RCS pressure, temperature, and level after the RHR function may be lost.

Union Electric Response

2A. Description of instrumentation and alarms is as follows:

For each train of RHR, there is flow indication, pump discharge pressure indication, and a three pen recorder for flow, pressure and heat exchanger return temperature (located on the main board). In addition, there are computer points available to the operator to monitor RHR flow, discharge pressure, and motor current. Each train also has annunciators for low flow, high discharge pressure and motor trouble (overcurrent).

Level indication for partially filled conditions is provided in the control room by level indicator BB-LI-53 and locally by level indicator BB-LI-55 which are permanent plant equipment. These instruments are connected to the RCS via 3/4" piping. There are annunciators on the main control board and locally in the reactor building for both high loop level and low loop level when operating at partially filled conditions.

Each of the above instruments are periodically calibrated per an I&C department procedure. The level indication and alarms are calibrated each time the plant reaches a partially filled condition. The level alarm setpoints were determined as a result of an engineering evaluation. The alarms and scales for the RHR flow, discharge pressure, and overcurrent are suitable for operation at partially filled conditions.

Attachment 3 provides a detailed listing of the instrumentation and alarms provided to the operators for controlling thermal and hydraulic aspects of the NSSS during operation with th RCS partially filled.

2B. A description of temporary connections, piping, and instrumentation used for this RCS condition and the quality control process to ensure proper functioning of such connection, piping, and instrumentation, including assurance that they do not contribute to loss of RCS inventory or otherwise lead to perturbation of the NSSS while the RCS is partially filled is as follows:

Callaway has three temporary piping connections that could be used when draining the RCS.

- One temporary connection is a reinforced tygon hose from valves BB-V-085 to BB-V-090. This connection is for venting the pressurizer to the pressurizer relief tank (PRT). This is controlled by procedure OTN-BB-00002.

- The second temporary connection is the tygon level indicator hose which is installed on the loop 1 crossover at valve BB-V-311 and is extended to approximately two feet above the top of the

pressurizer. The details of this connection are as follows:

From valve BB-V-311, a pipe to swagelock adaptor is installed. Connected to the swagelock fitting is 3/8" stainless steel tubing. The stainless steel tubing is routed on the floor from BB-V-311 to the elevator wall where it rotates 90° upwards. The tubing is installed to prevent kinking or tearing of the tygon hose. The 3/4" tygon hose is connected to the stainless steel fitting with a hose clamp. The tygon hose is secured along the elevator wall and is accessible by stairway along the entire length of the hose. The elevations are painted on the wall along the length of the hose. These elevations are marked in 1 inch increments in the area corresponding to RCS mid-loop level. The installation of the hose is an initial condition for procedure OTN-BB-00002 and is verified by checklist 1, Draining the RCS Prestart checklist. The checklist is checked by two operators as well as signed by the Operating Supervisor. The control process of placing the tygon level indicator hose in service is guided by OTN-BB-00002. In addition, there is an Equipment Operator stationed at the tygon hose level indicator during level changes.

- A third temporary connection is used when draining the RCS to the Recycle Holdup Tank via the Reactor Coolant Drain Tank (RCDT) pumps. This connection consists of a spoolpiece installed upstream of valve HB-7174 and is controlled by OTN-BB-00002.

2C. The following is a description of our ability to monitor RCS pressure, temperature, and level after the RHR functions may be lost:

The following instruments monitor RCS pressure, temperature, and level after loss of RHR.

Pressure: BB-PT-403, 405, 406 (wide ranges, control room indication)
BB-PI-402, 404 RHR Suction (local) indication

Temperature: Refuel schedules assure that some thermocouples remain functional until just prior to head removal.

Level: BB-LI-53, BB-LI-55, BB-LAH and LAL-54 (RCS loop level indication)

The Reactor Vessel Level Indication System (RVLIS), unless disconnected for head removal.

Generic Letter Item 3

Identification of all pumps that can be used to control NSSS inventory. Include: (a) pumps you require be operable or capable of operation (include information about such pumps that may be temporarily removed from service for testing or maintenance); (b) other pumps not included in item a (above); and (c) an evaluation of items a and b (above) with respect to applicable TS requirements.

Union Electric Response

3A. The following pumps are used to control NSSS inventory and are required to be operable or capable of operation.

one	Centrifugal charging pump
two	RHR pumps
one	Boric acid transfer pump when boric acid storage tank is source of borated water.

3B. The following sources were not listed in response 3A, but may be used for NSSS inventory control based on availability.

one	Boric acid transfer pump
two	Safety injection pumps
one	Centrifugal charging pump
two	Reactor makeup water pumps
one	Positive displacement charging pump
four	Safety injection accumulators
one	RWST

Although the safety injection accumulators and Refueling Water Storage Tank (RWST) are not pumps, they are sources of borated water available to maintain the core covered during a loss of RCS inventory.

3C. The following discussion provides an evaluation of the items listed in 3A and 3B with respect to the applicable Technical Specification requirements. These represent restrictions placed on plant equipment to protect against events such as cold over-pressure and boron dilution events. Times listed in this section assume equipment is not inoperable for maintenance activities.

- The one inoperable centrifugal charging pump and the two inoperable safety injection pumps are required to be inoperable per Technical Specifications 3.5.3 and 3.5.4. This is accomplished by securing their motor circuit breaker in the open position. The amount of time required to make one of these pumps available as a source of RCS makeup would be minimal, less than 15 minutes.

- The reactor makeup water pumps will be limited to 150 gpm per procedure OTG-ZZ-00006 when chemical and volume control system valve BG-V-178 is closed and tagged.

- The safety injection accumulators are required to be isolated from the RCS by closing their respective isolation valves and removing power per OTG-ZZ-00006. Normally the accumulators remain filled and pressurized unless maintenance activities require otherwise. Again, it would require less than 15 minutes to adjust accumulator pressure and align power to the isolation valves to make them a source of borated water makeup to the RCS. Also A and D accumulators are set above the level of the loop and could be used as a source of water by gravity feed should they be depressurized for maintenance.

- The RWST would normally be greater than 95% full and could be used as a source of makeup by gravity feed through numerous flow paths. With the RCS at mid-loop and the RWST greater than 95%, a 40 foot head exists for flow to the RCS.

- When cold overpressure protection utilizes RHR pump suction reliefs, the positive displacement charging pump may also be capable of operation.

Generic Letter Item 4

A description of the containment closure condition you require for the conduct of operations while the RCS is partially filled. Examples of areas of consideration are the equipment hatch, personnel hatches, containment purge valves, SG secondary-side condition upstream of the isolation valves (including the valves), piping penetrations, and electrical penetrations.

Union Electric Response

Technical Specification requirements for maintaining containment integrity are relaxed in Mode 5 with no special requirements for partially filled operations versus loops filled operation. Callaway practices are given is described in response item 1F to this Generic Letter.

Generic Letter Item 5

Reference to and a summary description of procedures in the control room of your plant which describe operation while the RCS is partially filled. Your response should include the analytic basis you used for procedures development. We are particularly interested in your treatment of draindown to the condition where the RCS is partially filled, treatment of minor variations from expected behavior such as caused by air entrainment and de-entrainment, treatment of boiling in the core with and without

RCS pressure boundary integrity, calculations of approximate time from loss of RHR to core damage, level differences in the RCS and the effect upon instrumentation indications, treatment of air in the RCS/RHR system, including the impact of air upon NSSS and instrumentation response, and treatment of vortexing at the connection of the RHR suction line(s) to the RCS.

Explain how your analytic basis supports the following as pertaining to your facility: (a) procedural guidance pertinent to timing of operations, required instrumentation, cautions, and critical parameters; (b) operations control and communications requirements regarding operations that may perturb the NSSS, including restrictions upon testing, maintenance, and coordination of operations that could upset the condition of the NSSS; and (c) response to loss of RHR, including regaining control of RCS heat removal, operations involving the NSSS if RHR cannot be restored, control of effluent from the containment if containment was not in an isolated condition at the time of loss of RHR, and operations to provide containment isolation if containment was not isolated at the time of loss of RHR (guidance pertinent to timing of operations, cautions and warnings critical parameters, and notifications is to be clearly described).

Union Electric Response

Attachment 2 provides a summary description of the procedures referenced in our responses to the items of this Generic Letter. Included are the procedures used in the Control Room to cover operation while the RCS is partially filled.

5A. The following list provides the procedures used in the Control Room which are applicable to operating conditions while the RCS is partially filled.

Procedure	Title
OTN-BB-00002	Reactor Coolant System Draining
OTO-BB-00003	Reactor Coolant System Excessive Leakage
OTO-EJ-00001	Loss of RHR
OTA-RL-RK049	Annunciator Response Procedures Windows 49A through 49F
OTA-RL-RK050	Windows 50A through 50F

The primary controlling procedure is OTN-BB-00002 which covers areas such as draining down to partially filled loops, actions taken during operation with partially filled loops, proper operation at mid-loop, alignment of various drains, and the re-establishment of full loop condition.

The analytic bases for these procedures include Westinghouse operating experience, established procedures,and practices; Callaway systems design; evaluations to avoid conditions of vortexing; and maintaining net positive suction head (NPSH) during this mode of operation. While procedures are based upon enveloping conditions, additional assessments support the following details.

- To avoid vortexing during mid-loop operation, the level setpoint is set to alarm at the mid-loop level. Calculations, which have been verified with SNUPPS plants operational data, support this setpoint.

- Assuming loss of all cooling at fifty hours after shutdown and assuming the availability of pressure relief, the time to the onset of core uncovery is greater than forty minutes. This allows ample time for operator response. The time to core damage was not evaluated since the time to uncovery is long enough for operator response to prevent core damage. In addition starting one centrifugal charging pump provides more than enough makeup flow to maintain RCS inventory and prevent core uncovery due to boil-off.

- Assuming loss of all cooling at fifty hours after shutdown, and assuming no pressure relief, the time to RCS pressurization significantly above atmospheric (200 psia) is slightly greater than 40 minutes. Again this allows time for operator response.

  Pressurization calculations take no credit for vapor filled pressurizer or steam generator primary volumes. This is conservative since a smaller vapor volume results in a greater pressurization rate following a loss of RHR. Also no credit is taken for RCS heat removal by steam generators due to condensation of steam.

The procedure OTN-BB-00002 governs the draindown to the condition where the RCS is partially filled. The procedures OTA-RL-RK049 and OTA-RL-RK050 would govern responses to any alarms on low level or low flow. Included in these procedures are "caution" statements which caution the operator not to start the standby RHR pump (to prevent possible pump cavitation). Operating experience and procedure cautionary notes provide further guidance to the operators during the draindown.

Variations from expected behaviors would be covered by the off-normal procedure OTO-EJ-00001. Problems caused by air

entrainment and de-entrainment should be avoided by instrumentation monitoring, maintaining the mid-loop level and adherence to OTN-BB-00002.

In the event of boiling in the core, the operator has over forty minutes in which to respond by restricting RCS pressurization and by providing other sources of makeup water to maintain RCS inventory above the core. Off-normal procedures OTO-BB-00003 and OTO-EJ-00001 govern the actions to be taken. For example both procedures direct the operator to start centrifugal charging pumps. The evaluation shows that charging pump flow provides more than enough makeup to maintain RCS inventory to offset losses through boil-off.

The detailed description of the Callaway instrumentation and alarms available for operation with the RCS partially filled was presented in response to Item 2 of the Generic Letter.

The concerns of air in the RCS/RHR system and vortexing are avoided by maintaining the mid-loop level and monitoring the provided instrumentation and alarms. Again any deviations would be covered by procedure OTO-EJ-00001.

5B. Evaluations show over forty minutes for operator response prior to core uncovery. Operator actions include activities such as starting centrifugal charging pumps for makeup flow or venting the system to avoid RCS pressurization. Refer to response 5A for a list and discussion of the applicable procedures.

Operations control and communication requirements cover any operation or maintenance activities that could perturb the NSSS while in partially filled loop operation.

- WPA and Maintenance must be authorized by the Shift Supervisor prior to any work being done.

- Valve operation is done by Equipment Operators (EOs) in accordance with approved procedures. They report to the Operating Supervisor/Shift Supervisor. Also, the Equipment Operator performs the LLRTs under the supervision of an Operating Supervisor/Shift Supervisor.

- Interdepartmental outage meetings are held frequently to discuss planned activities and the status of work in progress.

- Shift briefings are held to discuss the current plant status and evolutions that are planned for the shift.

- Testing, operation or maintenance is done following approved procedures in which "precautions and limitations" and "initial conditions" are met.

- Special restrictions are covered in night and standing orders.

In the event of a loss of RHR, the off-normal procedure OTO-EJ-00001 would be followed. Containment isolation would be primarily dictated by health physics concerns and governed by the guidance listed in our response item 1F.

Generic Letter Item 6

A brief description of training provided to operators and other affected personnel that is specific to the issue of operation while the RCS is partially filled. We are particularly interested in such areas as maintenance personnel training regarding avoidance of perturbing the NSSS and response to loss of decay heat removal while the RCS is partially filled.

Union Electric Response

Attachment 4 provides a brief description of the training provided or to be provided to operators and other affected personnel regarding loss of RHR (including various industry events concerning loss of RHR along with associated plant conditions, indications, and responses). As indicated, an overview of loss of RHR and the Diablo Canyon incident was presented to maintenance and technical support personnel as part of the retraining agenda.

Generic Letter Item 7

Identification of additional resources provided to the operators while the RCS is partially filled, such as assignment of additional personnel with specialized knowledge involving the phenomena and instrumentation.

Union Electric Response

Administrative procedure APA-ZZ-00010, "Conduct of Operations - Operations", provides more Control Room personnel to be on shift during Modes 5 and 6 than do the Technical Specifications. The following Table gives a comparison of the shift manning between the procedure and the Technical Specifications.

	APA-ZZ-00010	TECHNICAL SPECIFICATIONS
Shift Supervisor	1	1 *
Operating Supervisor	1	0
Unit Reactor Operator	2	1
Shift Technical Advisor	1	0

* Shift Supervisor or Operating Supervisor with a SRO license

In addition, an Equipment Operator is stationed at the temporary connection tygon hose during level changes.

Generic Letter Item 8

Comparison of the requirements implemented while the RCS is partially filled and requirements used in other Mode 5 operations. Some requirements and procedures followed while the RCS is partially filled may not appear in the other modes. An example of such differences is operation with a reduced RHR flow rate to minimize the likelihood of vortexing and air ingestion.

Union Electric Response

Procedure OTN-BB-00002, RCS Drain Procedure, provides special precautions, limitations, and instrumentation for controlling mid-loop operations.

Prior to draining to mid-loop, loop level instrumentation BB-LT-53 and BB-LI-55, will be placed in service and tested. This instrumentation is in addition to the tygon hose and provides loop level indication in the containment and Control Room and high/low level alarms in the containment and Control Room.

Special precautions and limitations in OTN-BB-00002 for mid-loop operations include:

- Dedicated tygon hose watch for draining and filling operations.
- Reminder to maintain minimum RHR flow requirements for controlling desired RCS temperature.
- Caution to maintain loop level above the low level alarm to minimize vortexing and subsequent air binding.
- Operator actions to be taken if RHR pump air binding occurs.
- Necessary operator action for restoring RHR cooling if vortexing or binding occurs.
- Caution to monitor core temperatures if RHR pumps are stopped.

Generic Letter Item 9

As a result of your consideration of these issues, you may have made changes to your current program related to these issues. If such changes have strengthened your ability to operate safely during a partially filled situation, describe those changes and tell when they were made or are scheduled to be made.

Union Electric Response

As a result of the issues raised in Generic Letter 87-12, Information Notice 87-23, and INPO SER 15-87 'The Diablo Canyon Event', the changes listed in Attachment 1 have been evaluated or are under evaluation to strengthen Callaway's ability to operate safely during partially filled conditions. The expected implementation dates for these issues are also provided in Attachment 1.

TABLE OF ITEMS EVALUATED OR UNDER EVALUATION TO STRENGTHEN OPERATION DURING PARTIALLY FILLED CONDITIONS

Program Area	Changes	Implementation
Training	Loss of RHR added to GET II Systems training for maintenance and technical support personnel	November, 1987
	Generic Letter 87-12 specifics to be added to the existing loss of RHR portion of the systems section of the Hot License Course for SRO/RO/STA Hot License personnel	February, 1988
	Loss of RHR specifics to be added to the Equipment Operator Primary Course	May, 1988
	Maintenance and Technical support personnel received an overview of loss of RHR and Diablo Canyon incident as part of Pre-Outage Training	September, 1987
Operations	RCS mid-loop low level alarm was re-evaluated and adjusted to prevent level dropping to a point which could result in vortexing.	September, 1987

TABLE OF ITEMS EVALUATED OR UNDER EVALUATION TO STRENGTHEN OPERATION DURING PARTIALLY FILLED CONDITIONS

Program Area	Changes	Implementation
Operations	The procedure OTN-BB-00002, governing drain down of RCS to mid-loop and operation at mid-loop, is being revised to add caution statements for the operator to specifically look for parameters indicating vortexing (i.e., RHR low flow alarm, sporadic RHR pressure and/or flow). In addition, a precaution will limit flowrate during draindown to the minimum required to maintain temperature. A further note requires tripping a pump without starting the other pump until the problem with the first pump has been corrected.	September, 1987
	The procedure for draindown of the refueling pool is revised to limit the flowrate to avoid vortexing.	September, 1987
	Evaluating the capability of removing possible level errors due to pressure differences between the RCS and containment	Under Evaluation
	Evaluating providing hot leg level indication during partially filled operations	Under Evaluation

TABLE OF CONTENTS
PROCEDURES SUMMARIES

PROCEDURE NUMBER: APA-ZZ-00010

PROCEDURE TITLE: Conduct Operations - Operations

This procedure establishes the Operations Department organizational structure, departmental functions, interfaces with other departments, responsibilities of personnel, and organization of departmental procedures.

PROCEDURE NUMBER: OTN-BB-00001

PROCEDURE TITLE: Reactor Coolant System

This procedure provides the instructions necessary for ensuring that the RCS is properly filled and vented prior to initial operation or following RCS draining.

There are 8 checklists as part of this procedure to verify proper RCS lineup. These are checked by two Equipment Operators and verified complete by the Operating Supervisor. The checklists are as follows:

Checklist 1	Reactor Coolant System Loop 1 Valve Lineup
Checklist 2	Reactor Coolant System Loop 2 Valve Lineup
Checklist 3	Reactor Coolant System Loop 3 Valve Lineup
Checklist 4	Reactor Coolant System Loop 4 Valve Lineup
Checklist 5	Reactor Coolant System Pressurizer Valve Lineup
Checklist 6	Reactor Coolant System Post-Venting Valve Checklist
Checklist 7	Reactor Coolant System Electrical Equipment Lineup
Checklist 8	Reactor Coolant System Main Control Board Lineup

PROCEDURE NUMBER: OTN-EJ-00001

PROCEDURE TITLE: Residual Heat Removal System

This procedure provides the instructions for aligning the Residual Heat Removal System for safety injection standby and placing the RHR system in service for cooldown. This procedure also provides the instructions for borating the RHR system to bring boron concentration in the RHR system to within Tech Spec limits of the RCS.

Precaution and Limitation 2.5 recommends that the RHR cross-connect valves EJ-HV-8716A and EJ-HV-8716B should be closed for normal cooldown operation when in Modes 4, 5, or 6. In the body of the procedure, Step 4.3.15 instructs the operator to close EJ-HV-8716A and EJ-HV-8716B. These steps are included in the procedure to ensure that the RHR Loop flow alarms operate correctly.

Precaution and Limitation 2.8 instructs the operator to stop the running RHR pump prior to starting the standby RHR pump when shifting RHR trains. This should prevent possible loss of suction to RHR pumps due to 2 pumps running simultaneously.

PROCEDURE NUMBER: OTN-BB-00002

PROCEDURE TITLE: Reactor Coolant System Draining

This procedure provides the instructions necessary for lowering the reactor coolant level for maintenance or prior to removing the reactor vessel head for refueling.

The major operations that are addressed are as follows:

1. Draining the RCS via letdown
2. Placing a nitrogen cover gas on the Pressurizer
3. Venting the Pressurizer to atmosphere
4. Placing a nitrogen cover gas on the Reactor Vessel Head
5. Venting the Reactor Vessel Head to atmosphere
6. Nozzle dam installation
7. Draining the RCS to RCDT pump suction
8. Realignment of the drain path

Precaution and Limitation 2.8 is especially applicable to Generic Letter 87-12 and is summarized as follows:

The water level in the loop should not be decreased below the low level alarm setpoint in order to prevent vortexing and subsequent air binding of the operating RHR pump(s).

RHR flow is maintained at the minimum rate required to maintain the desired RCS temperature when the RCS level approaches or reaches just above the centerline of the hot leg. RHR flow, RHR pump discharge pressure and the RHR low flow alarm should be monitored for fluctuation indicating vortexing. If vortexing is indicated, increase charging or decrease RHR flow (trip the pump if necessary).

If the RHR pump is stopped, monitor core thermocouples, if available, to determine heatup rate. Also, venting of the RHR pump may be required and should be considered. Do not start the other RHR pump until level has been increased sufficiently to prevent vortexing.

The body of the procedure gives direction to the operator for all of the major operations listed above. In addition, there is an attachment and two checklists which aid the operators when draining. The attachment is a diagram which shows a Pressurizer Level Scale, Spent Fuel Pool Level Scale, RCS Loop Level Scale, and Tygon Hose Indication Scale. This allows the operator to compare the various level indicators to the elevation from tygon hose to ensure desired level is maintained.

PROCEDURE NUMBER: OTN-BB-00002 (Continued)

PROCEDURE TITLE: Reactor Coolant System Draining

The checklists are used tc verify proper valve lineup and temporary connections installation for draining the RCS. These checklists are checked independently by two Equipment Operators and verified completed by the Operating Supervisor.

PROCEDURE NUMBER: OTA-RL-RK050

PROCEDURE TITLE: Annunciator Response - Windows 50A through 50F

This procedure provides aid and guidance to the operator in responding to all alarms received on the Main Control Board Annunciator Panels, Windows 50A through 50F giving immediate action, subsequent action, and the instrumentation which feeds the alarm.

Included in these annunciator windows are:

1) RHR PUMP TROUBLE (50A),
2) RCS Loop Level Lo (50B),
3) RHR Loop 2 Flow Lo (50C),
4) RHR B Discharge Pressure Hi (50D) and
5) RCS Loop Level Hi (50E)

"Immediate Actions" which are applicable to Generic Letter 87-12 are:

For Window 50B, RCS Loop Level Lo

1) If the RHR pump discharge flow is abnormal, stop the RHR pump running to prevent cavitation.

2) Immediately increase charging flow and decrease letdown while monitoring VCT level.

3) If increase in charging flow will not recover the level, consideration should be taken to align charging to the RWST to recover level.

PROCEDURE NUMBER: OTA-RL-RK049

PROCEDURE TITLE: Annunciator Response Procedure Windows 49A through 49E

This procedure provides aid and guidance to the operator in responding to all alarms received on the Main Control Board Annunciator Panels, Windows 49A through 49F giving immediate actions, subsequent actions, and the instrumentation which feeds the alarm.

Included in these annunciator windows are:

1) RHR Loop 1 Flow Low (49C),

2) RHR A Discharge Pressure Hi (49D)

"Immediate Actions" which are applicable to Generic Letter 87-12 are:

For Window 49C, RHR Low Flow Annunciator

1) A "caution" states that the standby RHR train should not be started to prevent having both RHR trains inoperable.

PROCEDURE NUMBER: OTO-EJ-00001

PROCEDURE TITLE: Loss of RHR Flow

This is the off-normal operating procedure which provides instructions for placing the plant in a stable condition in the event of a failure of both Residual Heat Removal System trains. The following Subsequent Operator Actions of the procedure are applicable to Generic Letter 87-12:

1) Evaluate conditions for evacuating the Reactor Building.

2) Initiate actions to establish Reactor Building integrity.

3) Align the charging system.

4) Start the charging pump discharging to the RCS cold legs.

PROCEDURE NUMBER: OTO-BB-00003

PROCEDURE TITLE: Reactor Coolant System Excessive Leakage

This is the off-normal operating procedure, which:

1) describes the symptoms and required actions for a primary system leak, which is within the capability of the CVCS to maintain pressurizer level and

2) describes the symptoms and required actions for a loss of RCS inventory due to a failure of the RHR system piping in Modes 4 & 5.

GENERAL OPERATING PROCEDURES

The following are general operating procedures which would be used for instructions for cooling the unit down from 100% power. These procedures are intended to serve as guidelines to define the major evolutions that are required during cooldown.

PROCEDURE NUMBER: OTG-ZZ-00004
PROCEDURE TITLE: POWER OPERATIONS

This procedure provides instructions and the proper sequence for loading the unit from 20% to 100% power and load decrease from 100% to 20% power.

PROCEDURE NUMBER: OTG-ZZ-00005
PROCEDURE TITLE: PLANT SHUTDOWN-20% POWER TO HOT STANDBY

This procedure provides instructions for unloading the unit from 20% power to off line and shutdown of the reactor to the hot standby condition.

PROCEDURE NUMBER: OTG-ZZ-00006
PROCEDURE TITLE: PLANT COOLDOWN-HOT STANDBY TO COLD SHUTDOWN

This procedure provides instructions for cooling down the primary plant from hot standby condition to the cold shutdown condition. It also addresses the removal from service of secondary plant systems as the cooldown progresses.

PROCEDURE NUMBER: OTG-ZZ-00007
PROCEDURE TITLE: REFUELING PREPARATION, PERFORMANCE, AND RECOVERY

This procedure provides instructions for the following:

1) Cooldown of the RCS from cold shutdown to Refueling Temperature

2) Preparation for fuel movement

3) Preparation for return to service

INSTRUMENTATION AND ALARMS

CONTROL ROOM INSTRUMENTATION

RCS Loop Level Indication

BB-LT-0053	Level indication for "partially filled" operation

'A' Train RHR Loop

EJ-FI-618	RHR Flow to Loops 1 + 2
EJ-PI-614	RHR Pump A Discharge Pressure
EJ-TR-612	3 Pen Recorder for RHR Train 'A' 1) RHR Discharge Pressure 2) Heat Exchanger 'A' Return Temperature 3) Loop 1/2 Flow

'B' Train RHR Loop

EJ-FI-619	RHR Flow to Loops 3 + 4
EJ-PI-615	RHR Pump B Discharge Pressure
EJ-TR-613	3 Pen Recorder for RHR Train 'B' 1) RHR Discharge Pressure 2) Heat Exchanger 'B' Return Temperature 3) Loop 3/4 Flow

Computer Points

EJF0618A	RHR 'A' to Acc Inj Flow
EJF0619A	RHR 'B' to Acc Inj Flow
EJI0004	RHR Pump 'A' Current
EJI0020	RHR Pump 'B' Current
EJP0614A	RHR Pump 'A' Discharge Pressure
EJP0615A	RHR Pump 'B' Discharge Pressure
EJQ0001	RHR Pump 'A' Status
EJQ0002	RHR Pump 'B' Status
BBL0053H	RCS level
BBL0053L	RCS level

INSTRUMENTATION AND ALARMS

CONTROL ROOM INSTRUMENTATION (cont.)

Annunciators

Annunciator Window 49C	Residual Heat Removal Loop 1 Flow Low (Trips at 2500 gpm)
Annunciator Window 49D	RHR 'A' Discharge Pressure Hi (Tripped 600 psig)
Annunciator Window 50A	RHR Pump Trouble (overcurrent)
Annunciator Window 50B	RCS Loop Level Lo (17" from bottom of inside of hot leg)
Annunciator Window 50C	RHR Loop 2 Flow Lo (Trips at 2500 gpm)
Annunciator Window 50D	RHR 'B' Discharge Pressure Hi (Tripped at 600 psig)
Annunciator Window 50E	RCS Loop Level Hi (27" from bottom of inside of hot leg)

Instrumentation Available Locally (Reactor Building 2000')

BB-PI-0402	RCS LP-4 Hot Leg to RHR Pumps Local Pressure Indicator
BB-PI-0404	RCS LP-1 Hot Leg to RHR Pumps Local Pressure Indicator
BB-LI-55	Local Level Indication for "Partially Filled" operation
BB-LAH-54	Local "Partially Filled" Hi Level Alarm
BB-LAL-54	Local "Partially Filled" Lo Level Alarm

DESCRIPTION OF TRAINING PROVIDED ON LOSS OF RHR

TRAINING PROGRAM AREA	ACTION TAKEN FOR TRAINING ON LOSS OF RHR
Initial Training	
- Maintenance & Technical Support Personnel	Loss of RHR will be added to GET II System training prior to the next class scheduled in November, 1987.
- SRO/RO/STA Hot License Personnel	Loss of RHR is currently covered in the Systems portion of the Hot License Course. Generic Letter 87-12 specifics will be added to this course prior to the next class scheduled for February, 1988.
- Equipment Operator and Ass't. Equipment Operator	Loss of RHR specifics will be added to the EO Primary Course prior to the next class scheduled for May, 1988.
Retraining	
- Maintenance & Technical Support Personnel	Individuals in this area have received an overview of loss of RHR and Diablo Canyon incident as part of Pre-Outage Training prior to Refueling II, which began in September, 1987.
- SRO/RO/STA	In addition to Pre-Outage Training, these individuals have reviewed various industry events concerning loss of RHR along with associated plant conditions, indications, and responses as part of Licensed Operator Requalification prior to Refueling II.
- Equipment Operator and Ass't. Equipment Operator	In addition to Pre-Outage Training, these individuals received additional training in this area during Retraining conducted in early 1987.