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SUBJECT: Forwards response to Generic Ltr 87-12, "Loss of RHR While RCS Partially Filled," dtd 870709 request re nine items concerning operation of plant.

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JAMES D. SHIFFER
VICE PRESIDENT
NUCLEAR POWER GENERATION

September 18, 1987

PGandE Letter No.: DCL-87-233

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

Re: Docket No. 50-275, OL-DPR-80
Docket No. 50-323, OL-DPR-82
Diablo Canyon Units 1 and 2
Response to Generic Letter 87-12, Loss of Residual Heat Removal While the Reactor Coolant System Is Partially Filled

Gentlemen:

Generic Letter 87-12, "Loss of Residual Heat Removal (RHR) While the Reactor Coolant System (RCS) is Partially Filled," dated July 9, 1987, requested a response to nine items related to operation of the Diablo Canyon Power Plant with a partially filled reactor coolant system. PGandE's response is provided in the enclosure.

Kindly acknowledge receipt of this material on the enclosed copy of the letter and return it in the enclosed addressed envelope.

Subscribed in San Francisco, California this 18th day of September 1987.

Respectfully submitted,

Pacific Gas and Electric Company

By [signature]
J. D. Shiffer
Vice President
Nuclear Power Generation

Howard Golub
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By [signature]
Richard F. Locke

OFFICIAL SEAL
THERESE TOLIVER
NOTARY PUBLIC - CALIFORNIA
CITY AND COUNTY OF SAN FRANCISCO
My Comm. Expires Dec. 25, 1990

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

[signature]
Therese Toliver, Notary Public in and for the City and County of San Francisco, State of California

My commission expires December 25, 1990.

Enclosure

cc: L. J. Chandler, J. B. Martin, M. M. Mendonca, P. P. Narbut, B. Norton, CPUC, Diablo Distribution

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ENCLOSURE

PGandE Response to Generic Letter 87-12,
"Loss of Residual Heat Removal (RHR) While the
Reactor Coolant System (RCS) Is Partially Filled"

The following information is PGandE's response to items 1 through 9 in Generic Letter 87-12.

Item 1

Provide 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.

Response to Item 1

The RCS would be partially drained for SG or reactor coolant pump maintenance or inspection activities. Draining of the RCS is controlled by Operating Procedure (OP) A-2:II, "Reactor Vessel - Draining the Reactor Coolant System." A minimum of 48 hours after full power operation is estimated to be needed to partially drain the RCS. Draining of the RCS would start after the unit has been brought into Mode 5 (Cold Shutdown) with the primary coolant temperature less than 160 degrees Fahrenheit. The maximum decay heat load at this time is estimated to produce an RCS heatup of approximately 8 degrees Fahrenheit per minute without forced flow and without the RHR system in service. Both trains of the residual heat removal (RHR) system will be operable and at least one train of the RHR system will be in operation during the draining of the RCS. No Technical Specification or procedural requirements exist for minimum SG levels during mid-loop operation.

An interlock that could perturb mid-loop operation is the RHR autoclosure interlock (ACI). The RHR ACI function automatically closes either of the two RHR loop 4 series suction valves in a single line on the receipt of a high

pressure signal of 700 psig from the loop 4 hot leg or a high pressure signal of 700 psig from the loop 3 hot leg and a pressurizer vapor space temperature greater than 475 degrees Fahrenheit. The RHR ACI also closes the RHR system suction valves on loss of voltage to the instrumentation circuitry or control relays. This is the predominant cause of inadvertent isolation of the RHR system. PGandE has requested removal of the RHR ACI function in PGandE letter DCL-87-187, dated August 4, 1987.

During draining of the RCS and operation in the mid-loop configuration, work activities and testing are controlled to ensure that no potential RCS inventory loss path from the reactor coolant, RHR, or charging systems is created. Several surveillance test procedures have been identified that should not be performed during mid-loop operation. All personnel responsible for local leak rate testing are required to inform the Shift Foreman before draining any plant system. Also, direct communications are established between the control room and all critical work areas. During mid loop operation, all work activities and testing are planned so that the time duration in this configuration is minimized. All related activities are reviewed by the operations outage organization to determine potential impact during mid-loop operation. Since operation at mid-loop conditions requires close attention to system changes and minimum perturbations to systems connected to the RCS, the work during this period of an outage is limited. Work on the RCS or systems connected to the RCS during mid-loop conditions requires specific authorization by the outage manager or his designee. In summary, the scope of outage work to be performed on systems connected to the RCS during mid-loop operation will be restricted to those items that do not (1) communicate between containment and the environment or (2) have the potential to reduce RCS inventory.

When maintenance is to be performed on the primary side of the SG or on the RCPs, OP A-2:II would be used to drain the RCS to the mid-loop configuration to set initial conditions for the maintenance. If refueling of the reactor and maintenance of the SGs or RCPs were to occur simultaneously, then nozzle dams, to isolate the SG or RCP cavities, would be installed so that reactor vessel water level could be returned to the normal level for fuel assembly movement. At Diablo Canyon Power Plant, mid-loop operations is regarded as a operating condition to facilitate the installation or removal of water-retaining devices (either temporary nozzle dams or permanently installed covers or manways). If the maintenance period is to be of a sufficiently short duration (e.g., identifying and plugging a leaking SG tube) then mid-loop operation may be sustained throughout the repair period without the use of nozzle dams. However, in either case, time spent in the mid-loop configuration is kept to a minimum.

An inadvertent loss of RHR in the mid-loop configuration would cause a heatup and eventual pressurization of the RCS. Our analysis, referred to in item 5, assumes that at approximately 5 psig, the tygon tubing used for the reactor vessel refueling level indication system (RVRLIS) could rupture. This break would be small and would not terminate the RCS pressurization. At approximately 25 psig in the RCS, gravity flow makeup from the refueling water

storage tank would not be possible. However, OP A-2:II requires that one operable charging pump and either a second charging pump or a safety injection pump be available at all times during the draindown. The draindown to mid-loop operations begins by depressurizing the RCS and opening a power operated relief valve and its associated isolation valve (OP A-2:II). This allows the pressurizer relief tank to become part of the RCS pressure boundary. The highest credible pressure during this event would be approximately 100 psig. This pressure occurs due to dryout of the steam generators and rapid pressurization of the RCS to the relief setpoint of the rupture discs. If nozzle dams are installed, 50 psi is the maximum pressure rating for the devices. This pressure would be reached relatively early in the event, provided no operator action terminated the loss of RHR flow event. The integrity of the RCS pressure boundary would be maintained, with the exception of the RVRLIS tygon tubing and PRT rupture discs, if nozzle dams have not been installed. The abnormal procedure for loss of RHR flow, OP AP-16, provides requirements for plant recovery including actions for loss of inventory and restoring RHR flow.

Additionally, OP A-2:II and OP AP-16 require major pathways that communicate between the containment atmosphere and the outside atmosphere either to be closed or to have the capability of being closed in a timely manner (less than 30 minutes). One of these major pathways is the containment equipment hatch. The two procedures require that the hatch be in place and secured by a minimum of four bolts. Should the hatch not be in place, replacement of the hatch is expected to take 2 hours.

Item 2

Provide 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 connection, 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.

Response to Item 2

During mid-loop operation the following instrumentation and alarms have been or will be available to operators in the control room to monitor and control the RCS water level, temperature, and pressure.

1. RCS water level

   a. A narrow and wide-range reactor vessel refueling level indication system (RVRLIS) was used during the last two refueling outages to sense the loop 4 cold leg level,

referenced to the pressurizer vapor space. These two indications were available on accumulator level meters with high and low alarms. This installation was an interim measure pending the installation of permanent instrumentation described in items b and c.

b. A new permanent narrow-range RVRLIS is being provided to sense the loop 3 hot leg level. This instrumentation is a differential pressure system referenced to the reactor vessel head. This is indicated on an accumulator level meter with high and low alarms.

c. A new permanent wide-range RVRLIS indication channel is being provided to sense the loop 2 crossover leg level. This instrumentation is a differential pressure system referenced to the pressurizer vapor space and will be indicated in the control room through an accumulator level channel with high and low alarms. This channel has been installed for mid-loop operation in Unit 2 and will be installed in Unit 1 during the next refueling outage.

d. A visual standpipe level system referenced to the pressurizer vapor space inside containment, with a calibrated one-inch scale, will provide a direct indication of reactor vessel level.

Note: Accumulator level channels referenced above are modified during system installation with regard to appropriate meter scale faces and identification labels.

2. RCS water temperature

a. A minimum of two RCS core exit thermocouples will be in service when the reactor vessel head is in place, except during preparation for removal or replacement of the reactor vessel head.

b. A minimum of one loop RCS wide range (hot leg and cold leg) temperature monitors and recorders will be in service.

3. RHR temperature and flowrate

The following RHR indications are available: RHR pump flowrate, RHR suction valve positions, RHR pump circuit breaker positions, and RHR pump discharge temperature. An RHR low flow alarm provides a warning of low flow after a preset time delay. In addition, RHR pump motor current indication is available. This instrumentation is normally in service but is not required procedurally or by Technical Specifications.

4. RCS pressure

RCS pressure indication is provided by the RCS wide range pressure instrumentation.

The only temporary connections, piping, and instrumentation used for mid-loop operations were made during previous refueling outages for the installation of the temporary RVRLIS and the visual standpipe system. These installations were made through the temporary design change process and received a thorough quality organization review and inspection prior to and after installation (subsequent to the April 10, 1987 interruption of RHR flow event) to ensure that they did not contribute to system perturbations or loss of RCS inventory during operation. The permanent RVRLIS systems, which will be operational for subsequent refueling outages, will also receive a thorough quality organization review. RVRLIS will also be inspected by the Operations Department prior to use. The valve alignment is verified in accordance with OP A-2:II. During the actual draindown of the RCS the RVRLIS is compared against the pressurizer level indication and tygon tube level for accuracy. Prior to draining the reactor vessel one foot below the vessel flange an operator will be stationed inside containment. This operator will be able to very quickly verify reactor vessel water level by the tygon tube should it be needed. A daily inspection of the RVRLIS system is to be performed in accordance with OP A-2:II. This inspection is discussed in detail in the response to item 8.

If RHR flow is lost RVRLIS and the core thermocouples will still provide data to operators regarding reactor vessel water level and temperature, respectively. RCS pressure would still be provided by RCS wide range pressure. Without the presence of forced reactor coolant flow the accuracy of the wide range RCS temperature indication would be suspect.

Item 3

Provide identification of all pumps that can be used to control NSSS inventory. Include: (a) pumps you require to 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.

Response to Item 3

At the Diablo Canyon Power Plant, the Emergency Core Cooling System (ECCS) pumps consists of the centrifugal charging pumps (high-head safety injection), safety injection pumps (intermediate-head safety injection), and the residual heat removal pumps (low-head safety injection). Operation of the safety injection pumps and more than one charging pump is prohibited in Mode 5 by the Technical Specifications. When operating in Mode 5 with the reactor coolant loops not filled, Technical Specification (TS) 3.4.1.4.2 requires that two residual heat removal trains be operable with at least one RHR train in

operation (a one hour exception is noted in the Technical Specifications). TS 3.1.2.3 requires at least one charging pump to be operable in Modes 5 and 6. In addition to the Technical Specification pump requirements listed above, TS 3.1.2.1 requires an operable boron injection flow path, either via the boric acid storage tanks with an associated boric acid transfer pump, a charging pump, and associated motor-operated valves operable, or via the refueling water storage tank with an operable charging pump available.

In the mid-loop configuration, OP A-2:II requires the ready availability of either a second operable charging pump with its dc control power removed or an operable safety injection pump and its associated flow path with its dc control power removed.

The boric acid transfer pumps and the primary water storage tank pumps can deliver water to the RCS provided the RCS pressure is less than approximately 100 psig. However, the primary water storage tank pumps are not required to be operable during mid-loop operations. The boric acid transfer pumps are not required to be operable unless they are being used in accordance with TS 3.1.2.1.

Item 4

Provide 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.

Response to Item 4

Procedures governing mid-loop operation and abnormal procedures governing actions to be taken on interruption of RHR flow require that major pathways which communicate between the containment atmosphere and the outside atmosphere be closed (in the case of the equipment hatch and steam generator secondary side isolation) or have the capability of being closed (e.g., airlock door) in a timely manner (less than 30 minutes). Piping and electrical penetrations are not required to be capable of isolation by technical specifications or procedurally while the RCS is being operated in the mid-loop configuration. The piping and electrical penetrations do not represent a major pathway between the containment atmosphere and the outside atmosphere.

The following prerequisites for establishing a containment "boundary" prior to draining one foot below the reactor vessel flange level are contained in OP A-2:II:

- The equipment hatch is in place and secured with a minimum of four bolts.

- At least one personnel airlock door is capable of being closed, without obstructions present.

- Containment ventilation isolation can be assured with at least one valve either inside containment or outside containment capable of being closed.

- All steam generator secondary-side manways and inspection ports are installed or the associated main steam isolation valves and steam line atmospheric relief valves are closed and controlled by an administrative tagout.

The abnormal procedure for the loss of RHR flow, OP AP-16, requires that the following be verified in the event of a loss of flow during operation at mid-loop conditions:

- Equipment hatch closed

- At least one personnel airlock door closed

- Steam generator secondary side isolated

- Containment ventilation isolated

- Reactor vessel head vent closed

Future analysis of the consequences of RHR loss of flow may be used to allow opening of the equipment hatch or other penetrations provided closure can be accomplished in an appropriate time frame.

Item 5

Provide a 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).

Response to Item 5

As a result of the DCPP Unit 2 April 10, 1987, interruption of RHR flow event (see NUREG-1269) a detailed investigation of this event was performed. This investigation included performance of two major analyses using different computer programs for post-event evaluation.

(1) RETRAN was used to simulate the event with particular emphasis placed on the initial RCS heat-up after the interruption of RHR.

(2) The Modular Accident Analysis Program (MAAP) was used to predict the time to core damage assuming that no operator actions were taken to recover from the loss of RHR. The analysis indicated that given the initial conditions from the DCPP interruption of RHR flow event on April 10, 1987, core damage could have occurred approximately 45 hours from the start of the event.

The investigation resulted in revisions to procedures OP A-2:II and OP AP-16 regarding precautions, required instrumentation, operations, communications, outage controls, containment closure, and restoring of RHR flow. The revisions are described in detail in the responses to items 1, 2, 3, 4, 8, and 9 and summarized as follows.

Operating Procedure (OP) A-2:II, "Reactor Vessel - Draining the Reactor Coolant System," provides instruction for draining the RCS for maintenance, inspection or refueling activities. For refueling activities, this procedure will be performed in conjunction with OP L-6, "Refueling."

OP A-2:II contains specific precautionary statements regarding RHR pump vortexing, loss of suction pressure, and the effects upon instrumentation. An attachment to the procedure gives the operator specific guidance as to the RCS level (RVRLIS) and flow combinations expected to result in the incipience of vortexing. This procedure also specifies a minimum RCS level. Draining beyond this minimum level requires specific management approval. This procedure has precautions addressing operations that may affect the free volume air space of the RCS and the effect on RVRLIS operation (e.g., changing of ventilation systems condition). OP A-2:II also contains precautions relating to the RVRLIS system response to rapid RCS level changes and the formation of a pressurizer/RCS hydraulic seal at a predetermined level. Another precaution states that the loop 4 RVRLIS will be slower responding to RCS level or pressure changes. The loop 3 RVRLIS should not have any delay time related to rapid level changes. The precautions describing vortexing and cavitation include a description of pump current response to cavitation and vortexing, direction for reduction of RHR flow in response to cavitation, and a directive

to secure the operating pump until RCS level is restored to a level of 6 to 8 inches above the mid-loop condition level. The operator is also cautioned not to start the standby pump on a low level/cavitation condition.

Outage management administration has been strengthened to identify work activities that have the potential to drain water from the RCS or open a vent path from containment to the environment and these activities will not be scheduled during the time the RCS is partially filled. Prior to breaching a system for a local leak rate test, the cognizant engineer shall notify the Shift Foreman and obtain his concurrence prior to the start of the draining activity. Specific surveillance test procedures have been identified which may not be performed while the RCS is in a partially filled condition.

OP AP-16, "Malfunction of the RHR System," provides specific instructions for recovery actions from a loss of RHR flow while in mid-loop operations. OP AP-16 contains a table that provides heatup rates for days since shutdown to provide the operator guidance as to how long it will take to reach 200 degrees Fahrenheit given a loss of RHR flow. OP AP-16 provides the following guidance for restoration of RHR heat removal following a loss of RCS inventory. First, the operating RHR pump is secured and the pump suction from the refueling water storage tank (RWST) is opened from the control room to gravity feed the system, or the operable charging pump is used to provide forced makeup from the RWST. Alternately, the RHR to RWST return valve is opened to gravity feed the system. Following restoration of level, the RHR pump is vented and returned to service. If RHR flow cannot be returned to service, OP AP-16 directs RCS feed and bleed operations. The "feed" is by gravity from the RWST and the "bleed" is by letdown or through the opened primary manways. This procedure requires that major environmental release pathways to be closed on a prolonged loss of RHR. It is estimated that the isolation of these pathways would take approximately 30 minutes. An appendix to OP AP-16 directs the operator to notify the plant management if the procedure is activated and to notify the NRC Operations Center within 4 hours in accordance with 10 CFR 50.72 (b)(2)(iii)(B). If RHR flow is not restored within 10 minutes the operators are directed to designate the event an Unusual Event and if RHR flow is not restored within 1 hour or RCS temperature reaches 200 degrees Fahrenheit the event shall be designated an Alert.

Item 6

Provide 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 of loss of decay heat removal while the RCS is partially filled.

Response to Item 6

A specific training module with respect to mid-loop operations has been developed and included in the formal operator training program. Training of all operating crews on mid-loop operations as described in OP A-2:II and OP

AP-16 will be conducted prior to such operations, including RCS venting and RHR system venting (pumps and piping). The training is comprehensive and focuses on (1) RHR pump vortexing and associated causes and actions to take; (2) avoidance of operations that perturb the NSSS, including revisions to outage practices to restrict performance of maintenance and operations activities that could cause a loss of RCS inventory or path between containment and atmosphere; (3) operations personnel responsibility for any valve operation that has the potential for affecting the RCS inventory; and (4) action to be taken upon loss of RHR flow including monitoring of RCS temperature and heatup rate; closing of containment, reporting requirements, and restoring RHR flow. As stated previously in the response to item 1, maintenance and testing are controlled during mid-loop operations to ensure that perturbations to the NSSS are minimized. Specific training of maintenance personnel for mid-loop operations is not required since the operations department is responsible for any valve manipulation during maintenance and testing.

Item 7

Provide 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.

Response to Item 7

During mid-loop operation an engineer or manager knowledgeable with respect to the requirements of mid-loop operation and instrumentation will supplement the normal shift operating crews. These supplemental personnel will not relieve the Shift Foreman of his normal responsibilities; rather they will provide additional expertise and support.

Item 8

Provide a 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.

Response to Item 8

There are several differences in procedural and Technical Specification requirements for Mode 5 operation with the reactor coolant loops filled versus requirements for Mode 5 operation with the reactor coolant loops not filled. These differences are summarized below.

1. Technical Specifications

   Technical Specification (TS) 3.4.1.4.1 is applicable for Mode 5 operation with the reactor coolant loops filled. TS 3.4.1.4.1 requires at least one RHR train to be operable with either (1) an

additional RHR train operable, or (2) the secondary side water level in at least two steam generators greater than the 15 percent level.

TS 3.4.1.4.2 is applicable for Mode 5 operation with the reactor coolant loops not filled (mid-loop operation). TS 3.4.1.4.2 requires both RHR trains to be operable.

PGandE is considering submission of a license amendment request to propose reduced RHR flowrate while operating in the mid-loop configuration. This license amendment would increase the margin to vortexing and cavitation in the RHR pump by reducing the flowrate.

2. Procedures

OP A-2:II has several prerequisites and precautions for mid-loop operation that are not applicable to Mode 5 operation with the reactor coolant loops filled. These additional requirements are:

- A containment boundary shall be available prior to draining one foot below the RCS flange level. This includes the equipment hatch secured with a minimum of four bolts, at least one personnel airlock door readily capable of being closed, containment ventilation isolation assured with at least one valve, and all steam generator secondary side manways and inspection ports installed or the associated main steam isolation valve and atmospheric relief valve closed and administratively controlled.

- An alternate means of charging to the RCS shall be readily available by either (1) having a second operable charging pump with its dc control power removed, or (2) having an operable safety injection pump, with its dc control power removed, and its associated flow path available.

- Temporary RCS level indication as discussed in the response to item 2.

- Two incore thermocouples in place and available for monitoring RCS temperature when the reactor vessel head is in place. RCS loop 4 wide range hot leg and cold leg temperatures, or alternates, available for monitoring and temperature and flow indicators for both RHR trains are in service.

- RCS level versus flowrate guidelines has been provided as an attachment to OP A-2:II to prevent the incipience of RHR pump vortexing.

- An inspection of the RVRLIS is to performed on a daily basis while the system is in service. This inspection includes looking for kinked or collapsed tubing, verifying no

undesirable "loop seals" exist, verifying that the absence of condensation in the reference legs, and performing a daily channel check between the tygon tubing level and wide and narrow range RVRLIS indicated level.

- RVRLIS level values will be read and logged every four hours by a control room operator.

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.

Response to Item 9

As a result of the interruption of RHR flow event during mid-loop operations that occurred at DCPP on April 10, 1987, significant procedural, equipment, and training upgrades have been made with respect to mid-loop operations. These changes are summarized below.

- The procedure for draining the reactor coolant system, OP A-2:II, has been revised to (1) strengthen the requirements for maintaining the containment building in a condition such that pathways to the environment during mid-loop operations are capable of being closed in a timely manner; (2) require that the narrow range reactor vessel refueling level indication system (RVRLIS) to be in service during mid-loop operations; (3) provide precautions regarding the minimum reactor vessel water level as a function of RHR flow and RCS level to preclude significant air entrainment due to vortex formation; (4) provide checklists and walkdowns to ensure proper alignment of the reactor head and RVRLIS vent systems; and (5) provide guidance on RHR flow reduction to a value (to be determined with Westinghouse) consistent with adequate decay heat removal and other considerations.

- The abnormal procedure for loss of RHR flow, OP AP-16, has been revised to (1) include requirements for not starting the second RHR pump if the first pump cavitates or becomes airbound until proper RHR pump suction pressure is established and verified (OP A-2:II also provides guidance on this topic); (2) provide a table whereby the operator may determine the amount of time until the RCS will reach 200 degress Fahrenheit without forced flow; (3) include recovery actions to be taken in the event that RCS level decreases below acceptable values; (4) require that major pathways to the environment be closed as soon as possible if RHR flow is interrupted; and (5) provide contingencies for RCS feed and bleed if forced RHR flow cannot be reestablished.

- Emergency Procedure EP G-1, "Accident Classification & Emergency Plan Activation," has been revised to require operators to declare an unusual event if RHR flow is not restored within 10 minutes. In addition, an alert will be declared if RCS temperature exceeds 200 degrees Fahrenheit based on core exit thermocouples or the elapsed time determined from a conservatively calculated table (OP AP-16) indicating that the time to reach 200 degrees Fahrenheit has been exceeded. In any case an alert will be declared if RHR flow is not restored within one hour.

- A narrow range level transmitter was installed on Unit 2, prior to the resumption of mid-loop operations after the April 10, 1987 interruption of RHR flow event, to sense the loop 3 hot leg level, referenced to the reactor vessel head. This provided indication in the control room through an accumulator level indicator with high and low alarm capabilities. Also, the addition of wide range indication sensing of the loop 2 crossover leg level, referenced to the pressurizer vapor space, has been added to Unit 2 and will be added to Unit 1. This is indicated in the control room through an accumulator level indicator with high and low alarm capabilities.

- Additional training has been given to operating crews with respect to mid-loop operations as described in OPs A-2:II and AP-16. The training will also cover RCS venting and RHR system venting (pumps and piping). Training for the mid-loop mode of operation will be included in the formal operator training program.

- Work activities will be controlled during mid-loop operations as stated previously in the response to item 1.