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SUBJECT: Responds to Generic Ltr 87-12, "Loss of RHR While RCS Partially Filled." Reliable loop level indication installed, plant operating procedures revised & emergency procedures rewritten following RHR event in 1972. Details encl.

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September 21, 1987

U.S. Nuclear Regulatory Commission
Document Control Desk
Attn: Mr. Carl Stahle
PWR Project Directorate No. 1
Washington, D.C. 20555

Subject: Loss of Residual Heat Removal While Reactor Coolant System is Partially Filled (Generic Letter 87-12)
R. E. Ginna Nuclear Power Plant
Docket No. 50-244

Reference: (a) Case Study Report, AEOD/C503, Decay Heat Removal Problems at U.S. Pressurized Water Reactors, prepared by Dr. Harold Ornstein, dated December 1985
(b) NRC Information Notice No. 87-23, Loss of Decay Heat Removal During Low Reactor Coolant Level Operation, dated May 27, 1987

Dear Mr. Stahle:

Generic Letter 87-12 requested information for the NRC to assess safe operation of pressurized water reactors when the reactor coolant system (RCS) is partially filled. Principle concerns are (1) whether the RHR system meets the licensing basis of the Plant in this condition, (2) whether there is a resultant unanalyzed event that may have an impact on safety, and (3) whether any threat to safety that warrants further NRC attention exists in this condition. Enclosure 1 to GL87-12, Information Pertinent to Loss of Residual Heat Removal Systems while the RCS is Partially Filled, was also attached for review.

Our response to the requested information and description of plant operation during the approach to and while in a partially filled RCS condition is enclosed as Attachment 1. The information contained in Enclosure (1) to GL87-12 has been reviewed and our response has encompassed these topics. We have also reviewed the reference (a) case study for applicability to R.E. Ginna.

Following a loss of RHR event in 1972, more reliable loop level indication was installed. Plant operating procedures have also been modified to provide operators with the necessary precautions and guidelines to more safely operate in this mode. Emergency procedures were also rewritten to provide operators with instructions which more specifically addressed loss of RHR flow while operating with the RCS partially filled.

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Based upon our review of Information Notice 87-23 and Generic Letter 87-12, recommendations have been made which would further reduce the risk of loss of decay heat removal while the RCS is partially filled. These planned changes are listed in our response to item (9) in Attachment 1.

Very truly yours,

Roger W. Kober

Roger W. Kober

Subscribed and sworn to me
on this 21st day of September 1987

Lynn I. Hauck
LYNN I. HAUCK
Notary Public in the State of New York
MONROE COUNTY
Commission Expires Nov. 30, 1988

Attachments

xc: U.S. Nuclear Regulatory Commission
Region 1
631 Park Avenue
King of Prussia, PA 19406

Mr. T. Polich
Ginna Resident Inspector

ATTACHMENT 1

(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.

RESPONSE

R.E. Ginna Station Reactor Coolant System (RCS) would be entered into and brought through a draindown process and operated with the RCS partially filled under the following circumstances:

a) Lowering the RCS level below the reactor vessel flange prior to removing the reactor vessel head for maintenance or refueling.

b) Lowering the RCS level to approximately 8 inches above the loop centerline for eductor operation, steam generator inspection and maintenance and reactor coolant pump maintenance.

c) Lowering the RCS level to approximately 4 inches below the loop centerline for loop RTD maintenance and steam generator bowl decontamination.

d) Lowering the RCS level to approximately 54 inches above the loop centerline for Reactor Coolant Pump (RCP) seal maintenance.

Conditions Related to Plant Operation While the RCS is Partially Filled:

a) In preparation for the draindown process, the reactor normally is brought from full power to hot shutdown, then cooled down to below $100^{o}F$, purified and then drained down in approximately 68 to 86 hours.

b) After the RCS is in cold shutdown there is no requirement for minimum steam generator levels. However, if the secondary sides of the steam generators are not to be opened, both steam generators are put in wet layup (i.e., filled to approximately 100% narrow range levels).

c) Changes in the status of equipment for maintenance and testing and coordination of such operations while the RCS is partially filled is the responsibility of the following two groups:

   1) Operations Group (primary responsibility)
   2) Shutdown Planning Group (planning and coordination)

   These two groups are supervised by Senior Reactor Operators, Ex-Senior Reactor Operators and personnel with many years of

(1c cont'd)

experience in operation of Ginna Station. Restrictions regarding testing, operations, and maintenance that could perturb the Nuclear Steam Supply System are also controlled by the above two groups. Status and changes to be made to equipment line-ups are planned and discussed in daily planning meetings prior to the day's activity.

d) Both Residual Heat Removal (RHR) loops must be operable during operation while the RCS is partially filled, therefore, maintenance on RHR components is not performed unless 1) the RCS is filled and vented so that the steam generators provide an alternate means of decay heat removal or 2) the refueling cavity is flooded so that decay heat may be removed by circulation of the large body of water. For the latter mode, a path for borated water to the core is required in the refueling procedures.

e) The ability of the RCS to withstand pressurization if the reactor vessel head and steam generator manway are in place is controlled by the reactor vessel low temperature overpressure protection (LTOP) system. This system consists of the two pressurizer Power Operated Relief Valves (PORVs) and its own dedicated Nitrogen supply system and pressure transmitters. The system must be activated before either cold leg temperature is reduced below 330°F or the RHR system is in operation. If the system is not operable, the RCS has to be depressurized and vented through a 1.1 square inch vent(s) within 8 hours by Technical Specifications. The set pressure of the 2 PORVs during reactor vessel overpressure protection system line-up is required to be $\leq$ 435 psig and is normally $\geq$ 410 psig. This pressure is well within the limit of 10CFR50 Appendix G. The LTOP system is described in more detail in the UFSAR Section 5.2.2.

f) Requirements pertaining to isolation of containment are contained in O-2.3 (Plant at Cold Shutdown) step 5.2 which states, "Maintain a status of the C.V. isolation valve as per O-1.1B so the C.V. integrity can be re-established if necessary." O-1.1B is the applicable procedure entitled, "Establishing Containment Integrity". Abnormal Procedure AP-RHR.1 (Loss of RHR) directs the operator to establish containment integrity per O-1.1B if RHR flow cannot be established.

g) The time required to replace the equipment hatch should replacement be necessary is anticipated to be less than three hours. The required time could be reduced depending on circumstances prior to the replacement.

h) There are no formal requirements pertinent to re-establishing the integrity of the RCS pressure boundary. The status of the major openings in the RCS is the responsibility of the Operations Group under the direction of the Shift Supervisor.

(1 cont'd)

i) Interlocks exist to prevent opening valves that connect the RHR system to the RCS during high pressure conditions, but there are no interlocks that automatically isolate the RHR system. Description of these interlocks and isolation requirements are provided in Section 5.4.5.3.1 of the UFSAR. These interlocks would not cause a disturbance in the system.

(2) A detailed description of the instrumentation and alarms provided to the operators for controlling thermal and hydraulic aspects of the NSSS during operations with the RCS partially filled.

RESPONSE

a) Level instrumentation used with a partially drained RCS is a permanently mounted dp cell (PT-432A) that is connected to the hot leg of Loop "B" and which is close to the reactor vessel nozzle. PT-432A is lined up per Procedure O-2.3.1, Draining the Reactor Coolant System, and isolated per Fill and Vent Procedure O-2.3.2.

The readout from PT-432A is local by the dp cell and also in the control room on the front of the control board. There is also a local tygon hose that is calibrated to the same level scale as PT-432A. All loop level readings are required to be logged once per shift and the RHR suction line is required to be vented once per day when operating below 25 inches indicated loop level (14.5" above loop centerline). However, present practice at Ginna is to monitor main control board loop level frequently in this mode. There is no loop level alarm.

PT-432A is a Foxboro Model 613DM transmitter with local and main control board meter range from 0-100 inches of H_2O and transmitter output of 10-50 ma. Present accuracy of this loop level measurement is $\pm$ 2.75 inches. Procedures also call for loop level measurements via a tygon hose inside containment as a comparison against PT-432A.

The scaling of the transmitter is such that an indicator reading of 10.5" corresponds to hot leg centerline. Based upon the location of the transmitter in the 29.0" I.D. hot leg, the zero reference on the indicators corresponds to a water level of 4" above the bottom of the pipe. Level differences in the RCS would not affect the accuracy unless the indicator were to approach the zero reference, which is 6.5 inches below the minimum water level permitted during maintenance activities.

b) Flow instrumentation used with a partially drained RCS is a permanently mounted dp cell (FT-626) that is used for normal RHR flow and low head SI flow. FT-626 is connected to the RHR return line to Loop "B" cold leg just before it enters containment. FT-626 is normally aligned for flow measurement.

(2b cont'd)

The readout from FT-626 is located in the control room on the front of the control board in the form of an indicator and a recorder. During shutdown, RHR flow is logged once per hour.

There is an RHR low flow alarm that is set at 400 gpm when operating on RHR during cold shutdown and low loop level operation.

FT-626 is a Foxboro Model NE13DM transmitter with instrument range of 0-500 inches of water and a readout on the main control board of 0-4000 gpm. Transmitter output is 10-50 ma.

c) Pressure instrumentation used with a partially drained RCS is a permanently mounted dp cell (PT-420) that is also used for normal RCS pressure monitoring. PT-420 is connected to the RHR suction pipe near the "A" Loop hot leg. Except during its maintenance or calibration, PT-420 is aligned for pressure measurement. There is also a second pressure transmitter (PT-420B) connected to the RCS in the same area as PT-420. PT-420B is also used for normal operation and is aligned for operation.

The readout from PT-420 is located in the control room on the front of the control board in the form of an indicator with a range of 0-700 psig and a recorder throughout the full range of RCS pressures. Readout from PT-420B is in the control room on the front of the control board in the form of a recorder. It can also be read locally on the Appendix R Auxiliary Building Emergency Local Instrument Panel. PT-420B records the full range of RCS pressures. During cold shutdown PT-420 and PT-420B are logged once per hour.

PT-420 has a low RCS pressure alarm but not a high pressure alarm. The low RCS pressure alarm is interlocked with two of the four RCS/RHR isolation valves so these valves cannot be opened until the low pressure alarm is received. After these valves open there is no automatic closure due to high RCS pressure. A description of the interlocks and isolation requirements for these valves is provided in the UFSAR Section 5.4.5.3.1. PT-420 and PT-420B are Foxboro Model NE11GH transmitters with an instrument range of 0-3000 psig. Transmitter PT-420 has a signal output of 10-50 ma and transmitter PT-420B has a signal output of 4-20 ma.

d) Temperature instrumentation used with a partially drained RCS consists of the permanently installed RHR inlet temperature transmitter (TT-630) that is also used for normal RHR operation. TT-630 is connected to the discharge of the RHR pumps upstream of the RHR heat exchangers. Core outlet temperature indication is also available from the core exit thermocouples. However, by current procedure, these core exit thermocouples are not available if the reactor head is to be removed for refueling.

(2d cont'd)

With the core exit thermocouples disconnected and in the event of loss of RHR at low loop level, there is no true indication of core temperature. RG&E is investigating a method by which an auxiliary connection can be utilized to leave a sufficient number of CETs connected to obtain core temperature.

The readout from TT-630 is located in the control room on the front of the control board in the form of a recorder. The readout from the core exit thermocouples is located in the control room behind the control board in the form of a digital indicator.

There is no high temperature RHR alarm associated with TT-630. The core exit thermocouples can be set to alarm on the Plant Process Computer System (PPCS) when they are connected.

TT-630 is a Foxboro Model DB13U26W nickel RTD with a range of 100-400^{o}F.

The core exit thermocouples are Westinghouse supplied, Type K, Chromel/Alumel, mineral insulated, 1/8 inch OD sheath, ungrounded type with range of 0-2300^{o}F on the main control board.

(3) Identification of all pumps that can be used to control NSSS inventory:

<u>RESPONSE</u>

a) Pumps required to be operable or capable of operation:

1. Technical Specifications require at least two of the four coolant loops to be operable during cold shutdown. The four loops consist of the two residual heat removal loops and the two reactor coolant loops with the associated steam generators and reactor coolant pumps. During operation with the RCS partially filled and steam generators inoperable, both RHR pumps must be operable.

   The RHR pumps would not be removed for maintenance during low loop levels except for emergency maintenance.

b) Other pumps not included in item a (above):

1. Refueling Water Purification Pump

   As shown on Figure 9.1-6 and 9.3-7 of the UFSAR, this 40 gpm pump can be lined up to take suction from the RWST and discharge into the letdown line outside containment, then direct flow inside containment to the RHR system upstream of the RHR isolation valves, and finally into the Loop "B" cold leg.

(3b cont'd)

2. Reactor Coolant Drain Tank (RCDT) Pumps

   In the event that both RHR pumps cannot be started, current procedures initiate operation of both RCDT pumps. These pumps (pump 1A is 50 gpm and pump 1B is 150 gpm) can be lined up to take suction from either the RCS or sump "B". When aligned to take suction from the RCS, the flow path is from the Loop "A" hot leg through the RHR system suction piping then into the RCDT pumps. Flow is discharged from the pumps back to the RHR system upstream of the RHR heat exchangers, then to the Loop "B" cold leg. The flow path is shown on Figures 5.4-7 and 11.2-2 of the UFSAR.

3. Safety Injection Pumps

   Any of the 3 pumps can be lined up to take suction from the RWST or boric acid storage tanks and discharge to the RCS Loop "A" and "B" cold legs. The design flow rate is 300 gpm at 2700 feet (flow diagram is shown on Figure 6.3-1 of the UFSAR). During refueling outages, required maintenance on the safety injection system may preclude availability of these pumps.

4. Charging Pumps

   Any of the 3 positive displacement charging pumps (variable speed, 15-60 gpm) can take suction from the RWST or boric acid storage tanks and discharge to the RCS Loop "B" cold leg as shown on Figure 9.3-6 of the UFSAR. During refueling outages, required maintenance on the CVCS may preclude availability of these pumps.

Emergency power for these pumps (except the refueling water purification pump) is available from two separate diesel generators.

c) An evaluation of items a and b (above) with respect to applicable Technical Specification requirements:

Of the pumps mentioned in a and b (above), the two RHR pumps are required operable during the mid loop phase of cold shutdown. As described in (3)a)1., during cold shutdown two of the four coolant loops must be operable.

The action statement if the above conditions cannot be met is to immediately initiate corrective action to return the required loops to operable status, and if not in cold shutdown already, be in cold shutdown within 24 hours.

Amendment 43 to the Provisional Operating License for R.E. Ginna Nuclear Power Plant was issued June 3, 1981 in response to an NRC Staff letter to All Operating Pressurized Water Reactors, concerning decay heat removal, dated June 11, 1980. Current Technical Specifications address limiting conditions for operation during all modes of reactor operation.

(4) Description of the containment closure conditions required for the conduct of operations while the RCS is partially filled:

RESPONSE

At the present time there are no containment closure conditions required for the conduct of operations while the RCS is partially filled. However, Operating Procedure O-2.3 (Plant at Cold Shutdown) directs the control room operators to maintain a status of the Containment Vessel (CV) isolation valves per Operating Procedure O-1.1B (Establishing Containment Integrity) so the CV integrity can be re-established if necessary. Operating Procedure O-1.1B addresses all major containment isolation boundaries including the personnel and equipment hatches.

(5) Summary description of procedures in the control room which describe operations while the RCS is partially filled:

RESPONSE

a) Operating Procedure O-2.3.1 (Draining the Reactor Coolant System) is the major procedure involved with draining the RCS to a partially filled condition and is also used while operating in this condition. A summary description of the major instructions and notes of Operating Procedure O-2.3.1 during the draindown process and operation while in a partially filled condition are as follows:

1. Initial conditions prior to draindown require RCS temperature less than $100^{\circ}F$, RHR system in operation, containment purge exhaust system in operation, Reactor vessel over-pressure protection system in service, Iodine-131 activity less than 0.01 uCi/gm, and Cobalt plus Cesium isotopes less than 0.06 uCi/gm.

2. A note is included in the procedure prior to the draindown process and during preparations for refueling which allows the core exit thermocouples (CETs) to be disconnected. If CETs are disconnected, all available loop temperatures, flow and level indicators must be monitored at a minimum of every 2 hours.

3. Instructions are included in the procedure which isolate the major RCS points of potential inventory loss.

4. Instruction are provided in the procedure to depressurize the RCS and align the level indicators (PT-432A, tygon hose, and transmitter) to perform their function. The operators are required to verify that the transmitter indicators are in agreement with the tygon indicator.

(5a cont'd)

5. Instructions are provided in the procedure to record the initial CVCS holdup tank level of the tank to be used for draindown. At the end of the draindown process, this CVCS holdup tank level will be recorded again and a calculation made to assure approximately 30,000 gallons of RCS water has been drained. This instruction step is in the procedure primarily to assure that the steam generator tubes are drained but it also assures that the proper volume is drained.

6. After RCS draining commences, there are instructions in the procedure to throttle RHR flow to approximately 800 gpm. Throttling the RHR flow will reduce the possibility of vortexing at the RHR loop suction when operating at low loop levels (centerline of the hot leg).

7. A note is included in the procedure, following the draindown process and during operation of an RHR pump at an indicated low loop level of approximately 10 inches (which corresponds to loop centerline), that directs the stationing of an individual in containment to vent the RHR system if suction is lost.

8. An instruction in the procedure requires that, if the RCS is to be maintained at or below 25 inches, a log for comparison of loop level indication and for venting the RHR system is to be maintained. This log instructs the operator to log loop level indicators once per shift and to vent the RHR suction every 24 hours. RG&E will change this interval to record level once per hour as noted in our response to Item (9). There is also a note in the procedure stating that if RHR is lost, operators refer to Procedure AP-RHR.1 (Loss of RHR). Past experience has demonstrated that above 25 inches indicated loop level, vortexing and air entrapment does not present a problem. (The 25 inch indication corresponds to a water level of 15 inches above loop centerline.)

9. Instructions are provided in the procedure giving flow guidelines for the RHR pumps while operating at low loop levels noting that these guidelines are to avoid losing suction on the RHR pumps. Flow guidelines which have been verified by experience are provided for the range of loop levels from 4" below hot leg centerline, which corresponds to the level for RTD work or steam generator bowl deconing, to the 84" level, which represents the top of the reactor vessel flange.

10. The Operating Procedure O-2.3.1 contains action steps with regard to loss of RHR due to air entrapment at the pump suction. Operators are directed to Procedure AP-RHR.1, Loss of RHR, which provides instructions for restoring the pumps to operable status. This can be effectively achieved by venting the pumps and/or RHR system or backflooding from the

(5)a)10 cont'd

RWST by opening MOV 856 locally in the auxiliary building or from the main control board. The backflooding procedure will rapidly flood the RHR pump suction effectively removing an airbound condition. This procedure is also used to raise the water level to the 30" level (corresponding to 20" above loop centerline) prior to attempting to restart an RHR pump.

Use of this backflooding method proved successful in mitigating the consequences of the loss of RHR events which occurred in May 1972 and April 1983 by restoring RCS inventory. As previously indicated, procedural changes were instituted following the 1972 event which provided operators with specific cautions and instructions designed to minimize the risk of operation while in a partially filled condition. The April 1983 event was the result of a nitrogen gas bubble being forced into the RCS due to a leaking nozzle dam in the "A" steam generator in preparation for steam generator decontamination. The RHR system was vented and RHR was returned to service approximately 12 minutes after it had been lost.

b) A preliminary analysis has been performed which determined the approximate times from loss of decay heat removal to onset of boiling in the core and to core uncovery as a function of the time after shutdown. The time after shutdown varied from about 3 days, representing the minimum time at which the draindown process could begin, to 30 days. Curves were generated based on beginning of cycle of reactor fuel and end of cycle of reactor fuel. Initial conditions assumed an RCS temperature of 100°F and a minimum loop level of 4" below the hot leg centerline, corresponding to the highest initial temperature and the lowest level during maintenance activities. The results indicate that 3 days after shutdown, the time from loss of RHR to reach boiling in the core is approximately 30 minutes and the time to core uncovery is greater than 1.5 hours assuming end of cycle reactor fuel and no operator action during the event. The analysis represents the bounding case, since the water inventory utilized in the analysis represents the minimum inventory which would exist during a partially filled RCS condition. The results of the analysis and appropriate training will be provided to operators as recommended in our response to item (9).

c) A preliminary analysis was also performed to determine the off-site thyroid dose that would result from the evaporative losses of reactor coolant and the resultant releases of iodines as the coolant boils assuming RHR flow has been lost. The analysis assumed that the equipment hatch was removed during this event and no filtration occurs even though air is normally drawn from the containment and discharged through charcoal filters. Administrative procedures require limits on Iodine-131 less than 0.01 uCi/gram and particulates less than 0.06 uCi/gram (mainly Cesium and Cobalt). Only Iodine-131 would evolve with any significance,

(5c cont'd)

since noble gases would be removed prior to the draindown process and the particulates are non-volatile. Calculations show that the dose at the site boundary would be 128 mrem to the thyroid assuming all coolant has boiled off. This would be within the limit of 1500 mrem/year instantaneous dose rate to the thyroid set in Technical Specifications for unplanned releases and well within the limits set in 10CFR Part 100. Consequently, there would be no significant hazard to the public.

(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.

RESPONSE

The following training material exists or is in the process of being modified to address the operational concerns while at low loop levels:

a) Operator training module ROPO6C is currently under revision and covers the following areas:

   1) Operating Procedure O-2.3.1 (Draining the Reactor Coolant System)

   2) The cause of vortexing and procedural limits on RHR flow while at low loop levels.

   3) Industry events on loss of RHR including INPO SOER 85-4

b) Operator training module RAP18C has just been taught to the initial license class and is scheduled tentatively to be taught to the requalification class in October 1987. This module covers the following areas:

   1) Abnormal Procedure AP-RHR.1 (Loss of RHR)
   2) Actions to mitigate loss of RHR events while at low loop levels
   3) Industry events on loss of RHR

c) With respect to the simulator, there is an active training class change request to develop simulator lesson plans to cover the following:

   1) Draining the RCS
   2) Low loop level operations including, (a) adjusting RHR flow, (b) start, stop and switching of RHR pumps while drained to low loop levels, and (c) loss of RHR while drained to low loop levels.

(6c cont'd)

The lesson plans' development and training is scheduled to be accomplished prior to the 1988 refueling outage.

(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:

RESPONSE

During shutdowns for maintenance and/or refueling, including operations with the RCS partially filled, the normal Operations Department policy is to have additional operators on shift to help with the additional work load (i.e, equipment holding, isolation procedures, valve lineups). All operations personnel directly involved with the operation and supervision of the Plant are knowledgeable about the low loop level vortexing and air entrainment phenomena and the instrumentation available to indicate the required range of parameters to preclude vortexing. This instrumentation includes RHR flow and RCS level indication discussed in the response to item (2). They are also knowledgeable about the loss of RHR flow due to the vortexing phenomena and well aware of the Abnormal Procedure AP-RHR.1 used to mitigate "Loss of RHR".

(8) Comparison of the requirements implemented while the RCS is partially filled and requirements used in other cold shutdown operations:

RESPONSE

With the RCS partially filled, the following requirements exist in addition to the requirements used in other cold shutdown operations:

a) While running an RHR pump with low loop level indication of 10 inches or less, an individual is stationed in containment to vent the RHR system if suction is lost.

b) If core exit thermocouples are disconnected for refueling, then all available loop temperatures, flow and level indicators are monitored at a minimum of every 2 hours.

c) When the RCS is maintained at or below 25 inches indicated level (equivalent to 14.5 inches above loop centerline), a log is maintained for comparison of loop level indication and for venting the RHR system. The loop level indicators are logged once per shift and the RHR suction is vented every 24 hours.

d) When operating with the RCS partially filled, RHR flow guidelines are provided for specific loop levels to prevent suction vortexing in the RHR.

(9) As a result of RG&E's consideration of these issues, describe changes that have been made or are scheduled to be made that have strengthened the Plant's ability to operate safely during a partially filled RCS condition.

<u>RESPONSE</u>

The Operating Procedure for draindown of the RCS, O-2.3-1, Abnormal Procedure for the Loss of RHR, AP-RHR.1, and Emergency Procedure for Reactor Coolant Drain Tank Operation, ER-RHR.1, were written previously as the result of consideration of these issues. The loop level indicator PT-432A, discussed in our response to item (2), was also installed in 1975 to provide improved accuracy and control room indication. Flow limitations were also placed on the RHR pumps while operating at low loop levels, since the potential for vortexing is reduced at lower flow rates. Increased Plant personnel awareness and training has resulted from several NRC Information Bulletins (IE80-12) and Notices (86-101 and 87-23) and particularly the loss of RHR flow event that occurred at Ginna in May 1972. Plant Technical Specifications have been amended to address limiting conditions, actions, and surveillance during all modes of reactor operation.

Based upon our review of NRC Information Notice 87-23, Generic Letter 87-12, and the findings, conclusions and recommendations in the Case Study, reference (a), we will take the following actions to address the root causes of loss of decay heat removal events related to low reactor coolant level and further reduce the risk while operating in this mode. The primary root causes have been determined to be related to the level indication, human factors related to procedural errors and operator understanding.

The following actions will be taken prior to the 1988 Refueling Outage:

1. Upgrade operator training, prior to operating with the RCS partially filled, including discussion of the potential causes of RHR flow loss, recovery procedures, simulator training, and review of the information regarding the time margins available for recovery from postulated loss of DHR events as a function of time from shutdown.

2. Write and implement a separate abnormal procedure for loss of RHR applicable to operation while in a partially filled RCS condition. Immediate recovery options in this mode differ somewhat from the full loop level options, such as cautioning against starting the second pump if the first pump is lost in low loop operation.

3. The Operating Procedure O-2.3.1 now used for draining the RCS and operating with the RCS partially filled will be revised to be more specific regarding the containment condition and time required to isolate it.

(9 cont'd)

4. Revise operating procedures to require hourly logging of loop level consistent with present requirement on RHR flow.

5. Investigate the feasibility of leaving a sufficient number of the core exit thermocouples connected during operation with the RCS partially filled. Present draindown procedures allow the CETs to be disconnected after the RCS temperature has been reduced to 100°F. Although procedures require loop temperature, flow, and level indication be monitored at a minimum of every 2 hours, leaving a sufficient number of CETs connected would provide a true indication of core temperature.

In addition, the following actions will be considered on a longer term basis:

1. Consider improvements to the existing loop level instrumentation as follows:

   a) Set the reference leg of the level transmitter, PT-432A, to the top of the reactor vessel to eliminate possible loop level errors during eductor operation. It is presently vented to the containment atmosphere.

   b) Rescale PT-432A to correct for the 0.5 inch level discrepancy between procedure and the calculated loop centerline.

   c) Set the loop level zero reference at the bottom of the hot/cold legs so that the meter readings on the main control board correspond to more meaningful levels.

2. Investigate the feasibility of installing a low loop level alarm from the existing loop level transmitter PT-432A.