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January 4, 1989

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

Subject: Loss of Decay Heat Removal (Generic Letter 88-17)
R.E. Ginna Nuclear Power Plant
Docket No. 50-244

Dear Mr. Stahle:

Generic Letter 88-17 required a description of actions taken to implement each of eight recommended expeditious actions prior to operation in a reduced inventory condition. Specific actions and plans to comply with the seven Expeditious Actions applicable to R.E. Ginna Nuclear Power Plant (Action 8 is not applicable) are identified and discussed in Attachments 1 through 8.

RG&E has reviewed the correspondence and information found in the Information Notices, Generic Letters and Westinghouse WCAP-11916 concerning loss of decay heat removal while in a reduced inventory condition. Operations, training and staff personnel attended the Mid-Loop Workshop in Pittsburgh, PA conducted on September 21-22, 1988.

Westinghouse provided thermal hydraulic evaluations of the loss of RHR in the reduced inventory condition for the 2-loop, as well as 3 and 4-loop model plants, in WCAP-11916, "Loss of RHRS Cooling While the RCS is Partially Filled", Rev. 0, dated July 1988. The results of these analyses form the basis for the required operator actions implemented in procedures, administrative controls which direct reduced inventory activities such as containment closure requirements, and equipment required to be available for providing core cooling in the event RHR cooling is lost.

In several cases, improvement in the results of WCAP-11916 can be achieved for R.E. Ginna. The water volume which can be obtained by the gravity feed method and resulting increase in RCS level can be shown to provide significant improvement over the values presented in WCAP-11916. A 4% improvement can be achieved because Ginna 14 x 14 OFA fuel provides 4% more heatup volume than the 14 x 14 standard fuel

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used in the analysis. A delay in the predicted times to reach saturation and core uncovery can be obtained by reducing the initial water temperature less than 140°F. A temperature of 140°F was used in the analyses. Additional improvement can also be achieved by delaying the time prior to entering the reduced inventory condition for as long as is practical after shutdown. A time of 48 hours after shutdown was used in the analyses. It is our intention to utilize the results from the analyses presented in WCAP-11916 until such time as additional analyses can be prepared to supplement WCAP-11916 analyses for these specific plant parameters.

RG&E will comply with the seven applicable Expeditious Actions and will implement procedures and administrative controls prior to our next planned refueling shutdown scheduled to begin in March 1989. Guidance provided in the references below have also been used in developing our actions.

References:

(1) Letter from Roger A. Newton, Chairman, Westinghouse Owners Group to WOG Representatives, Subject: Early Notification of Mid-Loop Operation Concerns, OG-88-21, dated May 27, 1988
(2) NRC Information Notice 88-36: Possible Sudden Loss of RCS Inventory During Low Coolant Level Operation, June 8, 1988
(3) Mid-Loop Operations Workshop Report, Westinghouse Owners Group, Workshop held September 21-22, 1988
(4) Letter from L.A. Walsh, Chairman, WOG Operations Subcommittee to WOG Representatives, Subject: Transmittal of Mid-Loop Operations Interim Guidance, WOG-88-156, dated November 7, 1988
(5) Westinghouse WCAP-11916, Loss of RHR Cooling While the RCS is Partially Filled, Rev. 0, dated July 1988

Very truly yours,

Robert C. Mecredy
General Manager
Nuclear Production

Attachments
GAH\009

xc: U.S. Nuclear Regulatory Commission
Region I
475 Allendale Road
King of Prussia, PA 19406

Ginna Senior Resident Inspector

EXPEDITIOUS ACTIONS

DIABLO CANYON EVENT

Recommendation

Discuss the Diablo Canyon event, related events, lessons learned, and implications with appropriate Plant personnel. Provide training shortly before entering a reduced inventory condition.

Implementation

The recommended training will be covered with all Licensed Operator/Staff and Auxiliary Operators during the period from January 3, 1989 to the spring 1989 Refueling Outage. The training will consist of a 4-6 hour classroom session.

The following information will be discussed as part of this training:

a) A case study on Loss of Decay Heat Removal (INPO 88-18)
b) Loss or Degradation of RHR Capability in PWRs (SOER 85-4)
c) Loss of Decay Heat Removal (NRC Generic Letter 88-17)
d) Loss of RHR with Reduced Reactor Vessel Water Level at PWRs (SOER 88-3)
e) RHR Pump Cavitation (INPO OE 2906)

This discussion will center on the root cause, plant response, safety concern, corrective action, and lessons learned during each of these events.

The following procedures will also be reviewed during this period:

a) Loss of RHR at Low Loop Levels (AP-RHR.2).
b) Draining the Reactor Coolant System (O-2.3.1). Special emphasis will be placed on the importance of monitoring mass inventory and flow restrictions for various loop levels.
c) Loss of Component Cooling Water at Plant Shutdown (AP-CCW.3).

In addition to the above items, the following topics will be covered to maximize operator awareness to the significance of this evolution:

a) Viewing the WOG Mid-Loop Workshop video tape which demonstrates the vortexing phenomena at different loop levels and flowrates.
b) Discussion of core temperature measurement during refueling/low loop level operations.

c) Discussion on loop level measurement theory and application. Included will be reasons for discrepancies between actual and indicated level. Also, proposed changes to the present measurement system will be covered.
d) Proposed methods for containment closure.
e) Effects which the sequence of installing the nozzle dams has on the thermohydraulic characteristics of the RCS.
f) Basis of the analysis applicable to R.E. Ginna for the five plant configurations which could place the plant in a reduced inventory mode.

In addition, prior to Low Loop Level Operations, the Training Department will review and, as necessary, provide training on:

a) Any revised Operating or Abnormal procedures that deal with Low Loop Level Operations.
b) Any modifications to the level measurement system (temporary and permanent).
c) The actual containment closure mechanism decided upon and procedures which cover its operation.
d) Any additional information, curves, and analyses which have been generated by RG&E regarding this condition.

Also, all NRC active Licensed Operators will receive training on the Simulator using the revised procedures. For inactive license holders this will be done as part of the normal training cycle.

Additionally, Maintenance Department and Instrument and Control Department personnel will receive training on industry events and implications of loss of RHR while in a reduced inventory condition, prior to the spring 1989 Refueling Outage.

EXPEDITIOUS ACTIONS

CONTAINMENT CLOSURE

Recommendation

Implement procedures and administrative controls that reasonably assure that containment closure will be achieved prior to the time at which a core uncovery could result from a loss of DHR. These procedures and administrative controls should be active and in use:

(a) prior to entering a reduced RCS inventory condition for Nuclear Steam Supply Systems (NSSSs) supplied by Combustion or Westinghouse, and should apply whenever operating in those conditions.

If such procedures and administrative controls are not operational, then either do not enter the applicable condition or maintain a closed containment.

Implementation

The guidance in Generic Letter 88-17 requires establishing containment closure following initial loss of RHR cooling:

- within 30 minutes if a cold side opening exists which is larger than 1 in^2. This 30 minute time requirement can be extended to 2 hours if a vent path exists which is large enough to prevent core uncovery due to pressurization in the RCS.
- within 2.5 hours if the RCS is intact.

Containment closure is not necessary if the reactor vessel and surrounding pool contain no irradiated fuel.

The time constraints above correspond to the Plant configurations summarized in WCAP-11916 (Section 3.11) as follows:

CONFIGURATION NO.		CLOSURE REQUIREMENT
1) RCS intact, No water in either S/G, vent size less than 0.05 sq ft	:	2.5 hours
2) Configuration 1) except water in the secondary side in the narrow range of 1 or more S/G	:	2.5 hours
3) Large hot side vent, about 0.5 sq ft	:	2 hours

CONFIGURATION NO.		CLOSURE REQUIREMENT
4) Cold side opening, nozzle dams not installed (without large vent path)	:	30 minutes
5) Cold side opening, nozzle dams installed (without large vent path)	:	30 minutes

NOTE: Configurations 4) and 5) are regarded as adverse configurations and will not be entered.

Use of a temporary hatch plate has been utilized to date during refueling shutdowns in order to maintain refueling integrity without requiring reinstallation of the equipment hatch. This temporary hatch plate provides access openings for many of the cables required to be run into containment. Although the temporary hatch plate is attached to the equipment hatch bolt circle and is relatively well sealed, we have determined that its use will not meet the guidance provided in Generic Letter 88-17. Therefore, the existing procedure O-2.3.1, Draining the Reactor Coolant System, will be revised to establish a status of containment closure capabilities to ensure closure within 2 hours, should loss of RHR occur, utilizing the equipment hatch. This will satisfy the Generic Letter time constraint, because a large hot side vent path will be established during the draindown process in the reduced inventory condition prior to nozzle dam installation or for cases where a cold side opening must be made. When the RCS is intact, closure would be required within 2.5 hours, therefore the 2 hour capability will meet this limit. The adverse conditions described above are not created when this vent path is provided, therefore, the 30 minute closure time is not applicable.

The existing abnormal procedure AP-RHR.2 will be revised to address this containment closure requirement upon loss of RHR. This procedure is entered from loss of RHR.

A new procedure and administrative controls will be developed to provide control of containment penetrations and the capability to control containment closure. The equipment hatch will be used to ensure closure while in the reduced inventory condition. A procedure will be developed which will control any deviations from the containment integrity requirements. The procedure will provide the capability to establish a containment closure condition, as defined by the guidance of Generic Letter 88-17, within the 2 hour limit. When the loop level is raised above the reduced inventory condition, removal of the equipment hatch and installation and use of the temporary hatch plate can be performed.

The reduced inventory condition will also be entered near the end of the outage after refueling, therefore, the containment closure requirement also applies for this evolution. Times prescribed in Generic Letter 88-17 are not applicable because the time to core uncovery will be shown analytically to be extended due to the lower decay heat and extended time after shutdown. A large hot side vent path will be provided during this nozzle dam evolution. Therefore, the time to core uncovery will be greater than the times predicted in WCAP-11916. An analysis will be available which will provide the basis for an extension in the closure time requirement beyond the time prescribed in Generic Letter 88-17.

EXPEDITIOUS ACTIONS

RCS TEMPERATURE

Recommendation

Provide at least two independent, continuous temperature indications that are representative of the core exit condition whenever the RCS is in a mid-loop condition and the reactor vessel head is located on top of the reactor vessel. Temperature indications should be periodically checked and recorded by an operator or automatically and continuously monitored and alarmed. Temperature monitoring should be performed either:

(a) by an operator in the control room (CR), or

(b) from a location outside of the containment building with provision for providing immediate temperature values to an operator in the CR if significant changes occur. Observations should be recorded at an interval no greater than 15 minutes under normal conditions.

Guidance should be developed and provided to operators that covers evacuation of the monitoring post. The guidance should properly balance reactor and personnel safety.

Implementation

RG&E implemented a policy prior to the spring 1988 refueling outage whereby two core exit thermocouples remained connected and operable during reduced inventory operations. These actions will continue to be practiced. The core exit thermocouples are Westinghouse supplied, Type K, Chromel/Alumel, mineral insulated, 1/8 inch OD sheath, ungrounded type with a range of 0-2300°F. The readout from the core exit thermocouples is located in the main control room in the form of a digital indicator. Each of the thermocouples left connected will be powered from independent trains. The temperature readings provided are representative of core exit conditions.

Provisions are being made prior to the 1989 refueling outage to provide the control room operators with an alarm on the Plant Process Computer System (PPCS) of the two core exit thermocouple temperatures. When the PPCS is operating, Procedure O-2.3.1 will require manual logging of the temperatures once per hour. If the PPCS is not operable, the procedure will direct the control room operator to log the core exit temperatures at 15 minute intervals.

EXPEDITIOUS ACTIONS

RCS WATER LEVEL

Recommendation

Provide at least two independent, continuous RCS water level indications whenever the RCS is in a reduced inventory condition. Water level indications should be periodically checked and recorded by an operator or automatically and continuously monitored and alarmed. Water level monitoring should be capable of being performed either:

(a) by an operator in the CR, or

(b) from a location other than the CR with provision for providing immediate water level values to an operator in the CR if significant changes occur. Observations should be recorded at an interval no greater than 15 minutes during normal conditions.

Guidance should be developed and provided to operators that covers evacuation of the monitoring post. The guidance should properly balance reactor and personnel safety.

Implementation

An existing permanently mounted dp cell (PT-432A) is located in "Loop B" hot leg and is monitored locally as well as on the main control board in the control room and provides a reliable level indication. The existing indicator has a range of 0-100 inches, measuring from a level 4 inches above the bottom of the hot leg to a level 16 inches above the reactor vessel flange. The RHR suction line take-off is from Loop "A" hot leg, connected in a vertical orientation at the bottom of the hot leg. RG&E plans to install a second RCS loop level indicator in Loop "A" hot leg during the 1990 refueling shutdown which can be monitored in the control room.

The earliest date of installation of the second level indicator, planned as a result of our Generic Letter 87-12 response, is during the 1990 refueling shutdown. A thorough walkdown of the reactor coolant loop areas will be necessary to establish routing of electrical conduit and tubing. This information will be obtained during the upcoming 1989 shutdown, since these areas are inaccessible during power operations.

As an interim provision until the second permanently mounted transmitter is installed, a temporary modification is being planned to install a remote level transmitter and indication to the main control board from Loop "A" hot leg. This temporary indicator would be installed and available prior to entering the next reduced inventory condition.

This temporary device will provide added assurance to operators with independence of instrument tie-in location and power supply. The existing plastic tube attached to Loop "B" hot leg will remain in service, but will be used for comparison purposes only.

Existing Procedure O-2.3.1, Draining the Reactor Coolant System, will be revised to require the Control Room Operator to log the loop level indications in the control room at 15 minute intervals. During the draindown process when the water level is between the reactor vessel flange and a stabilized level at the loop centerline, the level is monitored continually. Additionally, twice per shift during the containment walkthrough, an operator will record the level readings on the local loop "B" indicator to compare with the water level observed visually in the plastic tube in order to obtain trending data on differences in level that may exist between the loop measurement points for the RHR flow occurring at that time.

The existing Procedure O-2.3.1 will be revised to address the loop levels available to the operators, those that are required to be logged and notations indicating that indicated level between the measurement points may differ. The difference calculated from Westinghouse ESBU/WOG-88-173 dated October 14, 1988 will be provided to operators for guidance.

RG&E has considerable operating experience at reduced inventory conditions. The Loop "B" hot leg level transmitter (PT-432A) was installed in 1972 and a number of procedural changes were made at that time regarding RHR flow versus level requirements and recovery procedures. Procedures will require that RHR flow be reduced and maintained at 800 gpm when operating at a level between 5" above loop centerline (level for nozzle dam installation) to loop centerline. This value provides more than 5 inches of margin above the guidance as analyzed and shown on Figure 2-18 of WCAP-11916. For operation at 4 inches below loop centerline, necessary in order to perform RTD maintenance, RHR flow is further reduced to approximately 500 gpm (pumps are rated at 1560 gpm). Operating experience has shown that vortexing is not a problem at these flowrates and levels.

The level indications available to operators during the draindown process is augmented in Procedure O-2.3.1 by volumetric measurement of RCS inventory drained from the system to the CVCS holdup tank. Previous experience has demonstrated this technique to be accurate for ensuring that the steam generators are properly drained.

EXPEDITIOUS ACTIONS

RCS PERTURBATION

Recommendation

Implement procedures and/or administrative controls that generally avoid operations that deliberately or knowingly lead to perturbations to the RCS and/or to systems that are necessary to maintain the RCS in a stable and controlled condition while the RCS is in a reduced inventory condition. If operations that could perturb the RCS or systems supporting the RCS must be conducted while in a reduced inventory condition, then additional measures should be taken to assure that the RCS will remain in a stable and controlled condition. Such additional measures include both prevention of a loss of DHR and enhanced monitoring requirements to ensure timely response to a loss of DHR should such a loss occur.

Implementation

NOTE: In these discussions, mid-loop level is defined (consistent with Generic Letter 88-17) as a level below the top of the hot leg, i.e., 25 inches for R.E. Ginna. Reduced inventory is defined as 3 feet below the reactor flange or the 48 inch level.

The primary responsibility for outage management rests with the Outage Planning Group and Operations Group. These two groups are supervised by Senior Reactor Operators and Ex-Senior Reactor Operators, personnel with many years of experience in operations of R.E. Ginna. Restrictions regarding testing, operations and maintenance having the potential of perturbing the RCS are controlled by these two groups. The status of, and changes to be made to, equipment line-ups are planned and discussed in twice daily outage planning meetings prior to the activities to be performed.

Appropriate notations will be inserted in Procedure O-2.3.1 to warn operators to review current activities for potential RCS/RHR perturbations. Current maintenance procedures will be reviewed for activities that may perturb the RCS/RHR systems. These procedures will be revised to insert steps calling attention to the reduced inventory concerns. A Shift Supervisor sign-off step to begin the procedure will be added.

For outage planning purposes, discussions of those activities that are directly related to the draindown will reinforce the mid-loop concerns. This will enhance the awareness of plant foremen and supervisors while in this condition. Each of the two daily planning meetings will include discussions of reduced inventory concerns. While in the mid-loop condition, posting on the Plant Communications System will be made to maximize awareness for all personnel.

Existing procedures require draindown to mid-loop levels for steam generator nozzle dam installation, in order to perform steam generator inspections or repair, and as soon as is practical flooding back up above the mid-loop level. Operations at mid-loop levels are minimized to the extent practical. Activities that can be effectively performed at other times, such as valve work, will not be scheduled during the mid-loop condition.

However, several maintenance activities, when scheduled to be performed, can only be done during the mid-loop condition. RTD maintenance is done at 4 inches below the loop centerline. All other mid-loop activities are performed above loop centerline, such as eductor operation, S/G inspection, S/G nozzle dam installation/removal, and reactor coolant pump maintenance. (Reactor coolant pump seal inspection and maintenance is performed while above the reduced inventory level.)

For the 1989 refueling shutdown, the only maintenance activities planned are nozzle dam installation and subsequent removal. Existing procedures require that the RHR flowrate be controlled dependent on loop level to prevent the onset of vortexing. Additionally, during any activities at loop centerline or below, Procedure O-2.3.1 will include an increased frequency of monitoring of loop level. As a precaution, during operations at levels below the top of the hot leg, Procedure O-2.3.1 will be revised to require an individual to be stationed in containment in order to vent the RHR system should RHR be lost. Additionally, both trains of RHR will be maintained available during the reduced inventory condition.

The warnings on the activities in the outage schedule will be to make personnel aware that they should check with the Shift Supervisor or Outage Coordinator prior to commencing an activity which may perturb the RCS. The warnings on the outage schedules and the added signoff in the maintenance procedures should bring any operations or work to the attention of the Shift Supervisor or Outage Coordinator. Evaluation and approval of activities planned during reduced inventory levels will be made on a case-by-case basis. Emphasis will be placed on minimizing the activities to those absolutely necessary. Attempts will be made to schedule reduced inventory activities for as late in the outage as is practical or following refueling when decay heat is lowest.

Procedures ensure that the reduced inventory condition will not be entered until RCS cold leg water temperature has been reduced to less than 140°F, and as close to 100°F or less as possible. This will provide additional margin over the 140°F value utilized in the Westinghouse WCAP-11916 analysis.

For the upcoming annual refueling, it is expected that the reduced inventory condition will be entered at about 110 hours after shutdown. Nozzle dam installation is expected in the order of 4 hours later. Additional benefit over the WCAP-11916 analysis is achieved when the reduced inventory condition is entered more than the 48 hours assumed in the analysis. Until available as part of Programmed Enhancement 4, Analysis, recovery procedure guidance will be based upon the limiting case of 48 hours after shutdown in order to envelop the case of a forced shutdown situation. RG&E will be placing increased emphasis on prevention of loss of RHR and availability of critical parameters needed to monitor the RCS and RHR systems and deal with the recovery aspects for the limiting cases.

Controls will be implemented to avoid the adverse conditions discussed in detail in Attachments 6 and 7. Proper sequencing of nozzle dam installation and removal will be controlled. For the upcoming outage, large line RCS boundary valve work is being scheduled during the 10-year ISI with no fuel in the reactor. A large hot side vent path will be provided during the draindown process and prior to installation of the last hot leg nozzle dam. This procedure will continue for future shutdowns as well. We will continue to work on developing an overall personnel awareness and understanding for those directly responsible for operations and supervision of activities while in a reduced inventory condition.

EXPEDITIOUS ACTIONS

RCS INVENTORY ADDITION

Recommendation

Provide at least two available or operable means of adding inventory to the RCS that are in addition to pumps that are a part of the normal DHR systems. These should include at least one high pressure injection pump. The water addition rate capable of being provided by each of the means should be at least sufficient to keep the core covered. Procedures for use of these systems during loss of DHR events should be provided. The path of water addition must be specified to assure the flow does not bypass the reactor vessel before exiting any opening in the RCS.

Implementation

RG&E will maintain available the equipment and associated flowpaths analyzed for recovery purposes for the 2-loop plant in WCAP-11916. A number of plant configurations were identified and analyzed for RCS response to loss of RHR. These configurations can be established in one of five categories and are listed in Attachment 2, Containment Closure. The recovery equipment and flow paths analyzed in WCAP-11916 for each of the configurations will be available during the reduced inventory condition.

Three methods will be available during reduced inventory operation. The preferred method of recovery is to restore level in the RCS quickly to restore RHR to service to regain decay heat removal capability.

The gravity feed method and flow path for R.E. Ginna will provide a large volume of water from the RWST directly to the Loop "A" hot leg. The flow path, shown on Figure 5.4-7 of the UFSAR, will force water from the RWST through valves MOV-856, MOV-701 and MOV-700 to the Loop "A" hot leg. The entire length of piping is 10 inch. The line enters the hot leg in a vertical orientation from underneath the hot leg. Preliminary results of a plant-specific analysis using the KYPIPE Code for the R.E. Ginna ECCS system indicate that a volume in the order of 7000 gallons can be delivered to the RCS if initiated within the 16 minute time after loss of RHR utilized in WCAP-11916. Procedures require venting the RHR system prior to initiating gravity feed. This method will raise the water level well above the top of the hot leg, and allow restart of an RHR pump. Because the flow path utilized for R.E. Ginna is much less restrictive than that assumed in the WCAP-11916 analysis (Section 3.9.1), the volume of water which can be delivered before RCS pressure would exceed the elevation head of water in the RWST is significantly greater than indicated in WCAP-11916. Both analyses assumed that RCS pressure was 30 psia at the time of gravity feed initiation (16 minutes).

Operator response to the gravity feed method will be validated, as necessary, to ensure that gravity feed can be accomplished within the time frame required by the analysis.

The second method of inventory addition will be an available charging pump with the flow path from the RWST to the Loop "B" cold leg (normal charging discharge path). The capacity of the charging pump meets the 55 gpm value utilized in the analysis for the 2-loop plant. For plant configurations where a cold side opening exists such as a check valve in the SI system, (large hot side vent path must be provided), charging to the intact cold leg will be made available prior to opening the cold side. R.E. Ginna has an alternate charging line which discharges to Loop "A" cold leg. The adequacy of the charging method to the intact cold leg initiated within 30 minutes after loss of RHR for the limiting case where the loss of RHR occurs 48 hours after shutdown has been demonstrated in WCAP-11916 (Sections 3.9.3 and 3.9.4). Additional benefit can be achieved where the time after shutdown is greater than 48 hours.

A third method of recovery will be an available safety injection pump taking suction from the RWST and delivering to Loop "A" hot leg (if SI pump "B" is used) or to Loop "B" hot leg (if SI pump "A" is used). The cold leg discharge paths will be closed so that all flow would be directed to the hot leg. This will help ensure the 360 gpm delivery shown to be acceptable in the analysis. This method of recovery has been specifically analyzed for adverse Configuration 5, requiring hot leg SI at 11 minutes after loss of RHR. Cold leg SI did not provide the ability to keep the core covered in this case. RG&E will prohibit entering the Configuration 5 condition by providing a hot side vent path large enough to prevent pressurization.

It has been recognized that for a condition where both nozzle dams were installed without a large vent path (a condition which will be prohibited), a postulated failure of the cold leg nozzle dam first would require hot leg safety injection for recovery. The Generic Letter requires a high head injection pump be one of the means available for inventory addition.

Existing Procedure O-2.3.1 will be revised to require the preferred flow paths and equipment to be available with power to the appropriate components prior to draindown. Existing Abnormal Procedure AP-RHR.2 will be revised to address the preferred flow paths and their use upon loss of RHR.

Depending upon the plant configuration, the time after shutdown, and initial water temperature in the RCS, the RCS pressurization rate and time to core uncovery will vary. The limiting cases, Configurations 4 and 5, where a cold side opening exists with the RCS not vented through the hot side, will not be permitted. For Configuration 1 (RCS intact) the loss of RHR would cause the RCS

to pressurize and reach saturation in about 10 minutes and continue to rise to 400 psia in 80 minutes. The gravity feed method initiated within 16 minutes (RCS pressure assumed to be 30 psia) would provide a large quantity of water sufficient to raise the water level significantly and enable restart of an RHR pump. An available charging pump would provide a backup means of inventory addition.

Configuration 2 (RCS intact, water in the narrow range of one steam generator) is similar to Configuration 1 except water in the secondary side of a steam generator provides additional decay heat removal capability, resulting in a much slower RCS pressurization rate. The time to reach 40 psia, approximately equal to the RWST head of water, would increase to 42 minutes as compared to 20 minutes for Configuration 1. This would allow more time for operator action to initiate gravity feed.

For Configuration 3, where a large hot side vent is provided, in cases where nozzle dams are installed or not, RCS pressurization would be prevented. Without recovery, the time to reach saturation and subsequent core uncovery, was determined to be 10 minutes and 83 minutes, respectively. This and the other results above were based upon loss of RHR occurring at 48 hours after shutdown with an initial RCS water temperature of 140°F. These times are extended as time after shutdown increases and water temperature decreases. An initial water temperature of 100°F results in the time to reach saturation and subsequent core uncovery of 15 minutes and 88 minutes, respectively, for the hot side vent configuration above.

As demonstrated by the analyses, adequate time exists to utilize these methods which will be available for recovery, and which would be effective in providing the necessary inventory addition capability to restore an RHR pump to service and prevent core uncovery.

EXPEDITIOUS ACTIONS

NOZZLE DAMS

Recommendation

(Applicable to Westinghouse and Combustion Engineering nuclear steam supply system (NSSS) designs). Implement procedures and administrative controls that reasonably assure that all hot legs are not blocked simultaneously by nozzle dams unless a vent path is provided that is large enough to prevent pressurization of the upper plenum of the RV.

Implementation

The maintenance procedures which are utilized to control the removal and installation of steam generator manways and nozzle dams will be revised to require that the hot leg manways and nozzle dams be removed first and installed last in the sequencing of steam generator maintenance. This sequencing will provide for a hot side vent path through a hot leg S/G manway for the longest period of time. Procedures will be revised to require approval of the Shift Supervisor prior to installation of the first hot leg nozzle dam.

During the initial draindown of the RCS after shutdown, and before the installation of the last hot leg nozzle dam, a large vent path will be provided either by lifting and blocking the reactor vessel head or by removing the pressurizer manway. The pressurizer manway vent is preferred, especially during "forced outage" situations, such as S/G tube repairs.

The operating procedure 0-2.3.1 covering draindown of the RCS will be revised to establish this vent path. Section 3.4 of WCAP-11916 utilized a vent size of 0.5 sq. ft. to limit pressurization. Since the surge line thermal sleeve limits the pressurizer manway vent to 0.39 sq. ft., this method will require an appropriate analysis demonstrating that this vent size will prevent pressurization. This analysis will be available prior to entering reduced inventory if this vent path is to be used. The window of time that operations are performed at mid-loop conditions is minimized and is in the order of 24-48 hours. Once the necessary activities have been performed in the mid-loop condition to install the nozzle dams and seat them, and in some cases perform S/G bowl decontamination, RTD maintenance, steam generator inspections, and reactor coolant pump maintenance, the level can be raised above the reduced inventory condition until final draindown after refueling to remove the nozzle dams. About four hours of the total time is expected after refueling and after draindown to remove the nozzle dams. During this phase after the refueling, the surge line vent path to the pressurizer manway is also preferred due to critical path scheduling considerations involving the reactor vessel head retentioning.

Because of the long time after shutdown combined with 1/4 less decay heat due to refueling, the vent size required is expected to be much less than the 0.5 sq. ft. vent path utilized in the Westinghouse WCAP-11916 analysis. An analysis will be available to support the use of the surge line vent path or we will provide another large vent path of sufficient size, such as from the lifted reactor head.

Plans for the 1989 refueling shutdown have not scheduled activities which would create a cold side opening while fuel is in the vessel, such as valve replacement in the safety injection system during the reduced inventory condition. For a condition where nozzle dams were not installed and a cold side opening existed and a large hot side vent had not been provided, an adverse condition (configuration 4) analyzed in WCAP-11916 (Section 3.7) would result and could lead to brief uncovery of the top of the core after the reactor coolant pump loop seal cleared. Analysis showed that the water level would stabilize several feet above the top of the core and fuel temperatures would not become excessive. For a plant condition where a cold side opening was created when nozzle dams were installed and a large hot side vent had not been provided, an adverse condition (configuration 5) could result in rapid and prolonged core uncovery if RHR were lost unless immediate recovery actions were taken (hot leg safety injection at 11 minutes). Both conditions above are regarded as adverse conditions and will not be permitted. Providing a large hot side vent path precludes these adverse conditions from occurring.

Activities which require cold leg openings during reduced inventory operation are under the control of the Outage Planning Group in coordination with the Shift Supervisor. Operations procedures will be modified to identify the plant pre-conditions to be met prior to entry into a reduced inventory condition. An operator checklist will be provided. When cold side openings must be created, procedural controls will be in place to ensure that a large hot side vent path exists which will prevent RCS pressurization and subsequent loss of inventory through the opening.

EXPEDITIOUS ACTIONS

LOOP STOP VALVES

Recommendation

(Applicable to NSSSs with loop stop valves). Implement procedures and administrative controls that reasonably assure that all hot legs are not blocked simultaneously by closed stop valves unless a vent path is provided that is large enough to prevent pressurization of the RV upper plenum or unless the RCS configuration prevents RV water loss if RV pressurization should occur. Closing cold legs by nozzle dams does not meet this condition.

Response

Not applicable to R.E. Ginna.