NORTHEAST UTILITIES

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WESTERN MASSACHUSETTS ELECTRIC COMPANY
HOLYOKE WATER POWER COMPANY
NORTHEAST UTILITIES SERVICE COMPANY
NORTHEAST NUCLEAR ENERGY COMPANY

General Offices • Selden Street, Berlin, Connecticut

P.O. BOX 270
HARTFORD, CONNECTICUT 06141-0270
(203) 665-5000

September 18, 1987

Docket Nos. 50-213
50-336
50-423
B12676

Re: 10CFR50.54(f),
Generic Letter 87-12

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

Reference (1): F. J. Miraglia letter to All Licensees of Operating PWRs and Holders of Construction Permits for PWRs, Loss of RHR while the Reactor Coolant System (RCS) is Partially filled (Generic Letter 87-12), dated July 9, 1987.

Gentlemen:

Haddam Neck Plant
Millstone Nuclear Power Station, Unit Nos. 2 and 3
Generic Letter 87-12
Loss of Residual Heat Removal (RHR) While the
Reactor Coolant System (RCS) is Partially Filled

In Reference (1), the NRC Staff requested each licensee to provide the NRC with a description of the operation of the plant during the approach to a partially filled RCS condition and during operation with a partially filled RCS to ensure that each utility meets the licensing basis for the plant. Specifically, the Staff requested information for nine (9) items to support the specific plant bases for their approach to mid-loop operations and related issues.

Pursuant to the provisions of Reference (1) and 10CFR50.54(f), Connecticut Yankee Atomic Power Company (CYAPCO), on behalf of the Haddam Neck Plant, and Northeast Nuclear Energy Company (NNECO), on behalf of Millstone Unit Nos. 2 and 3, are hereby providing a response to each of the nine (9) items. Attachment 1 provides information for the Haddam Neck Plant. Attachments 2 and 3 provide information for Millstone Unit Nos. 2 and 3 respectively. Attachment 4 provides a response to items 6 and 7 and is applicable to the Haddam Neck Plant and Millstone Unit Nos. 2 and 3.

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We trust you will find this information satisfactory and sufficient to resolve this issue. As always, we are available to address any questions the NRC Staff may have.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY
CONNECTICUT YANKEE ATOMIC POWER COMPANY

E. J. Mroczka

E. J. Mroczka
Senior Vice President

By: C. F. Sears
Vice President

cc: W. T. Russell, Region I Administrator
F. M. Akstulewicz, NRC Project Manager, Haddam Neck Plant
D.H. Jaffe, NRC Project Manager, Millstone Unit No. 2
T. Rebelowski, Resident Inspector, Millstone Unit No. 2
J. T. Shedlosky, Resident Inspector, Haddam Neck Plant
R. L. Ferguson, NRC Project Manager, Millstone Unit No. 3
W. J. Raymond, Resident Inspector, Millstone Unit No. 3

STATE OF CONNECTICUT)
) ss. Berlin
COUNTY OF HARTFORD)

Then personally appeared before me C. F. Sears, who being duly sworn, did state that he is Vice President of Connecticut Yankee Atomic Power Company and Northeast Nuclear Energy Company, Licensees herein, that he is authorized to execute and file the foregoing information in the name and on behalf of the Licensees herein and that the statements contained in said information are true and correct to the best of his knowledge and belief.

Lorraine J. D'Amico
Notary Public
My Commission Expires March 31, 1988

Docket No. 50-213
B12676

Attachment 1

Response to Generic Letter 87-12

Haddam Neck Plant

September, 1987

Haddam Neck Plant
Response to Generic Letter 87-12

Item (1):

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

Response:

The Haddam Neck Plant is a four loop, pressurized water reactor with loop isolation valves. Having these valves limits the number of times the RCS has to be at reduced water level. During refueling outages, prior to detensioning the head, the RCS water level is drained to eleven inches below the reactor vessel flange resulting in seventy one inches of water above the centerline of the nozzles. It is not necessary to go to mid-loop operation to support steam generator work due to the ability to use loop isolation valves. Occasionally, to support certain types of maintenance on the loop isolation valves the water level is lowered to approximately four inches above the top of the reactor vessel (RV) nozzles which is still below the valve bonnet flange. There are no interlocks that could cause a disturbance to the system.

Although there are no formal requirements in these areas, it typically takes four to six days to place the plant in a condition that will support draining the RCS below the top of the RV head.

The Technical Specifications require two reactor coolant loops with their steam generators and reactor coolant pumps (RCP) operable and one in operation in MODE 5. However, no reactor coolant loops need to be operable if two RHR loops are operable with one in operation. Aside from these requirements there are no requirements for minimum steam generator levels in MODE 5 or 6 in the current Technical Specifications. Assuming the reload Technical Specifications for Cycle 15 are approved, (in MODE 5 with reactor coolant loops filled) a condition is placed on minimum steam generator water level when two unisolated steam generators are credited in place of an additional RHR loop. The Limited Condition for operation is as follows:

"3.3.1.4.1 At least one RHR loop shall be OPERABLE and in operation,* the reactor trip system breakers shall be open or the control rod drive lift coils shall be de-energized, and either:

a. One additional RHR loop shall be OPERABLE, or

b. The secondary side narrow range water level of at least two unisolated steam generators shall be greater than 25%.

APPLICABILITY: MODE 5 with reactor coolant loops filled.**

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* The RHR pump may be deenergized for up to 1 hours provided: (1) no operations are permitted that would cause dilution of the Reactor Coolant System boron concentration, and (2) core outlet temperature is maintained at least 10°F below saturation temperature.

** A reactor coolant pump in an unisolated loop shall not be started with one or more of the Reactor Coolant System cold leg temperatures less than or equal to 315°F unless the secondary water temperature of each steam generator is less than 20°F above each of the Reactor Coolant System cold leg temperatures."

During refueling outages, status meetings are normally held twice a day with outage coordinators to ensure important evolutions are well coordinated.

There are no formal restrictions regarding testing, operations and maintenance that could perturb the system although all maintenance is authorized and controlled through the work control system and the coordination of such activities is accomplished through the outage meetings described above.

With respect to the ability of the RCS to withstand pressurization, the Technical Specifications require that below 340°F (assuming the reload Technical Specifications for Cycle 15 are approved, this number will be changed to 310°F) the RCS is either vented by a 3" nominal pipe opening or the LTOP system is in service with a relief valve setpoint of 380 psig.

There are no requirements for containment integrity as they relate specifically to reduced RCS level operations.

The time to replace the equipment hatch has been demonstrated to be less than two hours.

There are no requirements pertinent to reestablishing the integrity of the RCS pressure boundary.

Item (2):

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

Response:

The following instrumentation and alarms provide the operators with indications of RCS conditions during partially filled operations.

A. INSTRUMENTATION

1. RHR heat exchanger inlet temperature

2. RHR heat exchanger outlet temperature

   Note: Both temperatures recorded on the main control board (MCB). Also there is a local outlet indication.

3. RHR pump discharge pressure (MCB)

4. RHR pump inlet pressure (local)

5. RHR total flow (MCB)

6. RHR pump ammeter (MCB)

7. Wide Range RCS pressure (MCB)

8. Incore thermocouples (only if Reactor Vessel (RV) head cables are connected). There is no temperature indication when the head is off.

9. When CETs are operational the Inadequate Core Cooling (ICC) provides:

   a. Subcooled Margin

   b. RV head and plenum levels (only when head cables connected)

10. Cavity/pressurizer level indication. This is a pressure transducer with a digital display calibrated to indicate pressurizer or cavity level (inches) (MCB).

B. Alarms

1. Low RV head level

2. Low RV plenum level

3. RHR low flow

4. RHR pump in Trip Pull Out

5. 480 volt breaker tripped

6. RHR pump seal water high temperature

C. Temporary Connections

For work that requires taking loop stop valves apart, temporary tygon tubing is connected to the loop drain and run up along side the valve to monitor the water level. No special quality control processes are used to ensure functioning of the installation.

D. Ability to Monitor RCS After Loss of RHR

1. RCS Pressure - 2 channels of wide range pressure.
   Also RHR pump discharge pressure.

2. RCS temperature

   a. Core exit thermocouples (Not applicable in Mode 6)
   b. Loop T_C, if loop unisolated

3. Level

   a. Cavity level indicator
   b. Temporary tubing, if installed

Item (3):

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

Response:

At the Haddam Neck Plant, the following pumps can be used to control NSSS inventory:

1. 2 RHR pumps (dependent on Mode 5 & 6 T.S.)
   Reference: Technical Specifications 3.3.G and 3.13

2. 2 HPSI pumps (inoperable below 340 degrees F)
   Reference: Technical Specification 3.6.C

3. 2 LPSI pumps (inoperable below 340 degrees F)

4. 2 Charging pumps (one inoperable below 340°F)
   Reference: Technical Specifications 3.5.B, 3.6.D and 3.13.E

5. 1 Metering charging pump (no requirements)

6. 1 Purification pump (no requirements)

Item (4):

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

Response:

As noted in the response to item (1), there are no requirements for containment closure while the RCS is partially filled. Containment integrity requirements are based on RCS temperature, pressure and refueling operations.

Item (5):

Reference to and a summary description of procedures in the control room of your plant which describe operation while the RCS is partially filled. Your response should include the analytic basis you used for procedures development. We are particularly interested in your treatment of draindown to the condition where the RCS is partially filled, treatment of minor variations from expected behavior such as caused by air entrainment and de-entrainment, treatment of boiling in the core with and without RCS pressure boundary integrity, calculations of approximate time from loss of RHR to core damage, level differences in the RCS and the effect upon instrumentation indications, treatment of air in the RCS/RHR system, including the impact of air upon NSSS and instrumentation response, and treatment of vortexing at the connection of the RHR suction line(s) to the RCS.

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

Response:

Procedures:

1. NOP 2.9-3, "REFUELING CAVITY FILLING AND DEWATERING," establishes the proper water level in the cavity for conducting refueling operations and the subsequent dewatering upon completion of refueling.

2. There is no specific procedure that addresses the evolution of operating at reduced level to support loop isolation valve type maintenance. There is no analytic basis for this evolution.

3. AOP 3.2-12, "LOSS OF RESIDUAL HEAT REMOVAL SYSTEM" covers the following scenarios:

   a. A loss of RHR flow with cavity full which would produce a slow heatup of the wat[illegible] of the large quantity involved.

   b. A loss of RHR flow with reactor head still in place which would produce a somewhat faster heatup rate but could be handled by pressurizing the system and using a steam generator for heat removal.

   c. A loss of RHR flow with the reactor head closure studs more than half removed. This would necessitate a decision as to which alternate cooling system to use and whether to replace studs or continue removal.

   d. A loss of RHR flow due to air binding of the RHR pumps.

Calculations were performed for the Haddam Neck Plant to estimate the time from loss of RHR to when bulk boiling conditions exist in the core and the time required to boil off sufficient RCS liquid to result in the onset of core uncovery.

Based upon these conservative calculations, it is estimated that boiling would occur no sooner than 12 minutes and core uncovery would occur no sooner than 94 minutes from the time of loss of RHR.

In these calculations the decay heat rate was conservatively predicted assuming a decay time of 72 hours. The RCS liquid and metal masses were conservatively estimated with guidance provided by NUREG-1269 (Loss of Residual Heat Removal System - Diablo Canyon, Unit 2, published in June 1987). None of the steam generated during the boil off was assumed to condense and return to the core region.

Also, for both calculations the RCS is conservatively assumed to be at atmospheric pressure (i.e. the RCS is in a vented condition).

A further conservatism is that the calculation assumes that the RCS water level is at the hot leg centerline. As noted in the response to item (1), the RCS water level is typically lower to a point about 4 inches above the nozzles which is about 18 inches above the nozzle centerline. This level difference provides a significant amount of additional inventory for heatup and boil off.

It should be noted that the predicted times to core uncovery do not necessarily reflect the time to core damage. Due to the bulk boiling conditions in the core, fuel integrity will be maintained by steam cooling beyond this predicted time.

Additional analysis of the loss of RHR event for partial loop operation is being considered by the Westinghouse Owners group. Any information resulting from the owners group activities will be evaluated for impact on the Haddam Neck Plant procedures.

Item 6:

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

Response:

See Attachment 4.

Item (7):

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

Response:

See Attachment 4.

Item (8):

Comparison of the requirements implemented while the RCS is partially filled and requirements used in other Mode 5 operations. Some 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:

See a response to item (9).

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:

As a result of considering the above issues and those detailed in Information Notices the following changes have been made:

a. NOP 2.9-3, "REFUELING CAVITY FILLING AND DEWATERING" was revised to address:

   (1) Verifying availability of level monitoring instrumentation.

(2) Verifying no kinks in tygon tubing and proper valve lineup when temporary tubing is used.

(3) Potential for vortexing and air entrainment due to low water level or increased flow.

(4) Monitoring RWST level, RHR flow, and pump amps.

(5) Referral to AOP if RHR flow is lost.

b. AOP 3.2-12, LOSS OF RHR SYSTEM was revised to address recovery actions in the event that the RHR pumps become air bound.

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Attachment 2

Response to Generic Letter 87-12

Millstone Unit No. 2

September, 1987

Millstone Unit No. 2

Responses to Generic Letter 87-12

Item (1):

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

Response:

For Millstone Unit No. 2, draindown of the RCS is accomplished in accordance with Operating Procedure OP-2301E, "Draining the Reactor Coolant System." During periods of Cold Shutdown (Mode 5) or Refueling (Mode 6) operations, the RCS is typically operated under conditions of partial draindown to:

(1) conduct SG tube inspections and/or repairs, or to install SG nozzle dams in preparation for such activities;

(2) to replace Reactor Coolant Pump (RCP) seals;

(3) to perform RCS valve maintenance, where other plant conditions cannot adequately isolate the work area from the reactor coolant; or

(4) to support reactor vessel head and internals disassembly, in preparation for refueling.

The initial conditions for draining the RCS, as specified in OP-2301E, Section 7.1, include the RCS being in the cold shutdown condition, filled to the pressurizer vent, and at zero psig pressure. Initial RCS temperature is verified to be approximately 90 - 125°F. The conditions for beginning the draindown can typically be established in 40 - 48 hours after leaving 100% power. Stable, drained conditions (to the centerline of the RCS Hot Leg) can typically be achieved in approximately 72 hours. During the January - February 1987 forced outage for SG tube inspection activities, the plant was drained below the pressurizer level instrumentation indicating range beginning at 46½ hours after commencing downpower from 100%; reached the Hot Leg centerline in approximately 56 1/2 hours and had SG primary manways removed within 80 hours.

The following interlocks and conditions exist at Millstone Unit No. 2 which could cause or indicate interruption of Shutdown Cooling (SDC), regardless of RCS level:

(1) the SDC inlet isolation valves will automatically close, and cannot be opened by normal, remote means from the control room, whenever pressurizer (RCS) pressure exceeds 300 psia. To prevent inadvertent isolation of the SDC system during surveillance testing, appropriate procedural controls are incorporated into the procedures for testing the pressure instruments affecting this feature.

(2) the SDC pumps (Low Pressure Safety Injection (LPSI) pumps) receive an automatic stop signal from the Engineered Safety Features Actuation System (ESFAS) upon initiation of sump recirculation. Sump recirculation is initiated based on reaching a low level setpoint in the Refueling Water Storage Tank (RWST). To prevent inadvertent tripping of the LPSI pumps during SDC operation, plant cooldown procedures require that the sump recirculation feature of the ESFAS be blocked after entering Mode 5.

(3) the SDC pumps are tripped by the 94TG-1 and 94TG-2 relays associated with the 345 KV breakers at the main generator output. To prevent inadvertent tripping of the SDC pumps during turbine testing or 345 KV breaker operations, plant cooldown procedures require appropriate circuits to be opened and tagged prior to the initiation of shutdown cooling.

(4) annunciation is provided at the main control board C01 to indicate that either SDC (LPSI) pump has tripped.

There are presently no Technical Specification restrictions on containment integrity once the reactor is below Mode 4 (except during CORE ALTERATIONS); nor on SG level in Mode 4 or below unless one of the RCP/SG cooling loops is being maintained OPERABLE to satisfy Technical Specification 3.4.1.3. Plant operating procedures generally do not contain restrictions on containment conditions, SG level, or plant testing/maintenance beyond those appropriate to meeting Technical Specification requirements. At Millstone Unit No. 2, plant conditions, operations and planned evolutions/maintenance are reviewed by plant management at least daily during shutdown periods, for the purpose of identifying special operations considerations and potential conflicts. Managers in attendance at these outage meetings typically include the Unit Superintendent, Operations and Maintenance Department heads, departmental planners and outage coordinators, and first line supervisors such as the maintenance foremen and Operations Shift Supervisor. While plant management reviews and approves planned work and changes in plant status, the Shift Supervisor or Supervising Control Operator individually reviews and authorizes each work order and planned operation to ensure plant conditions are appropriate for the start of, and will not be jeopardized by the performance of, the proposed work. The reviews of planned work by management and shift operating personnel ensure that tests, operations or maintenance do not adversely affect stable RCS conditions.

Operating Procedure OP-2310, "Shutdown Cooling System," provides the operating requirements for a partial or total loss of shutdown cooling. This procedure requires that containment be evacuated and CONTAINMENT INTEGRITY be established prior to exceeding an RCS temperature of 200°F, or prior to performing steps which line up the contents of the RWST to the RCS. The following time estimates represent approximate minimum times to perform the Technical Specification requirements or, in the case of SG manways, to impede RCS leakage:

(1) install the containment equipment hatch - two hours.

(2) install the temporary equipment hatch - six hours.

(3) install SG primary manways - four hours.

During operation in Mode 5, and in Mode 4 with RCS cold leg temperature below 275°F, the RCS is protected from specified overpressurization transients by two power operated relief valves (PORVs) with reduced setpoint (less than 465 psia), or by an RCS vent of at least 1.3 square inches.

Item (2):

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

Response:

The following instrumentation and alarms provide the operators with indications of RCS conditions during partially filled operations with SDC in operation:

(1) SDC inlet and outlet temperatures
(2) SDC heat exchanger outlet temperatures
(3) Pressurizer (RCS) pressure
(4) SDC (LPSI) pump discharge pressure
(5) Discharge pressure of the idle LPSI pump, which provides an indication of RCS level (or nitrogen overpressure during draindown) OP-3201E provides guidance to the operator on use of this indication
(6) SDC system flow
(7) LPSI injection header flows
(8) SDC (LPSI) pump motor current
(9) A temporary, tygon tube level indicator which is connected to an RCS hot leg drain line and monitored using closed circuit television (CCTV) in the containment. The temporary level indicator is depicted on the attached sketch of the Millstone Unit No. 2 venting

and level indicating arrangement. OP-2301E requires that level in the tygon tubing level indicator compares favorably to the pressurizer level indication prior to commencing draindown, and invokes various restrictions and cautions to ensure the operators do not drain at such a rate, or otherwise operate the plant, as to invalidate the temporary level indication.

(10) SDC (LPSI) pump tripped annunciators.

Additionally, draining to mid-loop condition is performed while monitoring the volume discharged to the coolant waste system. Thus, the flow integrator to the waste system provides an important independent aid to maintaining adequate RCS level, and OP-2301E incorporates appropriate procedural controls.

Depending on the timing of the partially drained operation relative to reactor disassembly for refueling, the core exit thermocouples (CETs) and reactor vessel level monitoring system (RVLMS) may be available to the operators for additional indications. Typically, these instruments are in service for the first draindown of a refueling period - normally, for installation of SG nozzle dams. (For outages other than refueling, the CETs and RVLMS would be expected to remain in operation throughout any period of partially filled operation.) During past outages, Millstone Unit No. 2 has made special efforts to keep these systems in operation, and to compare RCS conditions as indicated on all available instruments. These efforts include the manufacture of special jumper cables so that the RVLMS may be in operation when much of the nomal supporting reactor superstructure is removed.

In the case where the CETs and RVLMS are not available, a loss of SDC could impact the operators' ability to monitor RCS temperature and level. SDC system temperatures would be meaningless during a loss of flow condition, and increasing RCS pressure or boiling could adversely affect the Tygon tubing level indication. Procedural guidance in the event of a loss of SDC, and the operators' training in this event, minimize the likelihood of indication problems of this type.

Item (3)

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

Response:

At Millstone Unit No. 2, the following pumps which can be used to control NSSS inventory are required to be OPERABLE or capable of operation when the plant is in Modes 5 or 6:

(1) One Charging Pump: Technical Specifications 3.1.2.1 and 3.1.2.3 requires either a Charging Pump or a High Pressure Safety Injection (HPSI) Pump to be OPERABLE for reactivity control. Plant cooldown procedures require both HPSI pumps to be disabled prior to cooling

below 190°F, thus the Charging Pump is routinely selected to meet the requirements of the indicated specifications. While the ACTION statements associated with these Specifications require only that CORE ALTERATIONS or positive reactivity additions be terminated if the required pump is not available, Millstone Unit No. 2 would typically require another pump to be in service prior to disabling the required pump for testing or maintenance.

(2) Two LPSI Pumps operating in the SDC mode: Technical Specifications 3.4.1.3 and 3.9.8.2 generally require that two LPSI Pumps be OPERABLE during Modes 5 and 6 (in Mode 6 under certain operating conditions a HPSI pump may be substituted for one of the LPSI pumps). Again, plant practice is to not permit any interruption in the availability of these pumps due to testing or maintenance.

Additionally, one or more of the following pumps could be available (or readily made available within 15 minutes) during most periods of operation in Modes 5 or 6:

(1) The two other installed Charging Pumps: These pumps are typically caution tagged for inventory/pressure control, and are available to substitute for the required OPERABLE pumps. Maintenance would be permitted on these pumps, during which they might be unavailable. However, it is not plant practice, and would be unlikely, that both backup pumps would be unavailable due to maintenance at the same time.

(2) The two HPSI Pumps: One of the pumps and its combined discharge valves is tagged out of service for inventory/pressure control pursuant to the note accompanying Technical Specification 3.5.3.a, while the other pump is disabled for the same reasons as part of the plant cooldown procedure. The installed spare HPSI Pump could also be a method of providing makeup to the RCS under emergency conditions.

(3) The two Containment Spray (CS) Pumps: No procedure exists for using the CS pumps either as the motive force for SDC operations, or as a method of moving water from the RWST to the RCS. However, these operations are possible and are being evaluated for inclusion in future off-normal operating procedures.

Item (4):

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

Response:

As noted in the response to item (1), Millstone Unit No. 2 does not presently restrict containment conditions beyond these required by the Technical Specifications. During those plant conditions when CONTAINMENT INTEGRITY is required, all aspects of the containment boundary are considered (including all items specifically identified in the item). During conditions when CONTAINMENT INTEGRITY is not required, the condition of containment is monitored by mangement, outage coordintating personnel (Management Representative and Containment Coordinator), and shift operating personnel, such that rapid attention could be directed to containment closure in the event of an emergency. It is also standard practice to temporarily close openings or penetrations created by maintenance activities.

Item (5)

Reference to and a summary description of procedures in the control room of your plant which describe operation while the RCS is partially filled. Your response should include the analytic basis you used for procedures development. We are particularly interested in your treatment of draindown to the condition where the RCS is partially filled, treatment of minor variations from expected behavior such as caused by air entrainment and de-entrainment, treatment of boiling in the core with and without RCS pressure boundary integrity, calculations of approximate time from loss of RHR to core damage, level differences in the RCS and the effect upon instrumentation indications, treatment of air in the RCS/RHR system, including the impact of air upon NSSS and instrumentation response, and treatment of vortexing at the connection of the RHR suction line(s) to the RCS.

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

Response:

As referenced in the responses to items (1) and (2), operation with the RCS partially filled is governed primarily by two procedures at Millstone Unit No. 2: OP-2301E, "Draining the Reactor Coolant System", and OP-2310, "Shutdown Cooling System". OP-2301E describes operating requirements for draining the RCS to a partially filled condition, including actions to be taken (and limits to be observed) to minimize the possibility or effect of air binding or vortexing. OP-2310 provides the SDC system operating requirements, as well as the actions to be carried out upon loss of SDC. Together these procedures contain all the guidance required by the Control Room operators to operate on SDC in a full or partially drained condition.

Calculations were performed for Millstone Unit No. 2 to estimate the time from loss of SDC to when bulk boiling conditions exist in the core and the time required to boil off sufficient RCS liquid to result in the onset of core uncovery.

Based upon these conservative calculations, it is estimated that boiling would occur no sooner than 13 minutes and core uncovery would occur no sooner than 122 minutes from the time of loss of SDC.

In these calculations the decay heat rate was conservatively predicted assuming a decay time of 72 hours. The RCS liquid and metal masses were conservatively estimated with guidance provided by NUREG-1269 (Loss of Residual Heat Removal System - Diablo Canyon, Unit 2, published in June 1987). None of the steam generated during the boiloff was assumed to condense and return to the core region.

Also, for both calculations, the RCS is conservatively assumed to be at atmospheric pressure (i.e. the RCS is in a vented condition).

It should be noted that the predicted times to core uncovery do not necessarily reflect the time to core damage. Due to the bulk boiling conditions in the core, fuel integrity will be maintained by steam cooling beyond this predicted time.

Additional analysis of the loss of SDC event for partial loop operation is being considered by the Combustion Engineering Owners Group (CEOG). Any information resulting from the CEOG activities will be evaluated for impact on the Millstone Unit No. 2 procedures.

Item 6:

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

Response:

See Attachment 4.

Item (7):

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

Response:

See Attachment 4.

Item (8)

Comparison of the requirements implemented while the RCS is partially filled and requirements used in other Mode 5 operations. Some 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:

At Millstone Unit No. 2, the principal differences between operation in Mode 5 with a full RCS and operation with the RCS partially drained are the restrictions imposed to minimize the chances of air entrainment, vortexing, or inaccurate level indication. In brief, the additional operational guidance provided for operations with the RCS partially filled includes:

(1) SDC flow is limited by OP-2301E to 2500 gpm when draining to the centerline of the RCS hot leg, and to 1500 gpm when draining below the centerline of the hot leg, to minimize vortexing at the SDC suction connection to the RCS. Operation is specifically limited to one SDC pump during mid-loop conditions.

(2) Noncondensible gases in the SDC system are evacuated through the system high point vent in containment once every four hours during draining evolutions per OP-2301E, and the operator is instructed to do this more frequently early in the evolution until gas accumulation rates are established. OP-2301E establishes the general requirements to use the temporary vacuum pump installed at the SDC high point vent on a twice per shift basis during partially filled operations. Additionally, OP-2310 requires evacuation of noncondensible gas in the SDC piping from vents inside or outside containment, and periodic venting of the LPSI pumps, in the event of a loss of SDC which is caused or accompanied by an air bound system.

(3) The rate of draining from the RCS, and the equalization of pressures around the RCS, are carefully controlled per OP-2301E to ensure erratic or false level indication in the temporary level indicating hose does not result. The operators are directed to keep a close watch on the temporary level indicator when level is in the hot leg, and to compare the volume of coolant drained (and the expected resultant vessel level) to the indicated level in the tygon tubing level indicator. Draining is stopped when any erratic or abnormal indication is observed.

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:

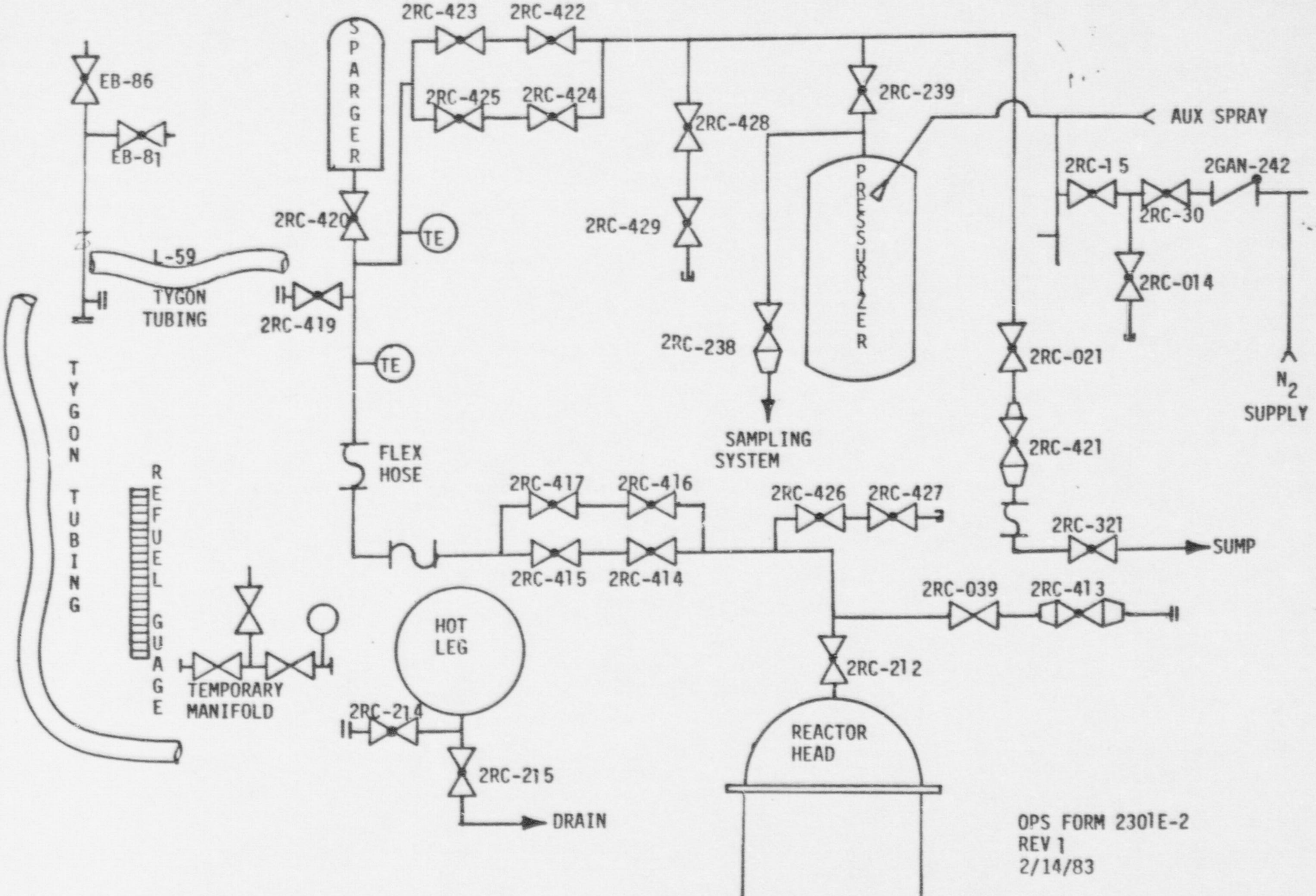
Over the past several years, improvements have been made in the physical setup and monitoring arrangements for the temporary equipment (level indicator, SDC evacuation setup) used during SDC and partially filled operations. These improvements have been made in response to operating experience at Millstone Unit No. 2, not specifically to industry events involving loss of RHR. Earlier this year, an investigation was begun to evaluate the feasibility and desirability of preparing a Loss of Shutdown Cooling Abnormal Operating Procedure (AOP), to provide in a single location the operating guidance and alternative strategies which may be needed to recover from a loss of SDC event. Presently, the total body of information pertaining to this subject is distributed through at least two procedures (although required actions are contained in OP-2310). A draft AOP has been prepared for a feasibility review, and a final need decision will be made in the future.

APPROVED [signature]

DATE 2/14/83

PORC MEETING NO. 2-83 5

RCS VENT SYSTEM



OPS FORM 2301E-2
REV 1
2/14/83

Docket No. 50-423
B12676

Attachment 3

Response to Generic Letter 87-12

Millstone Unit No. 3

September, 1987

Millstone Unit No. 3

Responses to Generic Letter 87-12

Item (1)

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

Response:

The RCS would be operated in a partially drained condition under a number of circumstances including Reactor Vessel Head Removal, Reactor Coolant Pump Seal work, repairs on non isolable portions of the coolant systems, and potential Steam Generator primary side entry. Millstone Unit No. 3 is equipped with loop stop valves which will limit the time spent in a partially drained condition. Two interlocks exist which could result in loss of RHR flow. The RHR suction valves will close automatcally at 750 psia. This pressure was selected to permit full opening of the RHR suction relief valves at 450 psia without closure of the RHR suction valves. The relief valves are sized to protect against maximum flow to the RCS from available pumps below 350°F. The second interlock automatically stops the RHR pumps on low low RWST level. This interlock would not present a problem in the drain down condition and only effects its respective train.

a. Millstone Unit No. 3 presently has no time limit prior to entering mid loop operation. Historically, Millstone Unit No. 3 has not operated mid loop until approximately 3 days or more after shtudown. The procedural control reduces flow to 1,000 gpm per RHR Train prior to reducing level below the Reactor Vessel Flange to avoid vortexing. The draining evolution is sufficiently slow to ensure stable heat removal at these flow rates.

b. The SG's have never been considered operable for heat removal once the primary side has been drained until the applicable loop has been sweeped and vented utilizing a RCP. Steam Generator levels have not been specified for operation at mid loop.

c. All equipment status changes are made by the Operations Department at all times. Maintenance of items connecting to the RCS are typical reasons requiring mid loop operation.

d. Ability of the RCS to withstand pressurization has not been previously addressed. Abnormal procedures address preventing core damage by creating a flow path both into and out of the RCS.

e. No containment isolation requirements are in place for mid loop operation. The containment equipment hatch could be closed in 4 hours except when moving large loads such as containment shield blocks.

f. RCS integrity requirements are not specified. Operation below the reactor flange is necessary during reactor assembly and disassembly.

Item (2):

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

Response:

The following instrumentation and alarms provide the operators with indications of RCS conditions during partially filled operations with RHR in operation.

1. RHR inlet and outlet temperatures

2. RHR pump suction and discharge pressures

3. RCS pressure

4. Suction and discharge pressures of the idle pump which provides and induction of RCS level.

5. RHR flow in each train

6. RHR pump motor current

7. Level is monitored by a tygon tube connected to the loop 1 cold leg connection. The valves for this connection are permanent plant equipment and specified in the procedure. To reduce radiation exposure a TV camera is used to permit continuous monitoring of reactor vessel level when operating near the mid plane of the RCS loops. An individual is provided with continuous communication and assigned to report any changes in level to the Control Room. The control operators also have used RHR pumps suction pressure from the plant process computer on a narrow range video to ensure expected system response.

8. RHR pump auto trip annunciators

9. Core exit thermocouples provide a direct indication of core exit temperature; however, these may have to be disconnected for refueling or maintenance.

In the case where core exit thermocouples are not available, a loss of residual heat removal flow would impact the operators ability to monitor RCS Temperature and level. RCS pressure and small vent paths provide an indirect indication that boiling has started.

Item (3):

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

Response:

a. No specific requirements presently exist except for Tec nical Specifications which require one charging pump capable of being powered from an emergency power source and both trains of RHR pumps. The RHR pumps could be shifted to the RWST.

b. A number of pumps are capable of injecting water into the RCS if their respective system is intact. These pumps may be specifically made inoperable for Technical Specification or to prevent inadvertent operation. Additionally, plant conditions could place these pumps in a condition where they would not be readily returned to service.

c.

Pump	Total Number
safety injection pumps	2 *
containment recirculation pumps	4
charging pumps	2 * *
Boric Acid Transfer Pumps	2
RWST Flow Path	(70 feet above the top of the core with RWST in its normal level band or 5 feet above the top of the pressurizer.

* The pumps are made inoperable to meet technical specifications below 350°F.

** Only one pump is permitted to be operable for over pressure protection while one charging pump is required to be operable as a boron injection path.

Item (4):

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

Response:

As noted in the response to item (1), Millstone Unit No. 3 does not presently restrict containment conditions beyond those required by the Technical Specifications. During those plant conditions when CONTAINMENT INTEGRITY is required, all aspects of the containment boundary are considered (including all items specifically identified in the item). During conditions when CONTAINMENT INTEGRITY is not required, the condition of containment is monitored by mangement, outage coordintating personnel (Management Representative and Containment Coordinator), and shift operating personnel, such that rapid attention could be directed to containment closure in the event of an emergency. It is also standard practice to temporarily close openings or penetrations created by maintenance activities.

Item (5):

Reference to and a summary description of procedures in the control room of your plant which describe operation while the RCS is partially filled. Your response should include the analytic basis you used for procedure 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:

Two procedures apply to mid loop operation. A system operating procedure (OP-3301E), "Reactor Coolant System Drain," which establishes drain down conditions and an emergency operating procedure (Loss of Shutdown Cooling (RHR))

The system operating procedure is a staged drain down that has several stop points and discusses the draining of the SG U tubes.

The EOP (3505) addresses loss of RHR. The first steps of the EOP are concerned with restoration of RHR by restoring level, pump venting and pump restart. If this is not accomplished, the EOP provides sufficient flow to the core to remove decay heat to prevent core damage. The EOP addresses the conditions with the RCS intact with the head tensioned, the head in place but not tensioned or the head removed. Figures for required core flow were obtained from curves generated for EOP's with no containment recirculation and based on core decay heat verses time after shutdown. This procedure is written to provide a path for RCS coolant to escape and thus provide cooling. The procedure explicitly recognizes that it may be necessary to spill RCS water to the containment floor to provide cooling. Boiling in the RCS is not precluded. Loss of functions necessary to maintain cold shutdown would result in an emergency classification of "alert" which activates all onsite emergency functions including radiological dose assessment and the ability to address event specific concerns.

Calculations were performed for Millstone Unit No. 3 to estimate the time from loss of RHR to when bulk boiling conditions exist in the core and the time required to boil off sufficient RCS liquid to result in the onset of core uncovery.

Based upon these conservative calculations, it is estimated that boiling would occur no sooner than 10 minutes and core uncovery would occur no sooner than 78 minutes from the time of loss of RHR.

In these calculations the decay heat rate was conservatively predicted assuming a decay time of 72 hours. The RCS liquid and metal masses were conservatively estimated with guidance provided by NUREG-1269 (Loss of Residual Heat Removal System - Diablo Canyon, Unit 2, published in June 1987). None of the steam generated during the boiloff was assumed to condense and return to the core region.

Also, for both calculations, the RCS is conservatively assumed to be at atmospheric pressure (i.e. the RCS is in a vented condition).

It should be noted that the predicted times to core uncovery do not necessarily reflect the time to core damage. Due to the bulk boiling conditions in the core, fuel integrity will be maintained by steam cooling beyond this predicted time.

Additional analysis of the loss of RHR event for partial loop operation is being considered by the Westinghouse Owners group. Any information resulting from the owners group activities will be evaluated for impact on the Millstone Unit No. 3 procedures.

Item (6):

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

Response:

See Attachment 4.

Item (7):

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

Response:

See Attachment 4.

Item (8):

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

Response:

The RHR flow rate is reduced to 1000 gpm per train by procedure OP-3301E when the RCS is partially filled. This reduces the likelihood of vortexing and air ingestion in the RHR system. The drain down is controlled in discrete steps by procedure OP-3301E and this procedure specifically addresses the draining of the steam generator 'SG' tubes.

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:

For Millstone Unit No. 3, a conservatively calculated dose rate for core boiling 3 days past shutdown using maximum allowable iodine (1.0 μc/gm DEQ I-131) yields 12 mrem/hour at the site boundary. This calculation assumes no decay and that all Iodine in the steam is instantly released into the environment without filtering. Realistic dose assessment indicates that even with boiling the dose rate would be much lower than 0.1 mrem/hour.

To address the issues, Millstone Unit No. 3 will impose the following interim administrative restrictions until these issues can be addressed on a generic basis.

Core Bypass of Injection Flow

Equipment availability is designed to ensure delivery of water to the core. The Millstone Unit No. 3 RWST is unique in size (1.2 million gallons) and each charging pump is capable of delivering 400 gallons per minute at low pressures. To preclude pressurization of the core from resulting in bypassing injection and forcing water from the core, administrative requirements will be established to ensure flow through the core.

It is considered that the cold leg will remain intact except for intentional removal of components. Therefore, non-isolated cold leg components will not be removed unless a seven square inch vent path exists to vent steam from the hot leg or an intact flow path exists from the RWST to the RCS hot leg injection. This is not to preclude packing removal when a valve is back seated or RCP seal replacement with the pump left in place. The above action is intended to limit loss from the cold leg to insignificant amounts compared to available water sources at pressures which may occur.

Containment Concerns

The equipment hatch and personnel hatch will be capable of closure within 4 hours whenever the RCS level is below the vessel flange.

Procedure Concerns - Prior to refueling

1. Precautions will specifically address vortexing and level in the systems operating procedure.

2. The EOP will be revised to indicate use of alternate fill paths if the charging pump fails.

3. The EOP will be revised to address possible pressure buildup in the RCS if boiling occurs.

4. The EOP will direct closing the Personnel and Equipment hatches and subsequently establishing containment integrity.

Docket Nos. 50-213
50-336
50-423
B12676

Attachment 4

Responses to item 6 and 7 of Generic Letter 87-12

Haddam Neck Plant
Millstone Unit Nos. 2 and 3

September, 1987

Haddam Neck Plant
Millstone Unit Nos. 2 and 3
Responses to items 6 and 7 to Generic Letter 87-12

Item (6)

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

Response:

Extensive training is provided to all licensed operators on the Residual Heat Removal (RHR)/Shutdown Cooling (SDC) systems and operations. This training includes RHR/SDC system design and configuration, system operation during all applicable Reactor Coolant System (RCS) conditions, system malfunctions, decay heat sources and post-shutdown behavior, and reviews of industry operating experiences pertaining to RHR/SDC malfunctions and misoperation. The operator training programs for the Haddam Neck Plant and Millstone Unit No. 2 are accredited and based by the job and task analysis. The operator training program for Millstone Unit No. 3 is also based by the job and task analysis and is undergoing accreditation process. The specifics of RHR/SDC training are detailed below.

LESSON PLAN	TRAINING ENVIRONMENT	DESCRIPTION
MILLSTONE UNIT NO. 2		
RO-2310	Classroom	SDC system design, configuration, and operation including a review of the loss of SDC procedure.
RO-2116G	Classroom	Decay Heat sources and post-shutdown behavior.
RO2-19(b)	Briefing Room	Used for Licensed Operator Initial Training (LOIT). Includes training on problems associated with SDC preparation, initiation, and operation.
RO2-19(S)	Simulator	Used for LOIT. Simulator training conducted on SDC operational problems, including loss of SDC from a partially drained condition.

LESSON PLAN	TRAINING ENVIRONMENT	DESCRIPTION
RQ2-85-1-5	Simulator	Used during 1985 Licensed Operator Requalification Training (LORT). Training conducted on loss of SDC from a partially drained condition.
RQ2-86-5-1(B)	Briefing Room	Used during 1986 LORT. Training included SDC initiation.
RQ2-86-5-1	Simulator	Used during 1986 LORT. Training included SDC preparation, initiation and malfunctions.
SOER-87-1	Classroom	Used in 1987 LORT. Industry Operating Experience training including INPO SER 17-86, SOER 85-4, SOER 86-3; all associated with loss of SDC.
SOER 87-2	Classroom	Used in 1987 LORT. Industry Operating Experience training including INPO SER 15-87 and NRC Info Notice 87-22.
MILLSTONE UNIT NO. 3		
RHS-01-C	Classroom	Used during LOIT. RHR system training including system operation which could result in a loss of RHR.
EO5-01-C	Classroom	Used during LOIT. Training conducted on loss of RHR.
ITS-07, 19	Simulator	Used during LOIT. Training conducted on loss of RHR, including loss of RHR from partially drained RCS conditions.
LORT(S)-10A LORT(S)-10B LORT(S)-10C	Simulator	Used during 1987 LORT. Training conducted on loss of shutdown Cooling initiation by various equipment malfunctions.
LORT(S)-10A/B-4	Classroom and Simulator	Used during 1987 LORT. Training conducted on RHR Operations including IE INFO Notice 86-101 and INPO SER 14-86.

LESSON PLAN	TRAINING ENVIRONMENT	DESCRIPTION
RTL-01-C	Classroom	Reactor theory training including decay heat sources and post-shutdown behavior.
HADDAM NECK PLANT		
MITCORE-L75001	Classroom	Training on methods of decay heat removal which includes sources of decay heat and post-shutdown behavior.
PR/SYS-LOO600	Classroom	Used during LOIT. Systems training on RHR.
AOP-L11	Classroom	Used during LOIT. Training on refueling malfunctions, including loss of RHR from all applicable RCS conditions.
AOP-S010	Simulator	Used during LORT and LOIT. Training on selected refueling malfunctions including loss of RHR.
LOCT-87-L07	Briefing Room and Simulator	Used during 1987 LORT. Training conducted on loss of RHR operating events and placing RHR in service.

It is significant to note that all simulator training described for all units is conducted on plant reference simulators.

In addition to training provided to licensed operators and senior operators, non-licensed operators receive RHR/SDC classroom systems training and are trained on the local operating and monitoring tasks that they are assigned.

Although maintenance personnel do receive NSSS classroom systems training, avoidance of maintenance-related NSSS perturbation is achieved by supervisory control of maintenance activities. During plant outages at the Haddam Neck Plant and Millstone Station, daily meetings are conducted among the various plant disciplines to discuss outage work progress and upcoming maintenance and operations activities. An outage coordination team plans these activities to ensure that proper plant conditions are established to support maintenance. A management representative whose responsibilities include monitoring important maintenance activities is available at all times.

The on-shift Shift Supervisor or Supervising Control Operator authorizes all maintenance and surveillances. This authorization includes establishing operational restrictions.

Item (7)

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

Response:

During outage conditions, additional operators (both licensed and non-licensed) are typically available to support plant operations and maintenance. These operators receive the training described in the response to Item (6). Additional resources are not normally provided to the operators while the RCS is partially drained, nor are additional resources deemed necessary.