INFORMATION ONLY

Form SPD-1002-1

DUKE POWER COMPANY
PROCEDURE PREPARATION
PROCESS RECORD

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(2) STATION: McGuire Nuclear

(3) PROCEDURE TITLE: Venting of Non-Condensible Gases From the Reactor Vessel Head

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By: _____ (SRO) Date: _____

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Reviewed/Approved By: _____ Date: _____

DUKE POWER COMPANY
McGUIRE NUCLEAR STATION
VENTING OF NON-CONDENSIBLE GASES FROM THE REACTOR VESSEL HEAD

This procedure describes the action to be taken for removal of non-condensible gases from the reactor vessel head by operation of the solenoid operated head vent valves for the following cases:

CASE I: Venting of Non-Condensible Gases - SI Reset

CASE II: Venting of Non-Condensible Gases - SI Actuated

1.0 Symptoms (for Cases I and II)

1.1 Abnormal Prz. level decrease during a NC system pressurization.

1.2 Abnormal Prz. level increase during a NC system depressurization.

1.3 Core uncovery events or accumulator tank discharge that may result in the presence of a non-condensible gaseous void in the vessel head.

CASE I

Venting of Non-Condensible Gases - SI Reset

2.0 Immediate Actions

None

3.0 Subsequent Actions

CAUTION

Do not trip any running or start any non-operating NC pumps during performance of the following actions:

3.1 Terminate any changes to the NC system that may be in progress (ie. heatup, cooldown) and bring the NC system to as close to a steady-state condition as possible. Normal letdown and charging should be re-established per the applicable operating or emergency procedure.

3.2 Attempt to recombine any condensible gases by increasing NC system pressure through the use of the pressurizer backup heaters and/or increased charging flow.

CAUTION

Increasing NC pressure with condensible gases in the system may result in a decreasing Prz. level. If Prz. level decreases to <20%, then attempt to restore level by increasing the charging flow and/or manually starting the NI pumps. If level cannot be restored, then manually initiate Satefy Injection and proceed to EP/1/A/5000/01 (Immediate Actions and Diagnostics).

3.3 If increasing NC pressure is successful in condensing the gas volume in the vessel head (as indicated by a return to normal readings in those parameters used to determine the presence of the gases) then return to the appropriate operating/emergency procedure.

3.4 If desired, an estimate of the total volume of gaseous voids in the NC system (other than the pressurizer) may be obtained by performing Enclosure 6.1.

3.5 Increase the NC system sub-cooling to 100°F by either increasing NC pressure or by dumping steam from the non-faulted steam generators.

3.6 Ensure the Emergency Hydrogen Mitigation System is in service per EP/1/A/5000/02 (Loss of Reactor Coolant).

3.7 Isolate letdown and increase pressurizer level to >50%.

3.8 If not already performed, manually block the low pressure SI initiation if 2/3 P11 status lights are off.

CAUTION

The venting operation may result in pressure decreasing below 1845 psig. Action should be taken to manually block the Auto. SI signal when pressure decreases below 1955 psig (P11).

3.9 Increase charging flow to maximum to limit the pressurizer pressure and level decrease during the venting.

3.10 Open either 1NC-272A and 1NC-273A (Trn. A Head Vents to PRT Isol.) or open 1NC-274B and 1NC-275B (Trn. B. Head Vents to PRT Isol.) and observe the pressurizer level trend. (PRT diaphragm will rupture if/when 100 psig is reached in the tank).

NOTE

If one or both valves in a train fail to open, close both valves and open the isolation valves in the parallel flow path.

3.11 Close both head vent isolation valves when:

1) Pressurizer pressure decreases by 200 PSI

or

2) Pressurizer level decreases below 20%

or

3) NC sub-cooling decreases below 50°F.

or

4) The reactor vessel head is refilled as indicated by a decrease in the rate of depressurization or a change in the rate of the pressurizer level trend.

CAUTION

If during the venting period, a loss of NC pump operation occurs, continue the venting and allow natural circulation to establish itself.

3.12 Re-establish normal charging and letdown per OP/1/A/6200/01 (Chemical and Volume Control System).

3.13 Using the following criteria evaluate the response of the pressurizer level trend during the venting operation to determine the probable status of the NC system:

1) Increasing Prz. level - Gaseous voids exist in the NC system other than the reactor vessel head or pressurizer.
2) Constant Prz. level - No significant gaseous voids exist in the NC system.
3) Decreasing Prz. level - Gaseous void exists in the reactor vessel head.

3.14 If it is determined that a gas bubble existed and the venting was terminated prior to the vessel head being completely refilled, then return to step 3.5.

3.15 Ensure covers are replaced on 1NC-272A, 1NC-273A, 1NC-274B and 1NC-275B to preclude inadvertent operation of these valves.

CASE II

Venting of Non-Condensible Gases - SI Actuated.

4.0 Immediate Actions

None

5.0 Subsequent Actions

5.1 Terminate any changes to the NC system that may be in progress (ie. Heatup, cooldown) and bring the NC system to as close to a steady-state condition as possible.

5.2 Ensure the Emergency Hydrogen Mitigation System is in service per EP/1/A/5000/02 (Loss of Reactor Coolant).

5.3 Increase the NC system sub-cooling to 100°F by either increasing NC pressure or by dumping steam from the non-faulted steam generators.

5.4 Open either 1NC-272A and 1NC-273A (Trn. A Head Vents to PRT Isol.) or open 1NC-274B and 1NC-275B (Trn. B Head Vents to PRT Isol.) and observe the pressurizer level trend. (PRT diaphragm will rupture if/when

100 psig is reached in the tank).

NOTE

If one or both valves in a train fail to open, close both valves and open the isolation valves in the parallel flow path.

5.5 Close both head vent and isolation valves when:

1) Pressurizer pressure decreases by 200 PSI

or

2) Pressurizer level decreases below 20%

or

3) NC sub-cooling decreases below 50°F

or

4) The reactor vessel head is refilled as indicated by a decrease in the rate of depressurization or a change in the rate of the pressurizer level trend.

CAUTION

If during the venting period, a loss of NC pump operation occurs, continue the venting and allow natural circulation to establish itself.

5.6 Using the following criteria evaluate the response of the pressurizer level during the venting operation trend to determine the probable status of the NC system:

1) Increasing Prz. level - Gaseous voids exist in the NC system other than the reactor vessel head or pressurizer.

2) Constant Prz. level - No significant gaseous voids exist in the NC system.

3) Decreasing Prz. level - Gaseous void exists in the reactor vessel head.

5.7 If it is determined that a gas bubble existed and the venting was terminated prior to the vessel head being completely refilled, then return to step 5.2.

5.8 Ensure covers are replaced on 1NC-272A, 1NC-273A, 1NC-274B and 1NC-275B to preclude inadvertent operation of these valves.

5.9 Return to appropriate emergency or operating procedure.

6.0 Enclosure

6.1 NC System Void Detection and Sizing.

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ENCLOSURE 6.1
NC SYSTEM VOID DETECTION AND SIZING

Perform the following to estimate the volume of gaseous voids in the NC system (other than the Pzr.).

1. Achieve a constant pressurizer level and pressure condition.

2. Place a NC system wide range pressure or pressurizer pressure channel on a trend recorder with a scale span of 150 psi. Place a pressurizer level channel on a trend recorder with a scale span of 10%.

3. Record the following parameters:

   NC Pressure = _____ PSIG
   PZR Level = _____ %
   Charging Flow = _____ GPM
   Seal Injection Flow = _____ GPM
   Seal Leakoff Flow = _____ GPM
   Time = _____

4. Isolate NC system letdown flow, turn off all pressurizer heaters and terminate any spray flow and place spray valves in manual.

5. Allow charging flow to either increase pressure 100 psi or increase pressurizer level by 5%. Record the following when this is achieved:

   NC Pressure = _____ PSIG
   PZR Level = _____ %
   Time = _____

6. Reinitiate letdown flow and restore normal pressurizer pressure and level control.

7. Calculate the initial and final pressurizer vapor space volumes by the following equations:

   Initial Vapor Volume = [(100- PZR Level %) X (Total Cylindrical PZR Volume FT^3)]+ Upper Spherical Volume FT^3

   Initial Vapor Volume = [(100 - _____)% X 1666 FT^3)]+ 89 FT^3
   = _____ FT^3

   Final Vapor Volume = Initial Volume - (% Chg. in PZR Level X Total Cylindrical Vol. FT^3)
   = _____ - (_____ X 1666 FT^3)
   = _____ FT^3

8. Determine the total charged volume into the NC system as follows:

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ENCLOSURE 6.1
NC SYSTEM VOID DETECTION AND SIZING

Charged Volume = (Charging + Seal Injection - Seal Leakoff GPM)
x Time(Min.) x .134 FT^3 /Gal.

Charged Volume = (_____ + _____ - _____) x _____ x .134
= _____ FT^3

9. Determine the expected pressurizer level change as follows:

$$\text{Expected Level Chg.} = \frac{\text{Charged Volume } FT^3}{\text{Total PZR. Volume } FT^3} \times 100\%$$

$$= \frac{\qquad\qquad}{1844} \times 100\%$$

= _____ %

10. If the actual pressurizer level change is less than the expected level change then a gaseous void exists in the NC system. Perform the following step to determine the volume of the NC system void.

11. The initial and final NC system gaseous void volumes can be calculated from the following equations:

$$\text{Initial NC Void} = \frac{\text{Initial Vapor Volume} - \text{Final Vapor Volume} - \text{Charged Volume}}{1 - \frac{\text{Initial Pressure}}{\text{Final Pressure}}}$$

= _____ FT^3

$$\text{Final NC Void} = \text{Initial NC Void} \times \frac{\text{Initial Pressure}}{\text{Final Pressure}}$$

= _____ FT^3