Docket No. 50-213

ATTACHMENT I

HADDAM NECK PLANT PROCEDURE

AOP 3.2-22-C

RCS VENTING OF NON-CONDENSIBLE GASSES

August, 1982

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PLANT OPERATIONS REVIEW COMMITTEE APPROVAL

Connecticut Yankee
Abnormal Operating Procedure
No. AOP 3.2-22

APPROVED BY STATION SUPERINTENDENT

EFFECTIVE DATE
8-26-82

REACTOR COOLANT SYSTEM/VENTING OF
NON-CONDENSIBLE GASES

1.0 DISCUSSION

1.1 The objective of this procedure is to specify the required operator actions and precautions necessary to remove gases from the reactor vessel head and pressurizer by operation of the reactor coolant system venting system.

CAUTION:

1. This venting procedure should not be used as the primary means to mitigate an inadequate core cooling event. This procedure assumes that reactor containment conditions are as follows:

   Pressure: Greater than or equal to 14.7 PSIA
   Temperature: Less than or equal to 225°F
   Hydrogen Concentration: Less than 2.9 volume percent.

2. This procedure requires the approval of the Director of Station Emergency Operations prior to use and is not to be used as a means of removing gasses during normal operations.

3. This procedure is applicable to a post accident condition with a degraded core where large volumes of hydrogen are formed in the reactor coolant system.

2.0 SYMPTOMS

2.1 Abnormal reactor coolant system conditions such as large variations in pressurizer level during normal charging or spraying operations have occurred.

2.2 Reactor vessel head water temperature equal to or greater than RCS saturation temperature.

2.3 Plant events, such as safety injection initiation or rapid RCS cooldown and evidence that core uncovery have occurred that may have resulted in the forming of gaseous void in the vessel head.

2.4 The presence of large quantities of non-condensible gases in the pressurizer steam bubble as indicated by a gas bubble in the reactor vessel, departure from saturation conditions, sluggish pressure control or direct measurement from pressurizer steam space samples.

NOTE: The presence of non-condensible gases in the pressurizer steam bubble can be indirectly ascertained by a departure from saturation conditions. For a given pressurizer temperature, the corresponding pressure will be higher than saturation. This effect is only pronounced for large gas volumes and provides only an indirect indication of the presence of non-condensible gases.

2.5 High concentrations of dissolved hydrogen in the primary system as measured with the post accident sampling system.

3.0 AUTOMATIC ACTION

3.1 None.

4.0 PROCEDURE

CAUTION: Do not trip any running or start any non-operating reactor coolant pumps during the performance of the following actions.

4.1 If safety injection system is not in operation:

4.1.1 Terminate any ongoing RCS evolutions and bring the RCS to as close to a steady-state condition as possible.

4.1.2 Attempt to redissolve any gases present by increasing RCS pressure through the use of the pressurizer backup heaters and increased charging flow. If this step is successful in condensing the gas volume in the vessel head (as indicated by a return to normal readings for those RCS parameters used to determine the presence of the gases) then return to the appropriate operating procedure.

CAUTION: Increased charging flow with condensible gases in the RCS may result in a decreasing pressurizer level. If pressurizer level decreases to less than 20% of span, manually initiate safety injection and proceed to subsequent venting operations for an operating safety injection system.

4.1.3 Increase the RCS sub-cooling to at least 50°F above saturation temperature by increasing pressure on RCS or by dumping steam from non-faulted steam generators.

4.1.4 Reestablish steady state condition in RCS.

4.1.5 Stop any containment purge that may be in progress and start or check running all containment recirculation fans. Check all recirculation fan face dampers open.

CAUTION: Once the containment air recirculation fans have been started and the venting process initiated, do not stop or start any containment air recirculation fans.

4.1.6 Determine maximum allowable time period for venting. Use instructions on Attachment A and curve on Attachment B.

4.1.7 Reduce letdown to 40 gpm and increase charging to raise pressurizer level to greater than 50% level.

4.1.8 Manually block safety injection initiation by opening circuit 13 in D.C. distribution panels "A" and "B".

4.1.9 Stabilize pressurizer level at greater than 50% level by reducing charging flow and/or increasing letdown.

NOTE: Pressurizer level must be closely monitored during venting process from vessel head vent for the following indications:

a. Increasing pressurizer level - Gaseous voids exist in the RCS other than the reactor vessel head or pressurizer.

b. Constant pressurizer level - No significant gaseous voids exist in the reactor coolant system.

c. Decreasing pressurizer level - Gaseous void exists in the reactor vessel head. When venting from the pressurizer vent, the pressurizer level may increase to the top of the scale.

NOTE: Containment spray may be initiated simultaneously with venting to minimize danger of hydrogen explosion. This may be done with concurrence of Duty Officer after considering hydrogen concentration in containment, anticipated size of the bubble and other containment conditions.

Do not vent from the reactor vessel head and the pressurizer simultaneously.

4.1.10 To vent reactor vessel head.

4.1.10.1 Close circuit #5 switch in D.C. Panel 1C in switchgear room to energize RC-SOV-596A and B.

4.1.10.2 Obtain keys for RC-SOV-596A and RC-SOV-596B. Open both isolation valves.

NOTE: If one or both valves fail to open, close both valves, remove keys and deenergize. Use parallel path valves RC-SOV-596C and RC-SOV-596D. Energize by closing circuit #6 in D.C. panel 1D.

4.1.10.3 Close, remove key and deenergize both vent isolation valves when:

a. Pressurizer pressure decreases by 200 psi, OR

b. Pressurizer level decreases below 20% level, OR

c. Reactor coolant sub-cooling decreases below the minimum value of 50°F above saturation for existing conditions in pressurizer, OR

d. The reactor head is refilled by a decrease in the rate of depressurization or a change in the rate of pressurizer level trend.

e. The maximum venting time established from instructions on Attachment A using curve #1 on Attachment B has been attained.

4.1.11 To vent pressurizer steam space.

4.1.11.1 Close circuit #6 switch in D.C. panel 1C in switchgear room to energize PR-SOV-552A and PR-SOV-552B.

4.1.11.2 Obtain keys for PR-SOV-552A and PR-SOV-552B. Open both isolation valves.

NOTE: If one or both valves fail to open, close both valves, remove key and deenergize. Use parallel path valves PR-SOV-552C and PR-SOV-552D. Energize by closing circuit #5 in D.C. panel 1D. Since gas is normally present in pressurizer steam space, venting of pressurizer should be performed to allow the pressurizer pressure control system to operate effectively.

4.1.11.3 Close, remove key and deenergize both isolation valves when:

a. Pressurizer pressure has decreased by 200 psi, OR

b. Reactor coolant sub-cooling decreases below the minimum value or 50° above saturation for existing condition in the pressurizer.

c. The mass equivalent of the pressurizer steam space, as determined from instructions on Attachment A using Curve #2 on Attachment C, has been vented from the pressurizer.

NOTE: The venting time determined from Attachment C is based upon the assumption that the steam space is 100% hydrogen. For mixtures of steam and hydrogen the venting times would be longer.

4.1.12 Evaluate the response of the pressurizer water level to determine if gas bubble existed in the vessel head. If venting was terminated prior to the completely refilling reactor vessel head, return to step 4.1.10.

CAUTION: If multiple venting operations are required and the containment hydrogen concentration is equal to or greater than 3 volume percent, then provisions must be made to remove or reduce the volume of hydrogen from the containment prior to re-initiating venting.

4.1.13 Restore auto initiation of core cooling to service by closing circuit #13 switch in D.C. distribution panels "A" and "B".

4.2 If safety injection system is in operation:

4.2.1 Terminate any ongoing RCS evolutions and bring the RCS to as close to a steady-state condition as possible.

4.2.2 Attempt to redissolve any gases present by increasing RCS pressure. This may be accomplished by attempting to increase the RCS subcooling margin to a minimum of 50°F above saturation for existing pressure and temperature conditions by either increasing safety injection flow if previously throttled or by dumping steam from the non-faulted steam generators. If this step is successful in condensing the gas volume in the vessel head (as indicated by a return to normal readings for those RCS parameters used to determine the presence of the gases) then return to the appropriate operating instructions.

CAUTION: Safety injection actuation may have resulted from a LOCA event. The pressurizer backup heaters should not be used to increase RCS pressure as this will decrease safety injection flow and retard the system refill process.

4.2.3 Reestablish, as near as possible, a steady state condition in the RCS.

4.2.4 Stop any containment purge that may be in progress and start or check running all containment recirculation fans. Check all recirculation fan face dampers open.

CAUTION: Once the containment air recirculation fans have been started and the venting operation initiated, do not stop or start any containment air recirculation fans.

4.2.5 Perform venting per steps 4.1.10 through 4.1.12 as necessary.

ATTACHMENT "A"

RV HEAD VENT GUIDELINE

VENTING TIME PERIOD

1. Determine the containment hydrogen concentration in volume percent units.

   NOTE: The containment hydrogen concentration will be insigificant if there has been no leakage from the RCS to the containment.

2. From Curve #1 (RCS Pressure vs. H_2 Venting Time) and using the initial containment hydrogen concentration from Step 1, determine the allowable venting period which will limit the containment hydrogen concentration to 3 volume percent.

PRESSURIZER VENT GUIDELINE

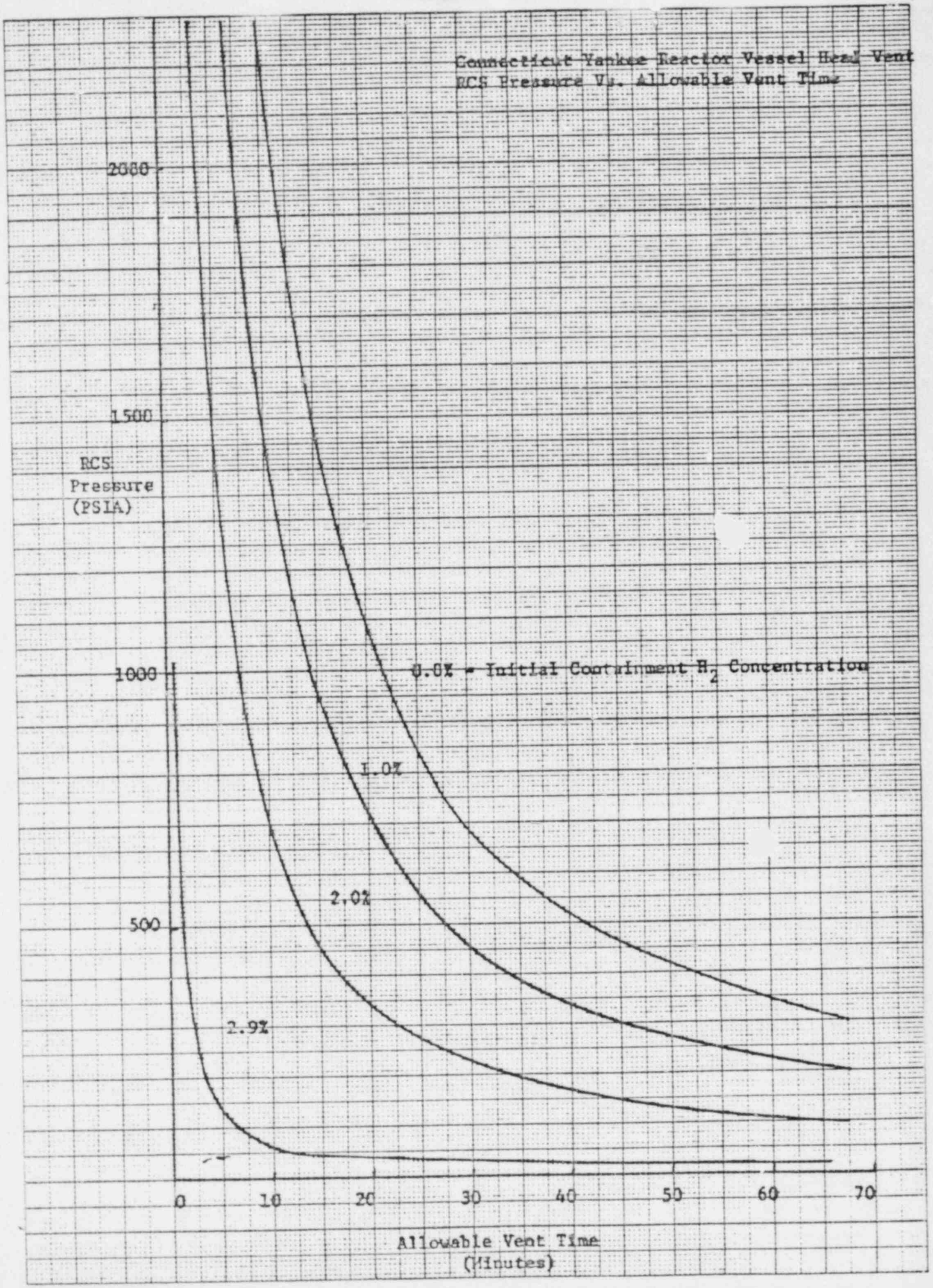
VENTING TIME PERIOD

1. Determine the containment hydrogen concentration in volume percent units.

2. Determine the pressurizer water level from pressurizer level instrumentation.

3. From Curve #2 (RCS Pressure vs. Pressurizer Venting Time), determine the venting time to remove the mass equivalent of hydrogen from the pressurizer steam space).

4. Venting time from curve #2 not to exceed venting time determined from curve #1.



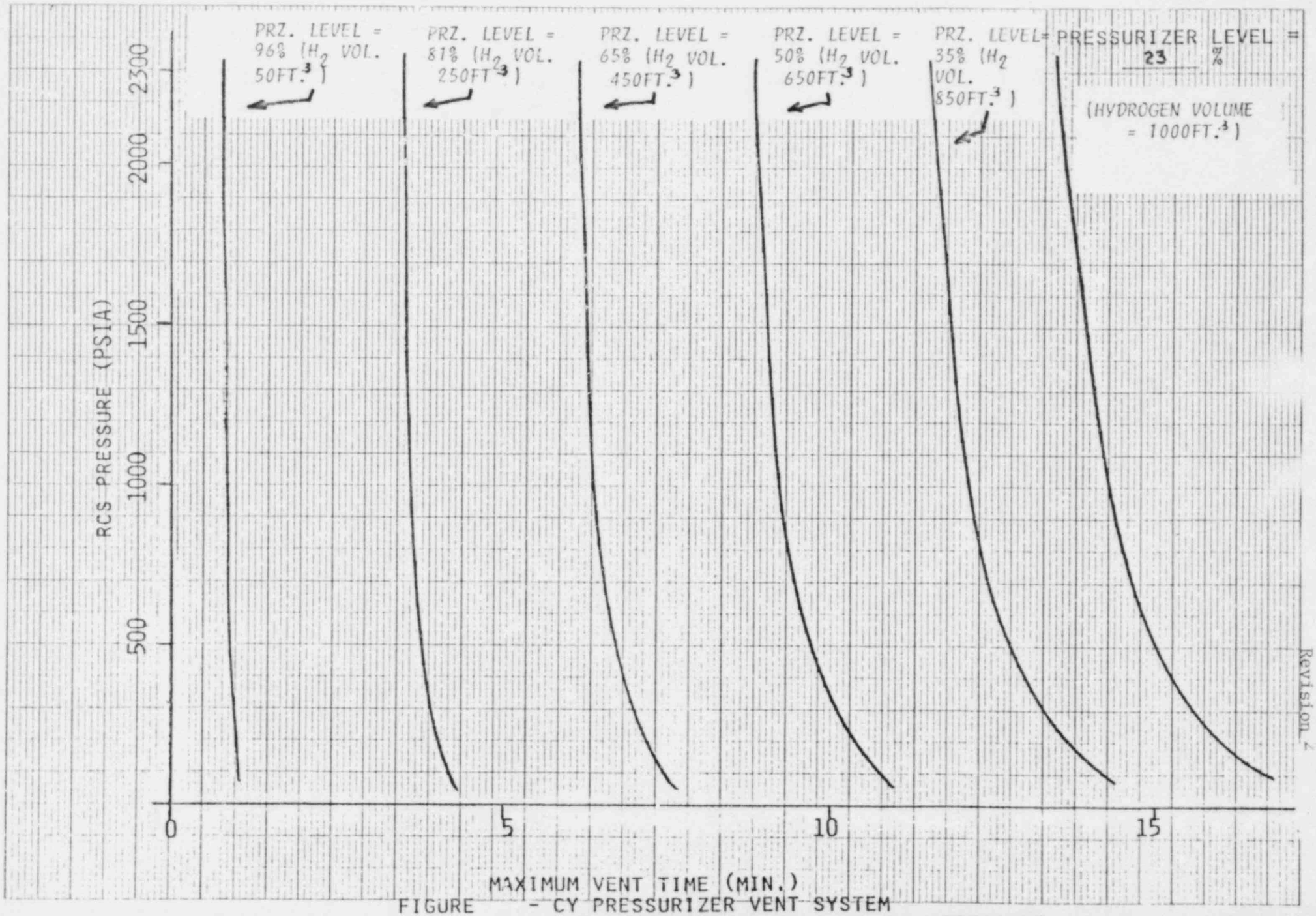


FIGURE - CY PRESSURIZER VENT SYSTEM
HYDROGEN VENTING TIME VS. RCS PRESSURE

Revision 2