TASK CLOSE OUT DOCUMENT

Task Scope USE OF CFT TO AID
REFLUX BOILER COOLING
TECHNIQUE

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Task No. 46 Date Complete 4-12-79

Reason felt task is complete:

The technique was ~~thoroughly~~ scoped out and felt to be marginally possible but not recommended unless all other modes (even RHR) ~~are~~ fail

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USE OF CFT'S TO AID
REFLUX BOILER COOLING TECHNIQUE

INDUSTRY ADVISORY GROUP

INTRODUCTION

The alternate core cooling method described below is intended as a backup to natural circulation at low pressures. If enough water vapor and noncondensables are carried to the top of the candy cane during depressurization, natural circulation thru the steam generator will be cut off. We could allow boiling to occur in the core and allow the resultant steam to be condensed in the steam generator; but again, if noncondensables gather in the top of the candy cane, the flow of steam to the steam generator will be cut off. Core cooling by natural circulation and by condensing core steam in the steam generator tubes were the subjects of earlier IAG reports. The method described below provides a way to vent the steam and possible noncondensables together and replace it with cooler water.

DESCRIPTION

Once it has been determined that natural circulation is not working, the system could be drained down to the elevation of the core flood tank surge line and barrel check valves. (Question #1: Can we drain the RCS? Normally, the RCS can be drained thru the makeup and letdown system. However, this will lead to large quantities of fluid being transferred from the RCS to tanks in the auxiliary building. This is undesirable. Also, it is unknown as to whether there is enough tank volume for draining the system above the CFT surge line elevation.) The system pressure would initially be atmospheric. As steam is generated in the core, the pressure in the vessel will rise depressing the fluid level and raising the fluid level in the hot leg riser. If the pressurizer vent valve is left open, the pressure in the downcomer above the water level will remain atmospheric and the water level unchanged. When the hot leg riser fills to some 3.6' above the top of the horizontal hot leg, there will be a 1.5 psi differential pressure across the barrel vent valves. This is achieved with only about a 3 or 4" depression of the upper plenum water volume. Thus, the hot legs remain covered. This is enough to fully open them. They will only stay open for a moment allowing steam and noncondensables to burp into the upper downcomer and thru a vent path provided thru one CFT (discussed later). The system pressure will be relieved and must build up again to burp again. As water is being vaporized and carried from the system, cooler water is added thru the other CFT surge line, thus the core remains covered and cooled.

STEAM/GAS VENT PATH THRU CFT

There are several obvious difficulties with trying to vent backwards thru the CFT surge line.

1. Two check valves (and possibly more) will impede the flow allowing only small leakage (allowable is 140 cc/hr). Therefore, these valves must somehow be open. The proposition is to enter the CFT system with a plumber's "snake" and push the check valves open. (Question #2: People say that this is theoretically possible. I believe it is doubtful that we can find a "snake" smart enough to get where we want it. Also, if the "snake" gets stuck with all valves in its path open, we may provide a

leak path for high activity fluid into the auxiliary building.) A snake that is small enough to fit through the one inch line to the accumulator from the containment may not be large enough to open the check valves on the 14 inch line from the accumulator to the downcomer.

2. The CFT's are currently full of water and pressurized by N_2 gas to 540 psig. The N_2 must first be bled off. This may be done by removing the N_2 supply, opening valve CF114 A or B, and allowing N_2 to leak back thru check valves CFV-100 A or B and CFV-101 A or B. It is assumed that these valves will leak. A N_2 vent to the reactor building is provided, but is controlled by a manual valve and has a blind flange downstream of the valve. The N_2 may be bled off thru the Gaseous Radwaste Disposal System (manual valves, CFV117 A or B is normally left open). The latter method is preferred.

   After the N_2 is vented and the CFT pressure is reduced to atmospheric, the water in these tanks can be drained thru the Liquid Radwaste Disposal System.

3. Even after the CFT is drained, some water will remain in the surge lines because there is a shallow loop seal here. This water will be blown out during the maneuver.

   After the CFT is prepared, the burping process discussed in the earlier section can proceed. A steam/noncondensable mixture will burp thru the CFT surge line. When the mixture reaches the CFT, the steam will start to condense. The condensate can be bled off thru the Liquid Radwaste System. The remaining steam/noncondensable mixture can be vented thru the Gaseous Radwaste System. (Question #3: Can the Gaseous Radwaste System handle steam? I believe it can and the steam will eventually condense. Perhaps a cooler and gas/water separator could be added to the Gaseous Radwaste System to remove the steam--draining the condensate again to the Liquid Radwaste System.) About 40 gpm of water added thru the makeup pumps will offset the boil off. If cooler water is added, the boil off can be reduced.

   (Question #4: Can a closed natural circulation loop be set up across the CFT system? I don't feel a closed natural convection circuit can be set up since many check valves exist and it will be impossible to maintain a water solid system.)

   (Question #5: Can a closed system be set up with small pumps? No, because the flow will be intermittent and the pump will lose suction.)

RECOMMENDATION

The proposed system seems marginally feasible. A lot of thought was given to it to find all of the weaknesses. The main weaknesses are highlighted by the first two questions. In light of these questions, I feel the RHR system is more preferable since it is a proven method and both methods transfer radwastes to the auxiliary building.

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