1-11-74

ACRS PRESENTATION

REACTOR COOLANT PRESSURE BOUNDARY LEAKAGE DETECTION SYSTEMS INDIAN POINT UNIT 2

by

DANIEL L. POMEROY
SENIOR NUCLEAR ENGINEER
DIRECTORATE OF REGULATORY OPERATIONS

First I will review 1) the systems that are provided; 2) their expected performance; 3) an analysis of their current capability as we see it and then 4) their performance during the feedwater line break incident.

This slide outlines the expected performance of the leak detection systems and shows our estimate of their actual capability to detect primary system leakage. Our estimate is based on current alarm set points and station operating practices.

The most sensitive system is normally the airborne particulate monitor. In the FSAR, Consolidated Edison calculated a leak of 25 thousandths of a GPM could be detected in 20 minutes. This calculation is based on detecting an increase about equal to the background. Our estimate of 25 GPM is based on the present alarm setting of about 1,000 times background. This alarm setting was determined by the station health physics staff and I believe the setting is based solely on personal protection from radio particulates and that the leak detection aspects of this system have been ignored. The 25 GPM in 20 minutes is equivalent to about 8 GPM in an hour.

The situation with the radio gas monitor is similar but its alarm is set at only three times background. The licensees calculation and our own estimate are based on the expected primary coolant activity as required by Regulatory Guide 1.45. In some cases you will see a much better sensitivity for this type of detector but it will be based on 1% failed fuel. Using that value of 1% F.F. in this case would reduce the two hours to two minutes.

The dew point and the cooling coil condensate values are based on vapor released to the containment atmosphere and are therefore optimistic in that all the liquid leaked will not flash. The expected values for the humidity detector do not appear to consider the effect of the fan coolers which remove moisture from the air. We believe that our estimate is much more realistic. Our estimate is based on the current alarm setting

of 5°F above background. Previous calculations have considered 1°F as the detection level but this is based on plotting the dew point data, which the licensee is not doing at this time. However, it does appear that something less than the 5° alarm setting maybe practical during periods of stable operation.

The condensate from the fan coolers flows into a standpipe and through a weir. The level behind the weir is a measure of the condensate rate and hence the leak rate. The problem with the weir level monitor appears to be in the flow coefficient of the weir. Each of the five weirs are designed to handle over 200 gallons per minute and the level instrument is therefore insensitive at low flow rates. The present alarm setting of four inches corresponds to a 7.5 GPM flow rate. With the normal four fan coolers operating a 30 GPM leak is the minimum detectable. About two hours is required to reach equilibrium. If a leak is suspected, a flow of less than 1 GPM can be measured by this system by draining the stand pipe and timing the water level rise.

The liquid inventory is a calculation that is performed daily during power operation. It is a water balance on the entire primary system. Typical values are 1-2 GPM.

The containment sump is automatically pumped to the waste hold-up tank by 2-50 GPM pumps. The sump level is indicated on the control room board by 10 level switch indicating lights. The level is not recorded; there is no alarm and from the control room it can not be determined if the sump pumps are running or not. Therefore a large prolonged leak is required to initiate operator action.

Containment temperature and pressure are also indicators of gross leakage. The station technical specifications require the reactor to be shutdown in less than 24 hours if primary system leakage exceeds 10 GPM. It appears the existing practices would provide the information necessary to make this decision.

Our concern is that the FSAR expectations and the requirements of Regulatory Guide 1.45 (1 GPM in 1 hour) are not being met. Our concerns have been discussed with the licensee and they have promised a timely response. A test has been planned of the humidity and cooling coil condensate system. Steam will be introduced to the Containment Building at a known rate and the response of these detectors will be monitored.

RO plans to follow up on the licensees actions and the results of this test. We also plan to review the performance of the primary system leak detection monitors at another PWR - one that is operating at a stabilized power level.

Now to get to the original question, during the discussion of the I.P.-2 feedwater line break, at the last ACRS meeting, a question was raised concerning the rate of leakage and the response of the leak detection systems.

The licensee has estimated that the feedwater leakage rate was about 200 GPM. This is considerable more than the few GPM that the leak detectors should respond to, however, the water was cold both thermally and radioactivity wise. Therefore, the detection systems response in this incident can not be compared directly to the expected response in the case of a primary system leak. A summary of the containment instrument response during the feedwater pipe break is shown on this slide. (Slide 2)

Since the secondary system was free of radioactive materials, at this time, the most important leak detectors (radio gas and particulate) did not respond. The steam generator did release enough hot water or steam to cause an increase in the containment temperature and humidity. The temperature indicator on the control board was observed by the operators to be increasing but it is not recorded and there is no alarm.

The humidity, as indicated by the wet bulb temperature at each of the five fan coolers, is recorded but the pen was not adequately inked on this day, so that only a blur is provided for further analysis. However, the increase from less than 70° to the 108° peak did appear to be quite abrupt. It remained about 90° for about an hour and in six hours it was less than 70° again.

The level behind the weir that measures the condensate rate and hence the leak rate was noted to increase on the fan coolers that were in operation. The level is not recorded so that no time response is available.

During this event the waste hold-up tank was isolated from the sump to prevent overfilling it. The sump then overflowed and there was six to eight inches of water on the Containment Building floor following the event. It is estimated that 50,000 gallons of feedwater was released into the Containment Building.

In conclusion, it can be said that some of the leak detection systems did respond to this large secondary system leak but that little was learned that can be used in determining the expected response to small primary system leaks.

SLIDE 1

PRIMARY SYSTEM LEAK DETECTION
INDIAN POINT UNIT 2

System -	Capability - GPM		
	Tech. Spec. Basis	FSAR	RO Estimate
Particulate Monitor -	1.0 in 1 min.	0.025 in 20 min.	25 in 20 min.
Radio Gas Monitor -	1.0 in 2 hrs.	2 in 2 hrs.	4 in 2 hrs.
Humidity Detector - Dew Point	0.25 for a 1°F rise	0.25 for a 1°F rise	2 in 2 hrs.
Cooling Coil Condensate - Weir Level, Each Unit	1.0	1.0 in 10 min.	7.5 in 2 hrs.
Liquid Inventory Calculation -	–	–	2 in 24 hrs.
Containment Sump or Waste Holdup TK Level -	–	–	10-100 for Several Hrs.

NOTE: REGULATORY GUIDE 1.45 - 1 GPM in 1 HOUR

LEAK DETECTION SYSTEM RESPONSE DURING FEEDWATER LINE BREAK - INDIAN PT. 2 - NOVEMBER 13, 1973 -

SYSTEM -	RESPONSE -
Particulate Monitor -	None
Radiogas Monitor -	None
Humidity Detector Dew Point -	Increased to $108^{0}F$
Containment Temperature	Increased to $120^{0}F$
Cooling Coil Condenstate - Weir Level	Increased -level not recorded
Containment Sump & Waste Holdup TK Level	Levels Increased