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TASK CLOSE OUT DOCUMENT

Task Scope Evaluate EP-21, recommend methods for long term use of "Blind" level control

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Task No. IA-33 Date Complete 4/29/79

Reason felt task is complete:

These recommendations for review by standard distribution and further work/ implementation thereby

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2004 291

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PERIODIC RECALIBRATION OF PRESSURIZER LEVEL CALCULATION

Attachment 1 of EP-21 shows a method for inferring the pressurizer level from known quantities such as:

1. Makeup tank level
2. Additions to makeup tank
3. Heating/cooling expansion/contraction of the RCS and pressurizer masses
4. System outleakage

The procedure should be reasonably accurate at short time intervals. However, there are several sources of error which will integrate to large values over a period of time.

1. Error in metering makeup tank additions.
2. Error (due to inappropriate temperature ranges) due to the fixed constant multipliers on the expansion/contraction terms.
3. Changes in the estimated system outleakage rate.

The second such error can be corrected algebraically via appropriate changes in the constants and adjustments in the initial conditions, by taking full range values of densities at the range (begin and end) temperatures. As we showed on Friday, the rate of change of pressurizer level with temperature is not constant at 2"/°F but ranges down to ~1.2"/°F at low temperatures. (This systematic error will cause underestimation of the pressurizer level as the system cools down) I would be strongly in favor of using charts in the long term or equation adjusting by Tech Support people to account for this source of error.

The remaining two sources of error are not adjustable without some sort of recalibration testing. If reliable alternate level instrumentation can be established, this recalibration testing will not be required. However, the experience prior to loss of normal level indication has indicated only marginal accuracy of such alternate instruments, and occasional recalibration of the actual level may be highly desirable (at least to gain increased confidence with the alternate instrumentation).

Methods considered for recalibration

The intent of the recalibration methods is to determine the makeup tank level as the pressurizer level crosses a known point. We have considered 3 separate physical phenomena which will indicate when the level passes a given point.

A. The change in resistance of heater elements as their temperature rises. With a moderate heating current, when the element uncovers, the temperature will rise and the heating current will decrease. Two types of installed equipment are available for this type of determination:

1. The resistive temperature detector installed on the pressurizer and 2. Any of the pressurizer heater circuits.

In the latter case, one of these circuits could be selected and reconfigured so that it can be powered from a low power source, thus minimizing the likelihood that it would heat up and burn out rapidly.

B. The steam space sample line could be used by pumping a small flow through it into the pressurizer, while slowly increasing the level. The pressure in the line downstream of the pump must be monitored. When the pressurizer level passes the sample line elevation, the sample line pressure should increase. It is not clear that the pressure increase will be noticeable relative to the expected pressure noise created by the pump.

C. Slowly take the pressurizer solid while monitoring any of the system pressure indicators. If pressurizer pressure control is maintained during this process, the pressure will be constant until the pressurizer becomes water solid, and then it will increase quite rapidly. At the low makeup water flow rates consistant with pump up without disturbing natural circulation, there is little danger of severe system overpressurization. Two advantages of this method are:

1. This method calibrates system mass with all collected steam (both in the pressurizer, and in the remainder of the RCS) collapsed.
2. This method will indicate the presence of any substantial amounts of separated noncondensibles. If the upswing of pressure is gradual, rather than steep, a gas bubble is indicated, and its size can be deduced from the measured Pressure vs Volume curve.

With successive recalibrations, any gradual trends in system outleakage can be determined, and the equation can be adjusted accordingly. The failure criteria of EP-21 (3.2.1 and 3.2.2) accurately reflect situations after which the level inference scheme should be abandoned. With frequent recalibration (once per day initially), these failure points should be avoidable in the absence of a drastic system upset such as increased outleakage.