TASK CLOSE OUT DOCUMENT

Task Scope - Fuel Temperature Thermocouple Readings During Pressure Transients from 4/9/79 to 4/12/79 - Determine whether TSAT WAS exceeded

To: M. Levenson
S. Levy
E. Zebroski

Task No. 10 B Date Complete 4-13-79

Reason felt task is complete:

all available evidence was examined - no indication the TSAT even might have been exceeded during that time period could be found.

Members of Committee

KOLAR

CAMPBELL

M J Kolar
Signed
Committee Leader

166 059

7905230462

TO: S. LEVY 4-12-79/2

FROM: CAMPBELL & KOLAR

SUBJECT: FUEL TEMPERATURE THERMOCOUPLE
READINGS DURING PRESSURE TRANSIENTS
FROM 4/9/79 TO 4/12/79

CONCLUSION

There is no evidence that core temperatures exceeded T_{sat} during the subject period.

BACKGROUND

The fuel temperature thermocouples were originally located at the top of the core inside sealed cylindrical vertical tubes. Each tube also contains seven neutron detectors and is packed with aluminum oxide. The tubes enter the core from below so that the thermocouple junctions were originally at the top of the tube. The following discussion is based on the assumption that the tubes and thermocouple junctions are still in the same location where they were originally installed.

The system pressure is measured at a tap near the top of the hot leg (just before it turns to enter the steam generator). It is assumed that pressure readings were reasonable throughout the period in question.

Since there is a considerable height difference between the top of the core and the location of the pressure tap, the static pressure at the TC position is higher than that at the pressure tap. Since relatively small velocities are likely at the TC location, we would expect the total pressure (static and dynamic) to be higher at the TC than at the tap. The saturation temperature increases with increasing pressure. Therefore, the saturation temperature at the thermocouple is actually higher than T_{sat} given below. We estimate the difference at about $4^{\circ}F$.

The attached graph shows the system pressure and the temperatures of the six hottest TC's for the subject period. The lowest pressure was 312 psig; this corresponds to a T_{sat} of $426^{\circ}F$. Since this pressure corresponded to the highest temperature reading of the entire period ($400^{\circ}F$), we conclude that the closest approach to Tsat occurred at this point, i.e. $26^{\circ}F$.

Obviously, the fuel temperature is higher than the T/C reading. We were informed verbally that there were no changes in the readings of the two source BF_3 neutron detection channels during the period of largest pressure reduction. (Noon on 4/11/79 to 6 a.m. on 4/12/79) We conclude that there is no evidence of gross boiling.

The temperature and pressure readings shown on the attached graphs were taken at one hour intervals using the plant computer. It does not appear that there was continuous recording of any temperatures. However, two T/C's (not among those shown on the attached graph) were being monitored continuously for AC voltage. The signal from one of these T/C's showed no change throughout the transient. However, the second T/C showed a factor of two change in amplitude when the pressure reached its minimum point. This new amplitude continued to be displayed throughout the ramp up in pressure. We do not believe this was associated with the T/C itself.

We do not have an explanation for this phenomenon at this time.

Memo to : S. Levy

From : Campbell & Kolar

Subject : Fuel temperature thermocouple reading during pressure transients from 4/9/79 to 4/12/79.

Background

The fuel temperature thermocouples were originally located at the top of the core inside sealed axial Vertical tubes. ~~The~~ Each tube also contains a self powered neutron detector and is filled with aluminum oxide. The tubes exted the core from below so that the thermocouple junctions were originally at the top of the ~~core~~ tube. The following discussion is based on the assumption that the tubes and thermocouple junctions are still in the same location where they were originally installed.

~~To be attached~~

~~The attached graph shows a plot of the difference between thermocouples and the system pressure as measured at the pressurizer.~~

System pressure ~~readings~~ readings are taken using differential pressure ~~sensors~~ (DP) cells ~~instruments devices~~ located in the pressurizer. There ~~are~~ were three such devices ~~when~~ operating ~~initially~~ when the TMI-2 incident started. One of these was lost prior to 4/9/79. A second DP cell was lost between noon and midnight on 4/11/79. (The information from the DP cells is relayed to the control room via transmitters. These are located about 3.5 feet above the floor of the containment building sump.

The system pressure is measured at a tap near the top of the hot leg (just before it turns to enter the steam generator). It is assumed that pressure readings were reasonable throughout the period in question. Since there is a considerable height difference between the top of the core and the location of the pressure tap, the static pressure at the TC position is higher than that at the pressure tap. Since relatively small velocities are likely at the TC location, one would expect the total pressure (static + dynamic) to be higher at the TC than at the Top. This has the effect of making Therefore, the saturation temperature increases with increasing pressure. Therefore, the saturation temperature at the thermocouples is actually estimated to be higher than the T_{SAT} given below. We Finders have no way of estimating the difference at present.

The attached graph shows the system pressure and the temperatures of the six hottest TC's for the subject period. The lowest pressure was 312 psig; this corresponds to a T_{SAT} of 426 °F. Since this pressure corresponded to the highest Temperature reading of the entire period (400°F), we conclude that the the closest approach to T_{SAT} occurred at this point, i.e. 26 °F.

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Obviously, the fuel temperature is higher than the T/C reading. We were informed verbally that there were no changes in the readings of the two

source BF3 neutron detector channels during the period of largest pressure reduction (noon on 4/11/79 to 6 A.M. on 4/12/79). We conclude that there is no evidence of boiling gross boiling.

The temperature and pressure readings shown on the attached graphs were taken at one hour intervals using the plant computer. ~~At this time~~, It does not appear that there was continuous recording of any temperatures. However, two T/C's (not among those shown on the attached graph) were being monitored continuously for AC voltage. The signal from one of these T/C's showed no change throughout the transient. However, the second T/C showed a change in amplitude factor of two change in amplitude when the pressure reached its minimum point. This new amplitude continued to be displayed throughout the ramp up in pressure. We do not believe this was associated with the T/C itself. ~~However, we have not been able to tell what it was.~~

We do not have an explanation for this phenomenon at this time.

Conclusion: There is no evidence that core temperatures exceeded Tsat during the subject period.

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