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NUCLEAR REGULATORY COMMISSION
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TMI
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MEMORANDUM FOR: Z. R. Rosztoczy, Chief, Analysis Branch, DSS

FROM: G. M. Holahan, Reactor Analysis Section, Analysis Branch, DSS

SUBJECT: CORE THERMAL HYDRAULIC CALCULATIONS FOR THREE MILE ISLAND POST-ACCIDENT CONDITIONS

The purpose of this memorandum is to document the results of COBRA IV calculations performed for the post accident conditions at Three Mile Island. A full core, course mesh model (one channel per assembly) was set up for the TMI core. The power distributions were taken from the FSAR calculations at 136 EFPD, and the decay heat levels were taken from a figure supplied by H. Richings.

The model was modified to include reduced flow to the core as well as significant amounts of flow blockage in assemblies which have thermocouples showing high temperatures. The thermocouple readings were assumed to be true readings of the core exit coolant temperature. The flow reduction and blockage were chosen to match the indicated core temperature rise from readings taken at 5 PM 3/30/79. The model was rerun with the decay heat for 4/3/79 and the calculated exit temperatures were found to be in fairly good agreement with the readings taken at 6 AM 4/3/79.

The core inlet flow was than reduced to simulate the change from the flow from one reactor coolant pump to the flow from one RHR pump. In addition several intermediate values of flow were also studied. The results of these calculations indicate that one RHR pump may not be sufficient to prevent superheated steam conditions in the hotter assemblies. A calculation with 13% of the presently estimated core flow from one reactor coolant pump produced marginally acceptable results. That is, it showed conditions close to superheated conditions only near the exit of the hottest assembly. Since one RHR pump provides only approximately 3% of the flow from a reactor coolant pump, this case indicates that use of one RHR pump or even two RHR pumps may not be sufficient to preclude superheated conditions in the core.

Although the present calculations are inexact and represent only one possible core condition of many possibilities, they do indicate that cooldown and use of RHR pumps for core cooling is inadvisable until the condition of the core is better understood or until decay heat is significantly reduced.

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Summary of Calculated Results

Case	Power BTU/hr-ft^2	Flow lb/hr-ft^2	Channel 3 exit temp. °F	Channel 5 exit temp. °F	Channel 13 exit temp. °F
1	540*	780,000	369	439	403
2	350**	780,000	338	387	361
3	350	390,000	394	461	423
4	350	1,000	coolant superheated at 3 ft.		
5	350	2,000	coolant superheated at 4.3 ft		
6	100	2,000	coolant superheated at 7. ft		
7	350	20,000	487	532	494
8	350	10,000	coolant superheated at 11.9 ft		

* decay heat @ 3/30/79
** decay heat @ 4/3/79

one reactor coolant pump = 780,000 lb/hr-ft^2
one RHR = 2000 lb/hr-ft^2

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