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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

JUL 11 1979

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MEMORANDUM FOR: D. R. Rosztoczy, Chief
Analysis Branch
Bulletins and Orders Task Force

FROM: B. W. Sheron
Analysis Branch
Bulletins and Orders Task Force

SUBJECT: TMI-2 TURBINE OVERSPEED TRIP OF 3/6/79

Per your request of 6/27/79, I have performed a preliminary evaluation of turbine overspeed trip on 3/6/79.

This evaluation was performed since the behavior of certain system parameters (pressurizer level), indicated that phenomena may be occurring which are not predicted to occur. In particular, an IE inspector (E.G. Hunter) has speculated that void formation in the primary system may be occurring.

The enclosure provides the details of my preliminary evaluation. The conclusion is that the system behavior is predictable up to approximately 5.5 minutes into the event. Beyond 5.5 minutes, measured temperatures indicated that the pressurizer level should be contracting whereas the data show both the pressure and pressurizer level increasing. This discrepancy was not resolved and more data will be needed in order to make a final determination if unexpected phenomena are occurring.

With regard to the system behavior up to 5.5 minutes, the sudden increase in pressurizer level at 3.5 minutes into the event is a direct result of steam generator B boiling dry at this time. The loss of heat removal capability from this steam generator greatly reduced the coolant contraction rate such that the makeup rate approximately equalled the contraction rate and pressurizer level and system pressure then stabilized.

Brian W. Sheron

Brian W. Sheron
Analysis Branch
Bulletins and Orders Task Force

Enclosure:
As stated

cc: D. Ross
T. Novak
A. Ignatonis
E. Hunter (IE)
G. Holahan
P. Norian

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Enclosure

TMI-2 Turbine Overspeed Trip 3/6/79

On 3/6/79, TMI-2 experienced a turbine overspeed which resulted in a reactor trip. The overspeed initially tripped the turbine which decreased the steam demand. This resulted in the primary system pressure and temperatures increasing due to the decreased heat removal. Pressurizer level increased due to coolant expansion.

The reactor then tripped on high pressure and both the pressure and coolant temperatures rapidly decreased because of the excess heat removal. The pressurizer level began to rapidly drop due to coolant contraction. In anticipation of this contraction, it is understood that the operators isolated the letdown and started up the second coolant makeup pump (one of the two pumps was already running at this time). The main coolant pumps remained running during the transient. Figure 1 shows the behavior described above.

At approximately 3 1/2 minutes into the transient, the pressure and the pressurizer level began increasing, although coolant temperatures continued to decrease. In addition to this, the B loop steam generator was allowed to boil dry at 3 1/2 minutes.

During the initial cooldown ($t < 3$ 1/2 minutes) the system was being cooled by both steam generators, and the cooldown determined the coolant contraction rate.

While coolant contraction worked to decrease the pressurizer level, the two makeup pumps worked to increase the pressurizer level. However, contraction far exceeded makeup, and a rapid level decrease in pressurizer level resulted.

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At 3 1/2 minutes, B loop steam generator was allowed to boil dry, greatly reducing the heat removal capability of the steam generator system. Because of this, the cooldown rate and contraction rate of the coolant were greatly reduced. The level drop rate was reduced in magnitude to approximately that of the level increase rate due to makeup pumps. As a result, the level in the pressurizer stabilized.

To confirm that the above explanation described what happened up to 5.5 minutes, pressurizer level drop rates were estimated from the measured coolant temperatures. Level increase rates from the makeup pumps assuming a makeup flow of 260 gpm were also calculated, and the results are shown in figure 2.

The initial level drop rate is insensitive to the makeup flow, and is in reasonably good agreement with the measured data. At 3 1/2 minutes, the coolant contraction rate is greatly reduced so that the makeup rate approximately equals it and a level stabilization is predicted.

Beyond 5.5 minutes, the coolant temperatures begin to rapidly decrease and a level decrease is again predicted. Contrary to this however, the observed level continued to slowly increase, as did the pressure.

To account for a pressure and level increase while system temperatures are dropping, either boiling is occurring in the system, or fluid is being added to the system. Since the coolant was approximately 100 ^{o}F below the saturation temperature, boiling does not appear likely. Makeup flows necessary to match the data are excessive, however (approximately 640 gpm needed at t=6 minutes, and 1000 gpm at t=7 1/2 minutes).

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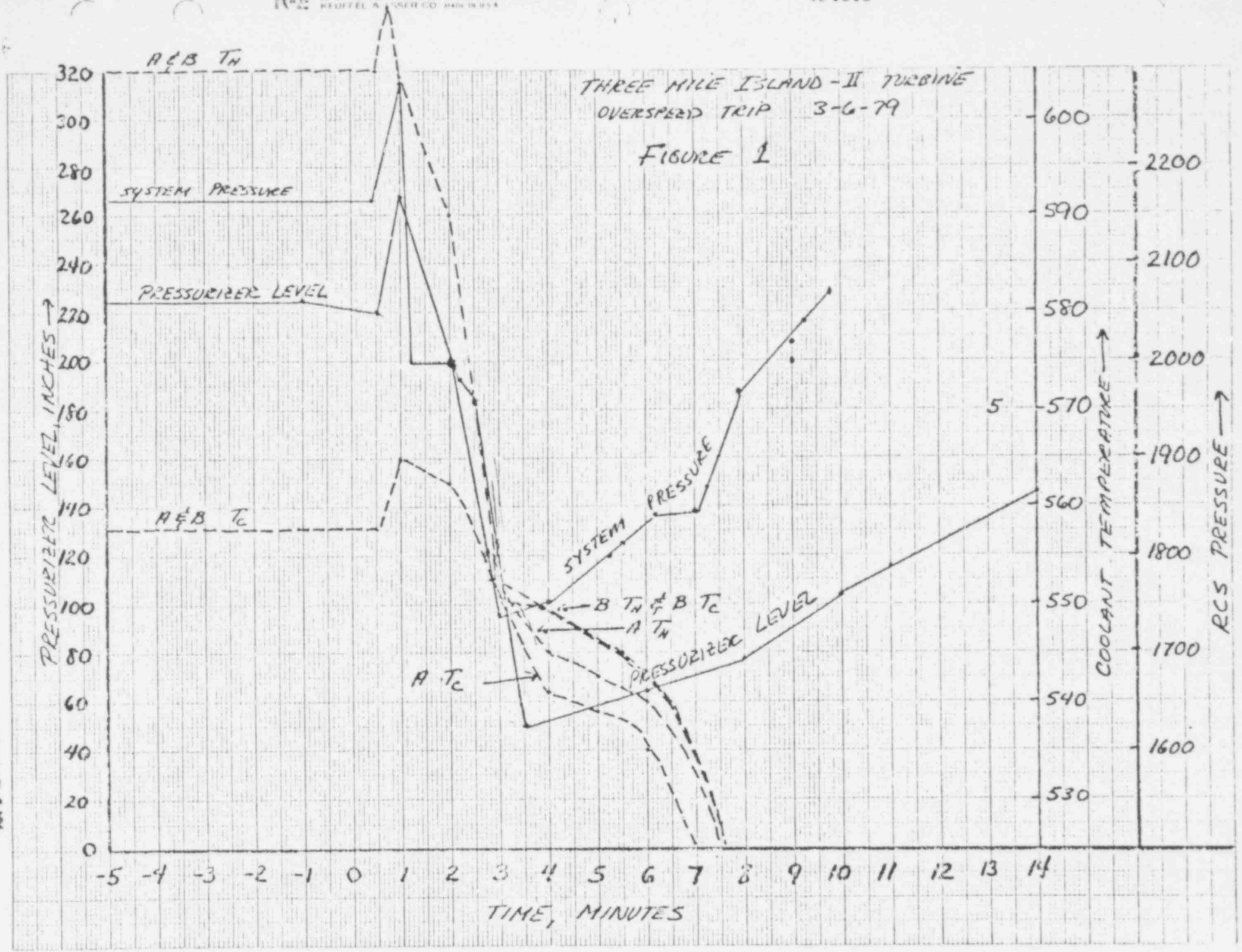

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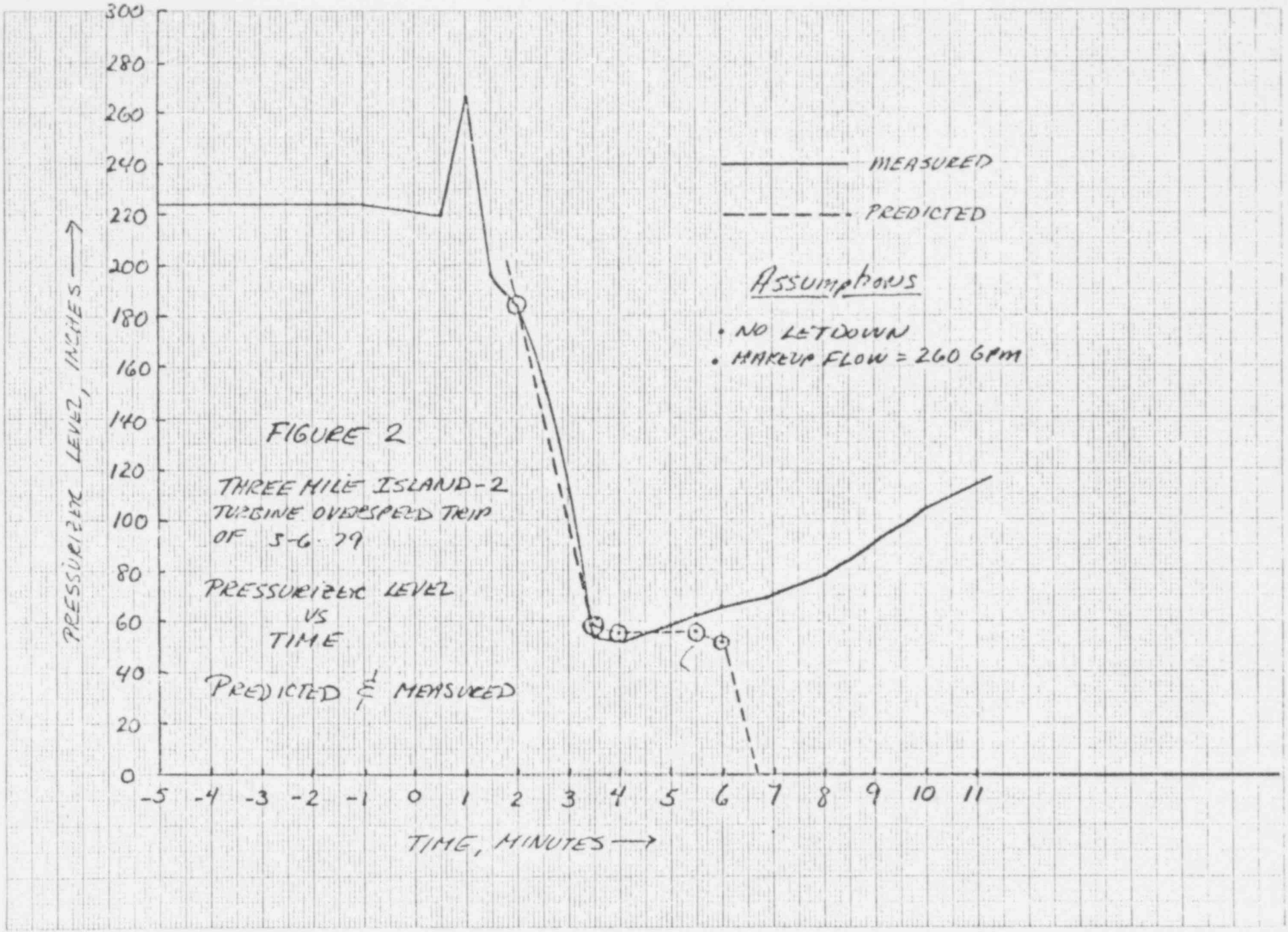

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