Memo No. 14-3

TASK CLOSE OUT DOCUMENT

Task Scope: Simulation of a Fire in Containment - System Capabilities - Containment Response

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Task No. 3

Date Complete 4-13-79

Reason felt task is complete:

1. Simulation basis fire defined 2. Containment Response defined. 3. Recommended system response defined. 4. Operator gues defined.

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SIMULATION OF FIRE IN CONTAINMENT

Industry Advisory Group

Three Mile Island Unit 2

4/13/79

James W. Thiesing

INTRODUCTION

In order to define the likely progression of events in the containment building in response to a fire within the building, a probable maximum combustion rate fire has been postulated and the resulting containment response to such a fire has been quantified.

DEFINITION OF SIMULATION BASIS FIRE

It was assumed that the 450 gallons of lubricating oil contained in the lube oil system for two reactor coolant pumps (one loop) is spilled uniformly on the floor of the steam generator vault (1000 ft.^{2}) resulting in an oil layer 0.8 inches thick. A burn rate of 8 inches per hour was used, resulting in a 6 minute fire. A heat rate of 20,000 Btu/lbm was used.

ASSUMED OPERATOR/SYSTEM RESPONSE

It was assumed that all 5 air coolers and both spray trains would be actuated by the operator one minute after ignition in response to the rapidly rising (superheat) temperature in the containment.

RESULTS

The attached figure describes the pressure and temperature response of the containment building (assumed homogeneous) to the simulation basis fire. Clearly, the building spray system is effective in suppressing building superheat and pressure to acceptable values. Given the convective nature of heat transfer to uninvolved equipment it is likely that most containment equipment would survive in operable condition.

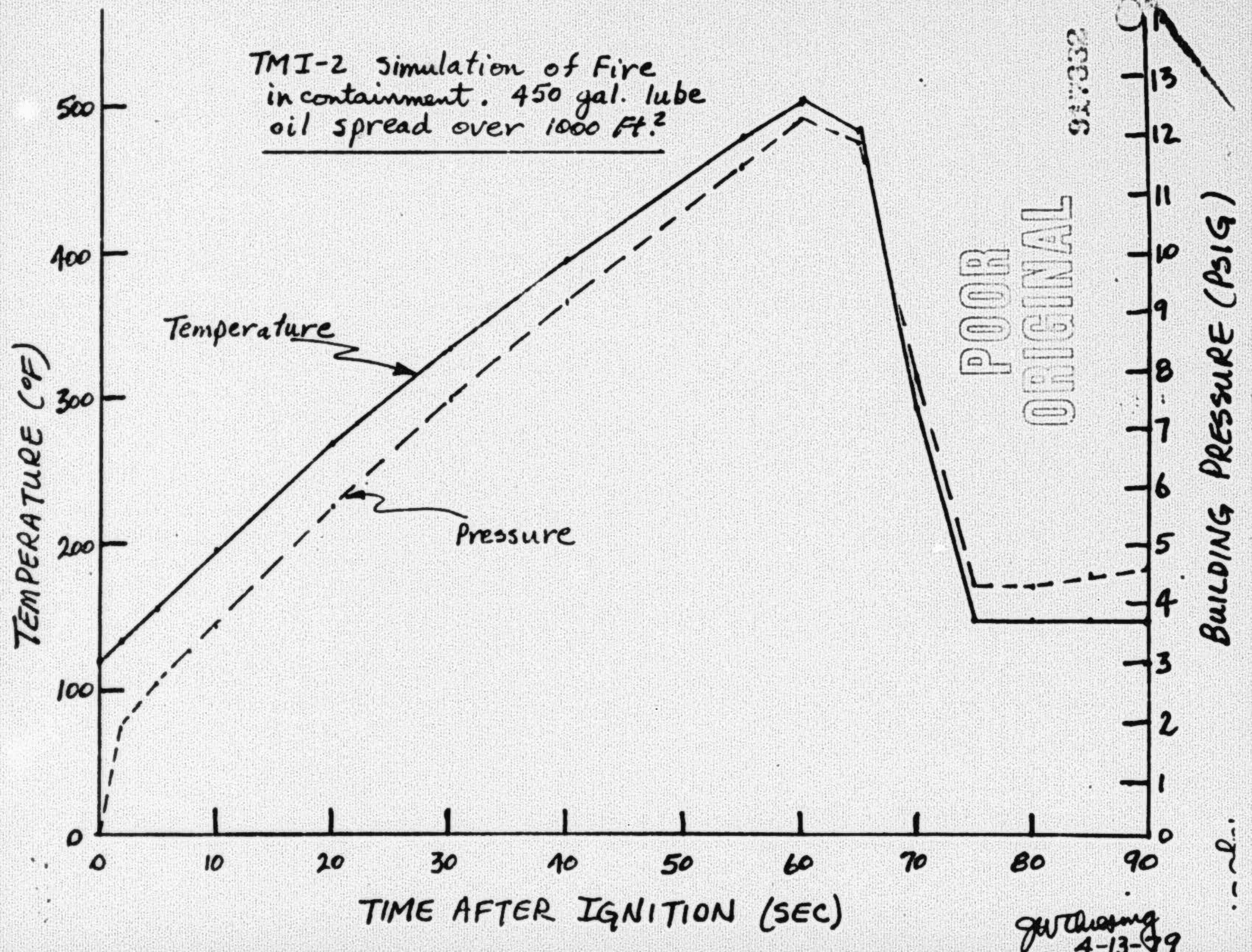
FIRE SUPPRESSION

Given a severe fire which does not communicate with other combustibles, the resulting pressure/temperature response can be controlled at acceptable levels provided the fire burns itself out without spreading. Equipment in the area of the fire would, of course, be disabled. It is doubtful that currently installed equipment (primarily building sprays) can extinguish large fires with any efficiency, it can only control the resulting temperature transient.

Effective fire suppression capability can possibly be established by installing a high capacity freon or other gaseous suppressant delivery system on one of the building purge penetrations. Ten volume percent freon could be established in ten minutes with a 20,000 cfm system, capable of pumping against, say, 50 psig.

OPERATOR QUES

As can be seen from the figure, the tip-off to existance of a fire in containment is a rapidly rising superheat temperature in the building (i.e. rapid temperature without a commensurate rapid pressure rise). Such a transient should, as a matter of procedure, call for immediate operator initiation of building sprays, air coolers, and any installed fire suppression systems.


TMI-2 Simulation of Fire in containment. 450 gal. lube oil spread over 1000 Ft.²
Temperature
Pressure
TEMPERATURE (°F)
0
100
200
300
400
500
BUILDING PRESSURE (PSIG)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
TIME AFTER IGNITION (SEC)
0
10
20
30
40
50
60
70
80
90
POOR ORIGINAL
4-13-79