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AUTH.NAME AUTHOR AFFILIATION
CRANE,P.A. PACIFIC GAS & ELEC
RECIP.NAME RECIPIENT AFFILIATION
STOLZ,J.F. ***LIGHT WATER REACTORS BRANCH 1

SUBJECT: Responds to 780725 ltr & forwards results of component thermal analysis re steam line break accidents.Concludes qualification program provides safety margin for accidents.

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December 18, 1978

Mr. John F. Stolz, Chief
Light Water Reactors Branch No. 1
Division of Project Management
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Re: Docket No. 50-275-OL
Docket No. 50-323-OL
Diablo Canyon Units 1 and 2

Dear Mr. Stolz:

Your letter dated July 25, 1978 requested additional information on the Diablo Canyon main steam line break (MSLB) analysis. Our letter of November 2, 1978 stated in part that we expect to satisfactorily qualify all safety related electrical equipment for a new MSLB analysis by performing component thermal analysis.

We have performed the component thermal analysis based upon the calculations made by the NRC for a typical containment. Attachment 1 summarizes review of MSLB using heat transfer approach. Figure 1 shows containment temperature with respect to time. Attachment 2 is a sample calculation of instrument thermal response to containment environment. Attachment 3 lists the qualification temperatures for Class IE equipment with potential for exposure to a main steam line break.

As indicated in the attachments, the calculated instruments and equipment temperatures are less than what would be expected from a design basis loss-of-coolant accident.

We conclude that the qualification program provides adequate margin for steam line break accidents.

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1/1

Kindly acknowledge receipt of the above material on the enclosed copy of this letter and return it to me in the enclosed addressed envelope.

Very truly yours,

PHILIP A. CRANE, JR.

Enclosures

CC w/enc.: Service List

ATTACHMENT 1

Environmental Temperature Qualifications For Containment Instrumentation

We have reviewed the environmental conditions (mainly temperature) that equipment listed in the table of Environment Qualifications of Class IE Equipment, submitted in a letter on May 3, 1978, would be subject to in the event of a main steam line break.

The instrument transmitters listed are protected more than those at most other reactor installations because of the protective cabinets used in the Diablo Canyon design. Although the instrument cabinets were provided for other purposes, they do afford insulation from the general containment environment in the event of a super-heated steam environment.

For purposes of calculating the environmental temperatures of the instrument transmitters and equipment, parameters were taken from a typical NRC Staff calculated containment atmosphere. The Staff's calculational results were obtained from an internal memorandum dated February 24, 1978, "Containment Environmental Qualification Best Estimates Evaluation for Main Steam Line Break Analysis." The basic parameters as used are contained in Figure 1. The assumptions and a sample calculation are shown in Attachment 2.

Using conservative heat transfer assumptions, calculations show that the peak surface temperature of the instrument transmitters would be about 252°F. This is less than the saturation temperatures resulting from a design basis LOCA. Using more realistic, best estimates, heat transfer coefficients would result in a peak temperature of about 230°F which is less than the saturation temperature of the steam environment. With regard to equipment in the containment, the peak temperatures were calculated to be 262°F. We have, therefore, concluded that the qualification program for the design basis LOCA environment provides adequate margin for a steam line break temperature excursion.

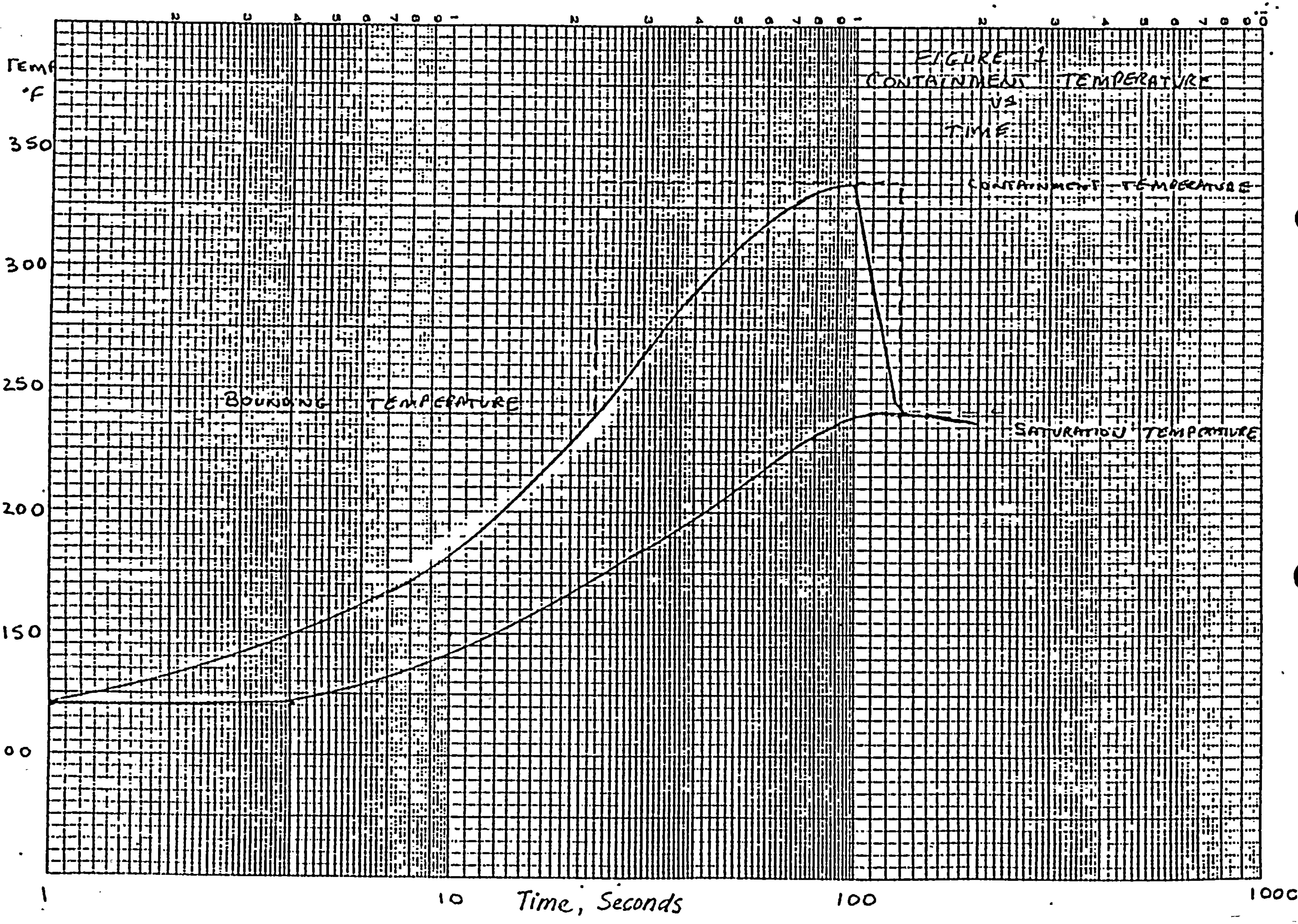
FIGURE 1
CONTAINMENT TEMPERATURE
VS
TIME
TEMP °F
350
300
250
200
150
00
CONTAINMENT TEMPERATURE
BOUNDING TEMPERATURE
SATURATION TEMPERATURE
1
10
100
1000
Time, Seconds

Sample Temperature Calculations

Assumptions

1. Material is steel flat plate geometry
2. Use infinite thermal conductivity -- no insulation effect of paint
3. Instrument wall thickness of ¼ inch

Heat Balance

$$WC_p \frac{dT}{d\theta} = hA(T_c - T)$$

Where:

W = weight of instrument
C_p = specific heat
T = temperature
θ = time
h = convection heat transfer coefficient
A = heat transfer area

Subscripts:

C = temperature of containment atmosphere
sat = saturation temperature of steam
in = initial wall temperature

Referring to temperature response figure, it is assumed that the heat transfer process is in two distinct parts; that of steam condensing for the first 23 seconds followed by a heat up due to superheated steam in the second time period. In the first time period a high condensing heat transfer coefficient of 400 BTU/hr ft^2OF was assumed and in the second time period a high steam heat transfer coefficient of 5 BTU/hr ft^2OF was chosen

Performing calculation for 1 ft^2 area for first 23 seconds:

W = 10.4
C_p = 0.11
h = 400
T_{sat} = 240
T_{in} = 120

$$T_{23} = T_{sat} - (T_{sat} - T_{in})\, e^{-\frac{hA}{WC_p}\Theta}$$

$T_{23} = 227$

Or for ease of calculation it was assumed that at 23 seconds $T_{23} = 240$

Calculating second time period to 130 seconds:

$h = 5$
$T_{in} = 240$
$T_c = 335$
and $T_{130} = 252$

QUALIFICATION TEMPERATURES
FOR
CLASS IE EQUIPMENT
WITH
POTENTIAL FOR EXPOSURE TO A MAIN STEAM LINE BREAK

Class IE Equipment Inside Containment - Subject to LOCA

Equipment	Manufacturer	Type (Model No.)	Qualification Temperature
1. Pressure and Differential Transmitters			
a. Pressurizer Pressure*	Rosemount	1152	350°F
b. Pressurizer Level	ITT Barton	764	320°F
c. Containment Sump Level	ITT Barton	764	320°F
d. Reactor Coolant System Wide Range Pressure	ITT Barton	763	320°F
e. Narrow Range Steam Generator Level	ITT Barton	764	320°F
f. Steam Flow*	Rosemount	1152	350°F
g. Sensor for Containment Pressure	Barton	351	320°F
2. Resistance Temperature Detector			
a. Reactor Coolant System Temperature	Sostman	11834B-1	320°F
3. Valve Motor Operators	Limitorque	SMB-0, 00, 000	340°F
4. Containment Fan Cooler	Westinghouse	300/100 h.p.	326°F

*Required for Initiation Only

Attachment 3

Equipment	Manufacturer	Type (Model No.)	Qualification Temperature
5. Electrical Penetrations	General Electric	NS02/03/04	340°F
6. Electrical Cables			
	Continental	Silicon/Silicon	392°F
	Boston	Silicon/Hypalon	340°F*
	Raychem	Stilan	554°F
	Okonite	Tefzel	346°F
	Boston	Silicon Glass Briad/ Kapton/Hypalon	
7. Electrical Terminations	Raychem	Sealed Splice	357°F
8. Stem Mounted Limit Switches	Namco	EA180	340°F
9. Containment Isolation Solenoid Valves	ASCO	8300 8302 8316* 8321*	See FSAR Paragraph 3.11.3-3

*Special valves with all plastic parts replaced with stainless steel or brass parts to withstand higher temperatures.

*Note for Qualification of Boston Cable

The Boston "Silicon Glass Braid/Kapton/Hypalon" insulated wires were tested in an autoclave at 302°F at 50 psig of saturated steam for 2 hours and 48 minutes. Insulation resistance was measured every 15 minutes during this period and found to be satisfactory at all times.

The insulation system of this conductor consists of silicon glass braid, 3 mils of Kapton tape, 6 mils of asbestos tape and an overall jacket of Hypalon. The silicon glass braid, Kapton and asbestos tapes are all capable of maintaining their properties at temperatures of 392°F. Hypalon, as an insulation for other conductors, has been qualified to 340°F.

[illegible]