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Director
Office of Nuclear Reactor Regulation
U S Nuclear Regulatory Commission
Washington, DC 20555

PRAIRIE ISLAND NUCLEAR GENERATING PLANT
Docket Nos. 50-282 License Nos. DPR-42
50-306 DPR-60

Pressure and Temperature Profiles Outside Containment

REFERENCE: (A) Robert A Clark, NRC
Letter to D M Musolf, NSP, dated July 29, 1982,
Pressure and Temperature Profiles Outside Containment Request for Information

Attached is our response to the referenced request for information concerning our high energy break outside containment analysis.

Please contact us if you require further information.

David Musolf
David Musolf
Manager of Nuclear Support Services

DMM/bd

cc: Regional Admin-III, NRC
NRR Project Manager, NRC
NRC Resident Inspector
G Charnoff

Attachment

A001

ANSWERS TO THE QUESTIONNAIRE (SEE ATTACHMENT)

PRESSURE & TEMPERATURE PROFILES OUTSIDE CONTAINMENT

FOR

PRAIRIE ISLAND UNIT 1 & 2

1. A double-ended main steam line rupture in Category I Zone compartment Y (Fig. 1).

   a. Steam

   b. $547^{o}F$

   c. 1020 psia

   d. Saturated steam from the steam generator at hot standby conditions.

   e. Assuming that fl/D = 0 and a discharge coefficient of one, the mass velocity from the Moody's correlation is 2100 lbm/sec ft^2. With an effective flow area of 7.16 in^2, the steam flow rate is 1044.17 lb/sec.

   f. Steam pipe I.D. = 27.951"
      O.D. = 30"

      Encapsulation sleeve I.D. = 30.75"

   g,h,i,j Effective annulus flow area defined by the steam pipe and the encapsulation sleeve is 71.6 in^2.

   k. The differential elevation is zero as fl/D=0.

   l. N/A

   m. None Assumed

   n. N/A

2. Compartment Data (See Fig. 1)

   a. Six compartments with venting to outside air.

   b. Initial conditions for all compartments are $80^{o}F$, 14.7 psia and 30% relative humidity. The compartment free volume in ft^3 vent area in ft^2 and concrete surface area for passive heat sinks in ft^2 are shown in Fig. 1. Assuming a time step of 0.002 seconds, the minimum pressure to initiate flow is predicted within the computer code.

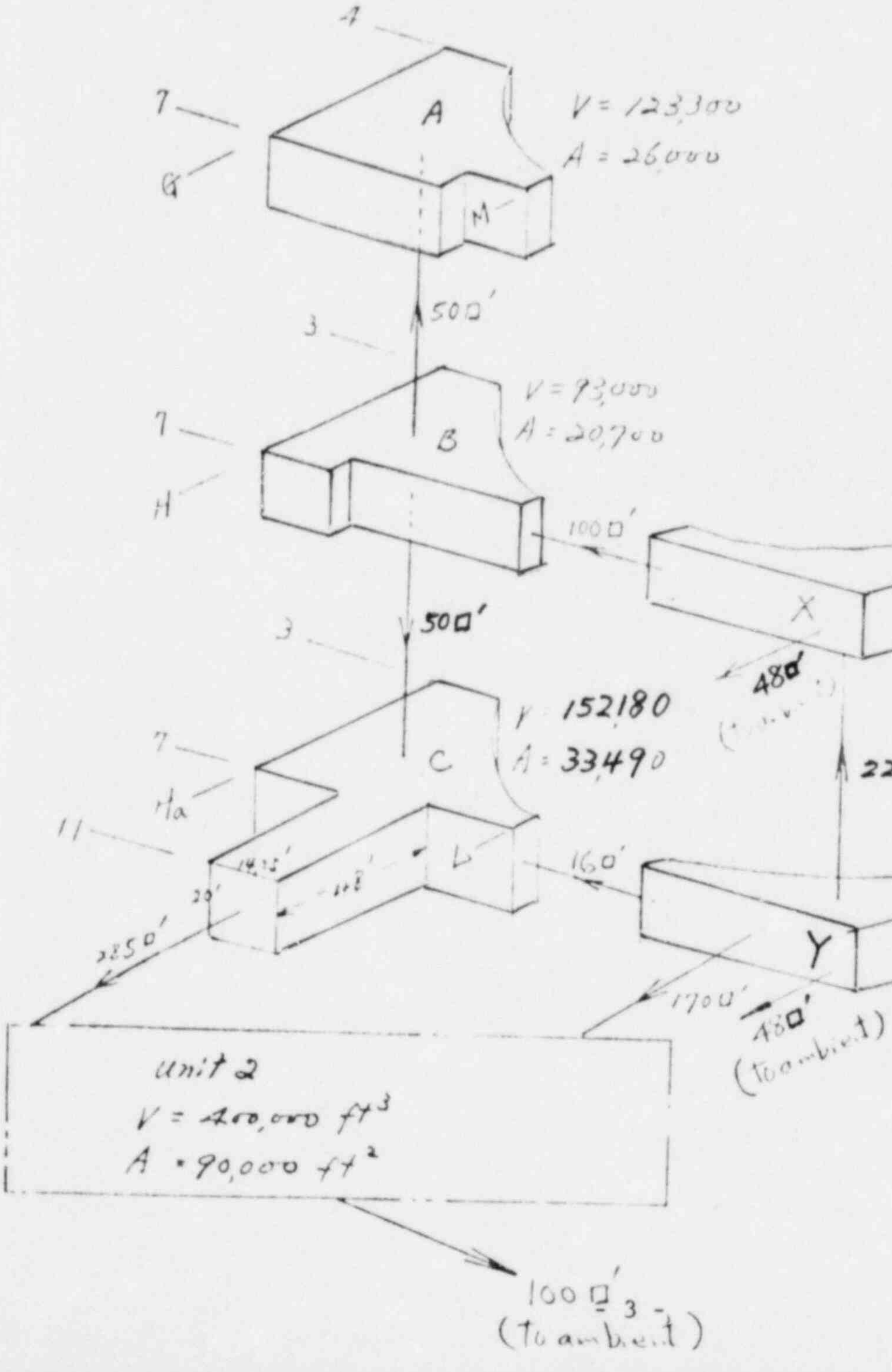
3. The computer code used in predicting the compartment pressure and temperature response to the steam line rupture is the CONTEMPT4/MOD2, a multi-compartment containment system analysis program. Each volume is considered a standard compartment and the method of computing the pressure and temperature response in a standard compartment is similar to the method used in the CONTEMPT-LT program.

   a. All vents (doors & stairways) are considered sharp edged orifice with a flow coefficient of $\Delta p = \frac{2.9\rho v^2}{2g}$

      from the Handbook of Hydraulic Resistance by Idelchik.

   b. N/A

FIG. 1 ZONE SV COMPARTMENT CONFIGURATION FOR A DOUBLE ENDED MAIN STEAM LINE BREAK IN Y COMPARTMENT



Note
1. V : Net free volume, ft^3
2. A : Heat sinks surface area, ft^2
3. Double-ended break in Y.

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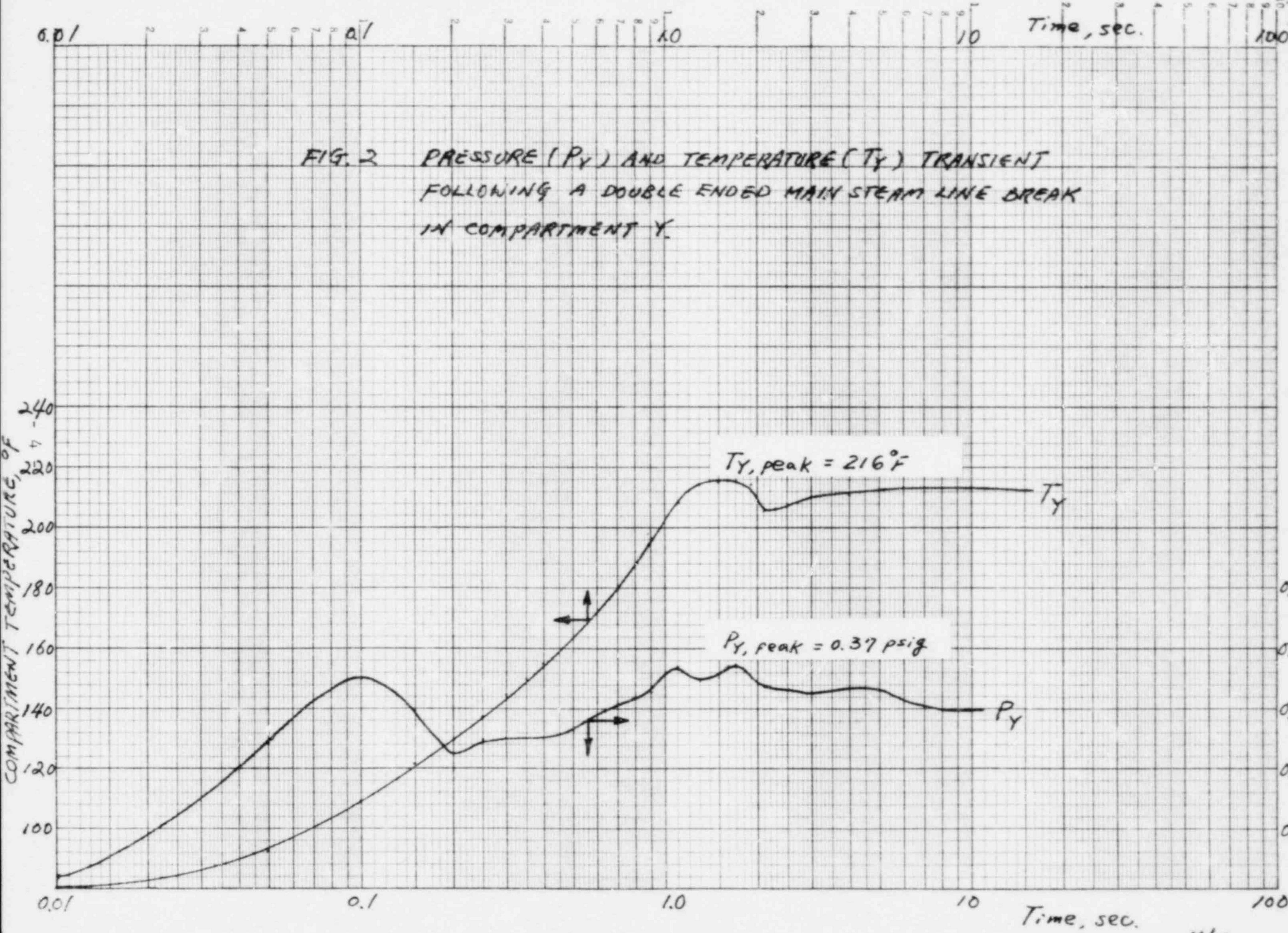
FIG. 2 PRESSURE (P_Y) AND TEMPERATURE (T_Y) TRANSIENT FOLLOWING A DOUBLE ENDED MAIN STEAM LINE BREAK IN COMPARTMENT Y.



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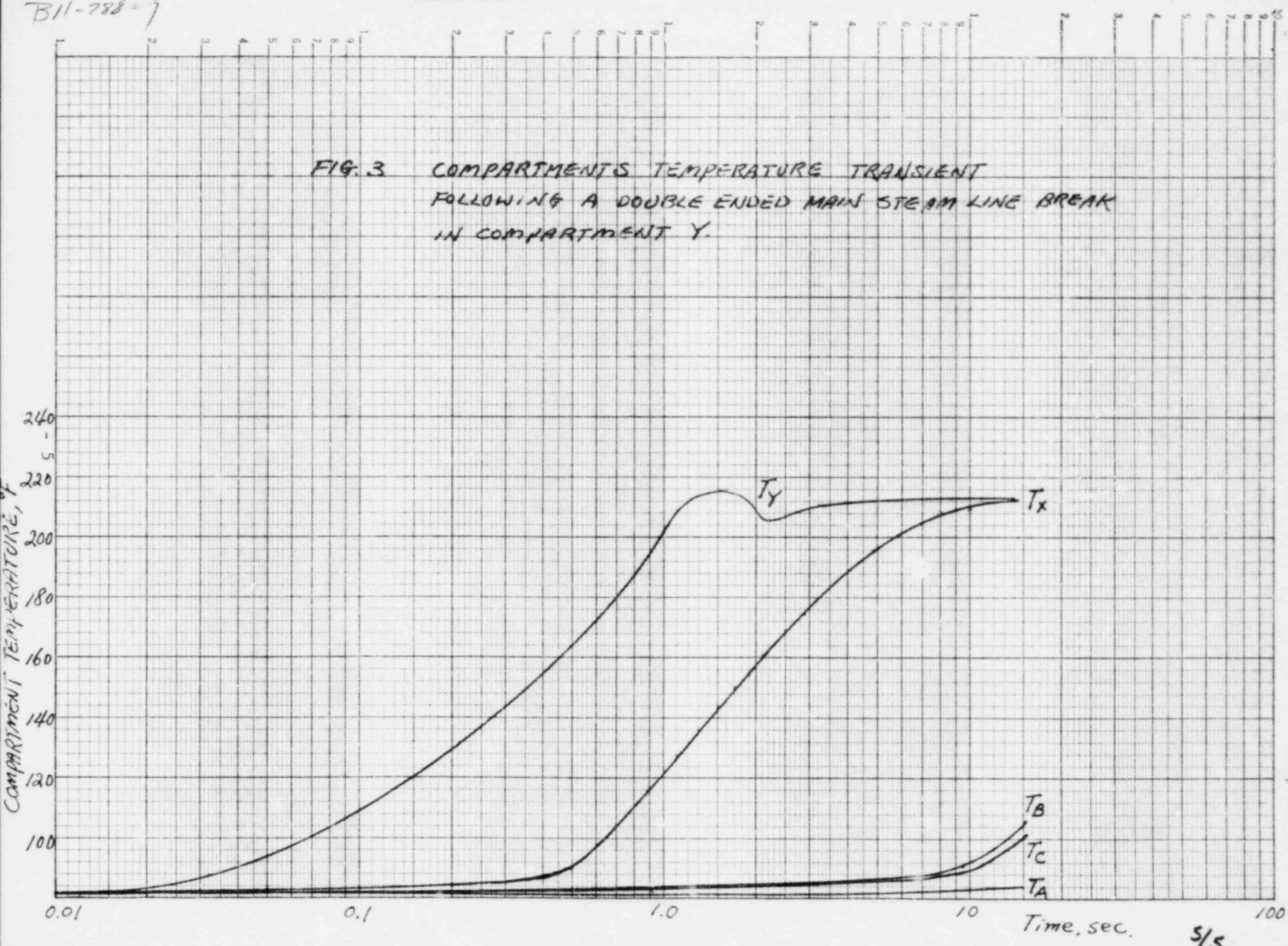

FIG. 3 COMPARTMENTS TEMPERATURE TRANSIENT FOLLOWING A DOUBLE ENDED MAIN STEAM LINE BREAK IN COMPARTMENT Y.

REQUEST FOR INFORMATION

FOR PRESSURE AND TEMPERATURE PROFILES OUTSIDE CONTAINMENT

FOR

PRAIRIE ISLAND UNIT NOS. 1 & 2

Provide the basis, assumptions and an analysis of a typical pipe break location (for example, auxiliary feedwater pump room for PWRs) that includes the following information:

1. With respect to the pipe to be broken, provide the following:

   a. Type of fluid (water or steam);

   b. Temperature;

   c. Pressure;

   d. Source of the fluid;

   e. Flow rate (or assumed flow rate);

   f. Pipe internal diameter;

   g. Wetted perimeter of the break (feet);

   h. Total pipe internal diameter;

   i. Exit flow area, if the break was not in the pipe, just described above;

   j. Area of flow restriction, if any;

   k. Differential elevation from the source to the pipe break;

   l. Total flow resistance (only if the fluid is water);

   m. Means to stop fluid flow (none, gate valve, globe valve, etc.); and

   n. If item 1.m above is a valve, then the valve's open throat area, full open flow coefficient, valve closure time, and delay time until initiation of valve closure.

2. With respect to the compartments being analyzed, provide the following:

   a. Number of compartment analyzed; and

   b. For each compartment:

      i. initial temperature
      ii. initial pressure
      iii. initial humidity
      iv. free air volume (cubic feet)
      v. number of vents and vent areas (square feet) for each vent; and
      vi. minimum pressure to initiate flow to the next compartment (psia).

3. Provide all assumptions used, including but not limited to the:

   a. Orifice coefficient for the "end effects" for the discharged fluid; and

   b. Fluid expansion factor.