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AEC INFORMAL RESEARCH
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P R E C O N

A FORTRAN Program for Computing Containment Pressure

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DISCLAIMER

The PRECON computer code is described herein as it existed on November 3, 1964. The code has been in continuous development for 1/2 year and in its presented form has been applied successfully by General Atomic to the kind of problems discussed later in this report. However, the development and improvement of the code are being continued, so that duplication of results (or even close agreement) between problems run with the code as published and the code as it existed either before or after this time is not necessarily to be expected.

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INTRODUCTION

PRECON is a digital computer program written in FORTRAN IV for the IBM 7044 computer.

The purpose of the program is to determine the containment pressure as a function of time, after ruptures have been assumed to occur in the primary system or in conjunction with a steam generator rupture. The maximum containment pressure calculated from these accident conditions is used to establish the containment vessel design pressure.

For a given set of input values the program will calculate the conditions in the steam generator, primary system, and the containment as a function of time. The conditions which are calculated and printed out for each time step are the pressure, temperature, amount of each gas and water, heat transferred, and the amount of gas flowing from the steam generator and primary system to the containment.

The program was written in a very general manner, for the study of a wide variety of situations. Because of this general nature of the program, various parameters utilized in the calculations are included as input factors. This makes it possible to carry out parameter studies by varying the input factors and determining the influence of each factor on the results.

The basic approach to the problem was to subdivide an HTGR system into three volumes, the steam generator, the primary system, and the containment. The gases within each volume are assumed to be mixed and at an average temperature and pressure. Incorporated in the code are the following rate-controlled processes:

(1) Helium and steam flow into the containment,
(2) Steam and/or water dump from the steam generator outside the containment,
(3) Heat transfer from the steam generator metal to the water in the steam generator,
(4) Steam and/or water flow into the primary system,
(5) Heat gained by the primary system gases from the decay heat and sensible heat in the core,

(6) The reaction of steam and graphite in the core, and

(7) Heat loss from the gases in the containment to the containment vessel, shielding and support concrete, and a containment space cooling system.

The use of the program is discussed under "Input Information." A sample problem has also been included to assist in assembling the input and to show the results of a typical problem which can be solved by the code.

DESCRIPTION OF PROGRAM

STEAM SYSTEM

The steam system section of the program solves the mass and energy equations that are specified in the analysis section.

One outlet for the blowdown of steam is provided and a maximum of three outlets for the blowdown of water. Each of the water valves may be assigned an initial quantity of water which is available to it. When the water available to a valve has been drained, the code provides for the discharge of steam through this valve. The steam dump valve is assumed to open instantaneously. The water dump valves are opened over a specified time interval during which the flow area varies linearly.

In the present steam generators some subcooled water and superheated steam would be present initially in the steam generators. In this program superheated steam and subcooled water at given constant temperatures are added to the system inventory. It is assumed that superheated steam will flow out of the steam valve and/or the generator tube rupture until it is gone, and then saturated steam will flow out of these areas. The steam generator tubes may also have an initial quantity of water in them. When this initial quantity of water has flowed out of the generator tube rupture, superheated or saturated steam will then follow. In order to simulate the delayed closing of the feedwater valve, the amount of time it remains open and the feedwater flow rate into the steam generator are inputs to the program.

The transfer of the sensible heat in the metal of the steam generator can be accounted for in the code as a function of the steam generator pressure and time.

PRIMARY SYSTEM

The primary system section of the program solves the mass and energy equations that are detailed in the analysis section. Flow of the mixed gases out of the primary system into the containment is calculated using the critical and subcritical isentropic gas flow equations at each time step. The water which enters the primary system and flashes to steam is calculated

based upon information from the previous time. This method eliminates iteration and, when small time steps are used, is sufficiently accurate.

Heat can be transferred to or from the gases in the primary system in several ways. The sensible heat of that metal in the system which is above the mixed gas temperature is a source of heat. The change in average metal surface temperature in a time step is included in the calculation. Heat may also be transferred from the core sensible heat, core decay heat, heat of reaction, and the heat removed in the intact steam generators, all of which can also be included. This information can be approximately obtained from the RAT* program for given gas flows through the core after the ruptures occur. It would be possible to include a simplified version of RAT in this program to calculate the heat transferred to the gases in each time step with the disadvantage of requiring much greater computer times. The steam-graphite reaction can be considered by the program as a function of the partial pressure of the saturated steam and hydrogen in the primary steam. The complete reaction equation[1] is a function of temperature and barium loading as well. The way in which these factors are handled is explained in the Analysis Section.

CONTAINMENT

The containment section of the program determines the mass of gases in the containment and solves the energy equation at each time step. Heat can be removed from the gases in the containment by a ventilation system and the metal and concrete (or any other material) in the containment.

*A General Atomic proprietary general purpose, transient, heat transfer code.

ASSUMPTIONS AND DISCUSSION OF ASSUMPTIONS

1. The steam dump valve is assumed to open instantaneously, while the water dump valves open over a specified time interval during which the flow area varies linearly.
2. Gas flow through the rupture areas is isentopic. This is a good approximation of the actual situation because the short time of flow allows little opportunity for heat to be transferred to or from the gases in the rupture or for friction to have much effect on the flow rate. Friction could be accounted for by using a smaller flow area than the actual one.
3. The fluids which are initially in the steam generator are steam and water. The fluid in the primary system initially is helium and in the containment there is nitrogen. These are the fluids which are used in the advanced HTGR's at the present time.
4. The gases in the primary system and the containment are completely mixed, perfect gases with constant specific heats. Therefore, they obey the perfect gas laws and Dalton's law of partial pressures. At the comparatively low pressures in the primary system and the containment the gases will behave as perfect gases. The use of a lumped system in the analysis requires the assumption of complete mixing of the gases.
5. The superheated steam and the subcooled water in the steam generator are each at given constant temperatures. This assumption is made because of the difficulty in determining the heat transferred to the superheated steam and subcooled water. The amount of superheated steam in the steam generator is less than 5 percent of the total inventory, so an error in this assumption will have little effect on the overall results. The amount of heat transferred to the subcooled water will be small as there will be only a small temperature difference between the steam generator tubes and the subcooled water after reactor scram.
6. Graphite sleeve temperatures in the core remain constant during the blowdown of the primary system. This assumption was checked using RAT and found to be approximately correct and is due to the

large heat capacity of the core. Also the cooling of the core due to the steam-graphite reaction and the circulating coolant is about equal to the decay heat generated in the core for the first hour after scram.

7. Superheated steam, by expanding in the steam generator rupture area, becomes saturated steam. This assumption can be verified as being approximately correct by following a constant entropy line from the initial superheated steam state to the final state. The assumption has little influence on the results since less than 5 percent of the steam generator inventory is superheated steam.
8. Saturated water which is in the primary system does not flow into the containment. Due to the physical layout of the primary system this is the situation unless the steam generator pressure vessel ruptures.
9. When the calculated pressures in the primary system and containment are greater than the steam generator and primary system pressures, respectively, no backflow of gas is allowed. Due to the inertia of the inflowing gases, no backflow is likely to occur.
10. The reactor is assumed to scram at the same time the rupture occurs. This is the customary assumption for such accidents.

ANALYSIS

The engineering analysis to determine the pressure and temperature history in the three volumes of an HTGR when a rupture occurs in the helium system or simultaneously with a steam generator rupture, is presented in this section. The three volumes considered were a steam generator, the primary system, and the containment vessel. For each volume, mass and energy equations are written and these are solved by the computer program.

STEAM SYSTEM

The steam system is taken to be only that steam generator in which a rupture has been assumed. Other steam generators which may belong to the same reactor system are not considered.

The simplified energy equation for the steam generator was modified to include part of the steam generator inventory as superheated steam and subcooled water. Feedwater which enters the steam generator during the time which the feedwater valve is still open is also considered. The energy equation is

$$\begin{aligned}\Delta Q\,(\Delta t) + W_{isc}\,(\Delta t)\,h_{isc} &= W_{ef}\,(\Delta t)\,h_{ef} + W_{eg}\,(\Delta t)\,h_{eg} + \\ W_{es}\,(\Delta t)\,h_{es} &+ W_g\,(t+\Delta t)\,U_g\,(t+\Delta t) + W_f\,(t+\Delta t)\,U_f\,(t+\Delta t) + \\ W_{sc}\,(t+\Delta t)\,U_{sc}\,(t+\Delta t) &+ W_{ss}\,(t+\Delta t)\,U_{ss}\,(t+\Delta t) - \\ W_g\,(t)\,U_g\,(t) - W_f\,(t)\,U_f\,(t) &- W_{ss}\,(t)\,U_{ss}\,(t) - W_{sc}\,(t)\,U_{sc}\,(t)\end{aligned} \tag{1}$$

The enthalpy, specific volume, and internal energy of the superheated steam and subcooled water are evaluated at the steam system pressure and at a constant temperature, which is an input to the code.

The total volume of the saturated water, subcooled water, saturated steam, and superheated steam in the steam/water side of the steam generator is initially

$$V_{sg} = W_g\,v_g + W_f\,v_f + W_s\,v_s + W_{sc}\,v_{sc} \tag{2}$$

The quantities of saturated steam, superheated steam, and water present after a time step are:

$$W_g\,(t + \Delta t) = W_g\,(t) - W_{ge}\,(\Delta t) + \text{water flashed to steam} \qquad (3)$$

$$W_f\,(t + \Delta t) = W_f\,(t) + W_{fi}\,(\Delta t) - W_{fe}\,(\Delta t) - \text{water flashed to steam} \qquad (4)$$

$$W_s\,(t + \Delta t) = W_s\,(t) - W_{se}\,(\Delta t) \qquad (5)$$

The flow equations were modified to include the flow of superheated steam and the subcritical (flow velocity through the rupture less than sonic) flow of saturated steam, superheated steam and water.

The flow of superheated steam is given by the equation

$$W = CA\sqrt{\frac{p}{v}} \quad \text{for } M = 1 \qquad (6)$$

where C is a dimensioned constant. For superheated steam, C = 44.7 when the units used are those given in the nomenclature section. The Mach number (M) for the flow of superheated steam out of the steam generator rupture area, A, is given as:

$$M = \left(\frac{\left(\frac{P_{ss}\,(t + \Delta t)}{P_{ps}\,(t + \Delta t)}\right)^{0.2185} - 1}{0.14} \right)^{1/2} \qquad (7)$$

When this calculated Mach number is greater than 1, it is set equal to 1, as the flow velocity cannot exceed the speed of sound which is M = 1. Subcritical flow of superheated steam is given by:

$$W = DA\sqrt{\frac{p}{v}}\,\frac{M}{(1 + 0.14\,M^2)^{4.07}} \qquad \text{for } M < 1 \qquad (8)$$

where D is a dimensioned constant. For superheated steam, D = 76.2 when the units used are those given in the nomenclature section.

To determine the Mach number of the saturated steam flow the following equation is used:

$$M = \left(\frac{\left(\frac{P_{ss}\ (t - \Delta t)}{P_{ps}\ (t - \Delta t)} \right)^{0.231} - 1}{0.15} \right)^{1/2} \qquad (9)$$

If the calculated Mach number is greater than 1.0 it is set equal to 1.0 because the flow velocity cannot exceed the speed of sound. The flow of saturated steam is determined from:

$$W = EA \sqrt{\frac{p}{v}} \frac{M}{(1 + 0.15\ M^2)^{3.83}} \quad \text{when } M < 1 \qquad (10)$$

where E is a dimensioned constant. For saturated steam, D = 77.6 using the units of the nomenclature section. For critical flow of saturated steam, $W = BA\ \sqrt{p/v}$, B = 45.5 is used.

The flow of water, when the steam system pressure is greater than 1.2 times the primary system pressure, is given by

$$W = 29.3\ A_p^{0.792}$$

Flow of water when steam system pressure is less than or equal to 1.2 times the primary system pressure is given by the following equation. This ratio of pressures ($P_{ss} < 1.2\ P_{ps}$) is based upon the critical pressure ratio for saturated water flow.

$$W = 29.3\ A\ (P_{ss} - P_{ps})^{0.792} \text{ when } P_{ss} < 1.2\ P_{ps} \qquad (11)$$

The heat in the steam generator tubes which is absorbed by the water and steam in the steam generator is considered to be a function of pressure and time. The equation used in the program is:

$$Q\ (\Delta t) = (e^{A - Bp})\ (1 - e^{-Ct}) - Q\ (t) \qquad (12)$$

The constants in the equation, A, B and C are input values to the program.

PRIMARY SYSTEM

The energy and mass equations which are solved by the program are given in this section.

The mass equation is solved first to determine the mass of each gas in the system at time t + Δt. The energy equation is then solved to determine the temperature of the gas mixture. Pressure in the primary system is then determined.

The mass equation for the primary system at time t + Δt is written as follows:

$$W_{ps}\,(t + \Delta t) = W_{ps}\,(t) + W_i\,(\Delta t) + W_{reaction}\,(\Delta t) - W_e\,(\Delta t) \qquad (13)$$

where the mass of gas and liquid in the primary system at time (t) is:

$$W_{ps}\,(t) = W_f\,(t) + W_g\,(t) + W_{co}\,(t) + W_{he}\,(t) + W_{h2}\,(t) \qquad (14)$$

The mass of gas and liquid which enters the primary system in Δt is determined from the steam system equations and is equal to:

$$W_i\,(\Delta t) = W_{fi}\,(\Delta t) + W_{gi}\,(\Delta t) + W_{si}\,(\Delta t) \qquad (15)$$

The mass of each gas produced or reacted due to the steam graphite reaction which is

$$H_2O\,(\Delta t)\,(\text{steam}) + C\,(\Delta t)\,(\text{graphite}) = CO\,(\Delta t) + H_2\,(\Delta t)$$

is an input to the program, and a function of the partial pressure of water vapor (P_{pg}) and hydrogen (P_{ph2}). The general reaction is also a function of graphite temperature and the barium loading in the graphite. The graphite temperatures are predetermined using the RAT program. The barium loading is based on in-pile experiments for the particular graphite to be used in the core. The reaction is written:

$$W_{reaction}(\Delta t) = W_{h2}(\Delta t) + W_{co}(\Delta t) - W_{g}(\Delta t) \quad (16)$$

For each gas (hydrogen, carbon monoxide and saturated steam) the reaction equation is written:

$$W_{i}(\Delta t) = AP_{pg}(t)\, P_{pH_2}(t)^{-B} \cdot \Delta t \quad (17)$$

where i = CO, h_2 and g

The coefficients A and B are quantities determined from the core temperature distribution and barium loading as discussed previously.

The partial pressure of water vapor is calculated from:

$$P_{pg}(t) = \frac{85.833\, W_{g}(t)\, T_{ps}(t)}{V_{ps}} \quad (18)$$

and the partial pressure of hydrogen is:

$$P_{pH_2}(t) = \frac{772.5\, W_{h2}(t)\, T_{ps}(t)}{V_{p.s.}} \quad (19)$$

The reaction can be restricted so it will not start until the pressure in the primary system drops below a specified value. This can take into consideration the fact that the steam flow through the core during the initial rapid blowdown is negligible for the present HTGR's.

The gas flow out of the primary system at Δt is assumed to be isentropic flow. This is a good approximation for the fairly rapid blowdowns which this program will ordinarily consider. The equation is:

$$W_{e}(\Delta t) = \left(A\, P_{ps}(t) \left(\frac{32.2\, k_{mix}(t)}{R_{mix}(t)\, T_{ps}(t)} \right)^{1/2} \frac{M}{\left(1 + \frac{k_{mix}(t) - 1}{2} M^2\right)^{\frac{k_{mix}(t)+1}{2\,(k_{mix}(t)-1)}}} \right) \Delta t$$

where

$$k_{mix}(t) = \frac{1.25\,W_{he}(t) + 3.45W_{h2}(t) + 0.25W_{co}(t) + 0.48(W_{g+s})(t)}{0.75\,W_{he}(t) + 2.48W_{h2}(t) + 0.1785W_{co}(t) + 0.36(W_{g+s})(t)} \quad (21)$$

$$R_{mix}(t) = \frac{1545}{MW_{mix}(t)} \quad (22)$$

$$MW_{mix}(t) = \frac{W_{g+s}(t) + W_{h2}(t) + W_{co}(t) + W_{he}(t)}{\frac{W_{g+s}(t)}{18} + \frac{W_{h2}(t)}{2} + \frac{W_{co}(t)}{28} + \frac{W_{he}(t)}{4}} \quad (23)$$

$$M = \left(\frac{\left(\frac{P_{ps}(t)}{P_{con}+(t)}\right)^{\frac{k_{mix}(t)-1}{k_{mix}(t)}} - 1}{\frac{k_{mix}(t)-1}{2}} \right)^{1/2} \quad (24)$$

Note: After expansion from the rupture in the steam system, the superheated steam is considered to be saturated steam in the mass equations.

If the Mach number (M) is greater than 1 from the above equation it is set equal to 1 which corresponds to critical flow.

The total mass of the gas and liquid in the primary system at time $t + \Delta t$ can now be calculated. If no liquid water (W_f) enters the primary system, the amount of each gas present at $(t + \Delta t)$ can be calculated and then the molecular weight of the gas mixture ($MW_{mix}(t + \Delta t)$. When liquid water enters the primary system some of it will flash to water vapor. The amount of each gas and liquid water at time $t + \Delta$ is then calculated from the following equations:

$$W_{g+s}\,(t+\Delta t) = W_{(g+s)}(t) + W_{(g+s)i}(\Delta t) - W_{(g+s)e}(\Delta t) -$$

$$W_{(g+s)\ \text{reaction}}\,(\Delta t) - W_e\,(\Delta t)$$

$$\frac{W_{g+s}\,(t)}{W_{ps}\,(t)} + \text{water flashed to steam} \tag{25}$$

$$W_f\,(t+\Delta t) = W_f\,(t) + W_{fi}\,(\Delta t) - \text{water flashed to steam} \tag{26}$$

where water flashed to steam is determined from the equation:

$$\text{water flashed to steam} = \frac{W_{fi}\,(h_{fi} - U_{f2})}{(U_{g2} - U_{f2})} \tag{27}$$

$$W_{he}\,(t+\Delta t) = W_{he}\,(t) - W_e\,(\Delta t)\,\frac{W_{he}\,(t)}{W_{ps}\,(t)} \tag{28}$$

$$W_{co}\,(t+\Delta t) = W_{co}(t) + W_{co\ \text{reaction}}(\Delta t) - W_{(\Delta t)}\,\frac{W_{co}\,(t)}{W_{ps}\,(t)} \tag{29}$$

$$W_{h2}\,(t+\Delta t) = W_{h2}\,(t) + W_{h2\ \text{reaction}}\,(\Delta t) - W_{(\Delta t)} \tag{30}$$

The molecular weight of the gases in the primary system at time $t + \Delta t$ can then be calculated,

$$MW_{ps}\,(t+\Delta t) = \frac{W_{co}\,(t+\Delta t) + W_{he}\,(t+\Delta t) + W_{h2}\,(t+\Delta t) + W_{g+s}\,(t+\Delta t)}{\frac{W_{co}\,(t+\Delta t)}{28} + \frac{W_{he}\,(t+\Delta t)}{4} + \frac{W_{h2}\,(t+\Delta t)}{2} + \frac{W_{g+s}\,(t+\Delta t)}{18}} \tag{31}$$

The energy equation for the primary system at time t + Δt is

$$\Delta Q\ (\Delta t) + Wi\ (\Delta t) h_i = W_e\ (\Delta t)\ h_e\ (t) + U_{(t + \Delta t)} - U_{(t)} \qquad (32)$$

where

$$\Delta Q\ (\Delta t) = (At - Bt^2 + HA_{surface}\ (T_{surface}\ (t) - T_{ps}\ (t)\ )\cdot \Delta t \qquad (33)$$

With A and B constants determined from the RAT analysis used previously to determine the graphite temperatures. These constants take into consideration the effects of decay heat, stored heat, and the heat removed from the gas in the steam generator(s) which have water flowing through them.

The change in surface temperature of the primary system in Δt is given by:

$$T_{surface}\ (t + \Delta t) = T_{surface}(t) - \frac{(HA_{surface}\ (T_{surface}(t) - T_{ps}(t)\ )\Delta t}{W_{surface}\ C_{p\ surface}} \qquad (34)$$

The energy into the primary system in Δt is equal to

$$Wi\ (\Delta t)\ hi = Wi_f\ (\Delta t)\ h_f + Wi_g\ (\Delta t)\ h_g + Wi_s\ (\Delta t)\ h_s \qquad (35)$$

and is obtained from the steam system calculations.

The energy which leaves the primary system in the mixed gases is determined from:

$$We\ (\Delta t)\ h_e\ (t) = W_e\ (\Delta t)\ C_{pmix}\ (t)\ T_{ps}\ (t) \qquad (36)$$

with

$$Cp_{\ mix}\ (t) = \frac{1.25\ W_{he}(t) + 3.45\ W_{h2}(t) + 0.25\ W_{co}(t) + 0.36\ W_{g+s}(t)}{W_{he}\ (t) + W_{h2}\ (t) + W_{co}\ (t) + W_{g+s}(t)}$$

The total internal energy of the primary system at t + Δt =

$$U(t+\Delta t) = (W_{ps}(t+\Delta t) - W_f(t+\Delta t))\, Cv_{mix}(t) T_{ps}(t+\Delta t) + W_f(t+\Delta t)\, U_f \quad (38)$$

with

$$Cv_{mix}(t) = \frac{0.75\, W_{he}(t) + 2.48 W_{h2}(t) + 0.1785 W_{co}(t) + 0.48 W_{g+s}(t)}{W_{he}(t) + W_{h2}(t) + W_{co}(t) + W_{g+s}(t)} \quad (39)$$

The quantities Cv_{mix} and U_f are determined from conditions at time (t) which is an approximation. This is reasonable when small time steps are used in the calculation.

The total internal energy of the primary system at t is:

$$U(t) = (W_{ps}(t) - W_f(t))\; Cv_{mix}(t)\, T_{ps}(t) + W_f(t)\, U_f \quad (40)$$

These energy equations are solved for the primary system temperature at time $(t + \Delta t)$. The temperature of the gases leaving the system can be assumed to be equal to a particular value. This will take into consideration the fact that a rupture in a cold duct of the primary system allows gas to flow out of the primary system at an average temperature which may be lower than the system average temperature. On the other hand, a rupture of a control rod nozzle will lead to flow out of the primary system at a higher-than-average temperature.

The pressure in the primary system at time $t + \Delta t$ is then calculated from:

$$P_{ps}(t+\Delta t) = \frac{(W_{ps}(t+\Delta t) - W_f(t+\Delta t))\,(1545)\,(T_{ps}(t+\Delta t))}{MW_{ps}(t+\Delta t)\, V_{ps}} \quad (41)$$

CONTAINMENT

The mass and energy equations for the containment vessel are given in this section. A determination of the mass in the containment is made first and then the energy equation is solved to determine the temperature of the gases in the containment. The pressure in the containment is then calculated using the perfect gas law.

The mass equation for the containment is:

$$\Sigma_j W_j (t + \Delta t) = \Sigma_j W_j (t) + \Sigma_j Wi_j (\Delta t) \qquad (42)$$

with $j = h_2$, he, co, n_2 and g

Example:

$$W_g (t + \Delta t) = W_g(t) + W_{ig} (\Delta t)$$

The molecular weight of the gases in the containment is given by:

$$MW_{cont}(t+\Delta t) = \frac{W_g(t+\Delta t)+W_{h2}(t+\Delta t)+W_{co}(t+\Delta t)+W_{he}(t+\Delta t)+W_{n2}(t+\Delta t)}{\frac{W_g(t+\Delta t)}{18}+\frac{W_{h2}(t+\Delta t)}{2}+\frac{W_{co}(t+\Delta t)}{28}+\frac{W_{he}(t+\Delta t)}{4}+\frac{W_{n2}(t+\Delta t)}{28}} \qquad (43)$$

The energy balance for the containment is:

$$-\Delta Q (\Delta t) + W_i (\Delta t) h_i = U (t + \Delta t) - U (t) \qquad (44)$$

The heat absorbed by the ventilation system, the metal and the concrete in the containment are given by the following equations.

$$\Delta Q (\Delta t)_{vent\ system} = C \Delta t \qquad (45)$$

where C is a constant determined by the particular ventilation system used.

The heat absorbed in the metal inside the containment is given by:

$$\Delta Q(\Delta t)_{metal} = Q(t+\Delta t)_{metal} - Q(t)_{metal} = C_{pm}\,\rho_m V_m (T_{cont}(t) - T_{initial\ metal}) \left(1 - e^{-\frac{H_m\, t}{3600\, C_{pm}\, \rho_m\, \zeta_m}}\right) - Q(t)_{metal} \qquad (46)$$

The possible sudden appearance of a quantity of heat absorbed in the metal is due to the fact that the computer treats $e^{-0.000,000,01}$ as 1.0. The quantity which suddenly appears is the total heat absorbed in the metal to that time and thus is a valid quantity. This is the Newtonian Cooling equation which considers that temperature gradients are negligible (which is approximately true for metal). The heat absorbed in the concrete which is inside the containment is:

$$\Delta Q(\Delta t)_{concrete} = Q(t+\Delta t)_{concrete} - Q(t)_{concrete} = \qquad (47)$$

$$A_c\, \zeta_c\, \rho_c\, c_{pc} (T_{cont}(t) - T_{initial\ concrete}) \sum_{\gamma=1}^{5} \frac{1 - \cos 2\phi_\gamma}{\phi_\gamma^2 + \phi_\gamma \sin \phi_\gamma \cos \phi_\gamma} \left(1 - e^{-\frac{\phi_\gamma^2\, \alpha_c\, t}{3600\, \zeta_c^2}}\right) - Q(t)_{concrete}$$

which is the exact solution (truncated after five terms of the infinite series) for an infinite plate insulated on one side considering the internal temperature gradient ϕ_γ is given by the transcendental equation

$$\phi_\gamma \tan \phi_\gamma = \frac{H_c\, \zeta_c}{K_c} \qquad (48)$$

Values of the first five roots of the above equation are given in Ref. 2 and Ref. 3.

The energy which comes into the containment during Δt is given by

$$W_i(\Delta t)\, H_i \qquad (49)$$

which is obtained from the primary system equations. The internal energy of the gases in the containment at time $t + \Delta t$ is

$$U\,(t+\Delta t) = W_{cont}\,(t+\Delta t)\quad Cv_{cont}\,(t+\Delta t)\,T_{cont}\,(t+\Delta t) \qquad (50)$$

with

$$Cv_{cont}(t+\Delta t)_{W_g} = \frac{0.36\,W_g\,(t+\Delta t) + 0.75\,W_{he}\,(t+\Delta t) + 2.48\,W_{h2}\,(t+\Delta t) + 0.1785\,W_{co}\,(t+\Delta t) + 0.18\,W_{n2}\,(t+\Delta t)}{W_g(t+\Delta t)+W_{he}(t+\Delta t)+W_{h2}(t+\Delta t)+W_{co}(t+\Delta t)+W_{n2}(t+\Delta t)} \qquad (51)$$

The internal energy in the containment at time t is similar to the above equations with conditions evaluated at t rather than (t + Δt).

From these equations the temperature of the gases in the primary system at time t + Δt can be calculated.

The pressure in the primary system at time (t + Δt) is then given by the perfect gas equation

$$P_{cont}(t+\Delta t) = \frac{1545\,W_{cont}\,(t+\Delta t)\,T_{cont}\,(t+\Delta t)}{MW_{cont}\,(t+\Delta t)\,V_{cont}} \qquad (52)$$

NOMENCLATURE

A	Area	ft^2
α	Thermal diffusivity	ft^2/hr
Cp	Specific heat at constant pressure	Btu/lb-^oR
Cv	Specific heat at constant volume	Btu/lb-^oR
δ	Thickness	ft
H	Heat transfer coefficient	Btu/lb-hr ft^2 ^oR
h	Specific enthalpy	Btu/lb
K	Thermal conductivity	Btu/ft-hr ^oR
k	Isentropic expansion coefficient	
M	Mach number	
MW	Molecular weight	
P	Pressure	lb/ft^2
p	Pressure	lb/in^2
Q	Heat energy	Btu
R	Gas constant	$ft/^oR$
ρ	Density	lb/ft^3
T	Temperature	^oR
t	Time	sec
Δt	Time step	sec
U	Total internal energy	Btu
u	Specific internal energy	Btu/lb
V	Volume	ft^3
v	Specific volume	ft^3/lb
$\dot{W}$	Flow rate	lb/sec
W	Mass	lb_m

NOMENCLATURE

Subscripts

c	Concrete
co	Carbon monoxide
cont	Containment
Δ	Incremental quantity
e	Properties of fluids leaving a system
f	Saturated water
g	Saturated steam
h_2	Hydrogen
he	Helium
i	Properties of fluids entering a system
m	Metal
mix	Mixed gases
n_2	Nitrogen
p	Partial pressure
ps	Primary system
s	Superheated steam
sc	Subcooled water
sg	Steam generator
s + g	Saturated plus superheated steam

CALCULATION PROCEDURE

The calculation procedure followed by the program is indicated in this section. In general, the program establishes the values of all system time dependent variables at time $(t + \Delta t)$ from knowledge of the variables at time t. Starting the calculation, therefore, requires that all the variables be input quantities or such that they can be calculated at the beginning of the program. With the old values available (either from the input data or previous calculations) the program proceeds to generate new values at each time step.

The general procedure is as follows:

1. Read in all input values.
2. Print out all the input values so they can be checked.
3. Perform the calculations for the steam generator system at time $t + \Delta t$.
4. Print out the steam generator pressure, saturated steam and water inventories and the amount of water, saturated and superheated steam which was dumped from generator in the time step.
5. Perform the primary system calculations for the time $(t + \Delta t)$.
6. Print out the primary system average pressure and temperature, weight of each gas in the primary system, weight of gases out of the system in Δt, molecular weight of the gases and the heat added in the system.
7. Carry out the containment system calculations for time $(t + \Delta t)$.
8. Print out the average temperature and pressure of the gases, weight of gases, heat absorbed in the concrete and metal and the weight of each separate gas (helium, hydrogen, carbon monoxide and steam).
9. Go back to step 3 and continue the calculations until the end of the maximum time it is desired to run the program.

INPUT INFORMATION

The input cards for the steam system, primary system and the containment are shown on the following pages.

The steam system input is somewhat complex, so a discussion of it is required.

The total weight of water in the various locations, AWSS, AWLSY, AWL(1), AWL(2) and AWL(3) must equal the total weight of water at the various conditions, WSUBAI, WSUBBI and WSATI. The subcooled water (WSUBAI and WSUBBI) and the saturated water (WSATI) will be distributed in the various places (example: AWSS) in proportion to the weight of water in each location.

The volume of the water and steam will be calculated by the program to see if the input quantity VOL, the volume of the steam generator, is correct. If necessary, the program will flash some saturated water to saturated steam so the volumes will be consistent.

It is recommended that the absolute error allowed in the energy equation, ERR, be at least 10.0 Btu for reasonably rapid convergence. At least 50 iterations, STPIT, should be allowed so convergence can be attained.

When choosing the time steps, a new time step of less than five times the previous time step should be selected. This will prevent erratic results when changing the size of the time steps. For a rapid blowdown, the new time step should be no more than twice as large as the previous one, especially at the beginning of the calculation, as all quantities are changing rapidly.

ERRORS

The problem may not be finished by the computer due to a number of errors. The steam tables used in the program have limits in which they can read steam or water properties. These limits are:

In the superheated region

Pressure greater than 5500 psia

In the saturated region

Pressure greater than 3100 psia or less than 0.125 psia

Temperature greater than $620^{\circ}F$ or less than $32^{\circ}F$

In the subcooled liquid region

Pressure greater than 6000 psia

Temperature greater than 620°F or less than 32°F

If convergence is not obtained for the energy equation (Equation 1) in the input number of iterations, the problem will not be completed. If the pressure in the primary system or the containment is calculated to be less than 0 psia or the temperature less than 0°R the problem will not be completed. In most cases an error which stops the problem is due to a data input error of the programmer.

Word		Specified by R. Hansen Programmed by M. J. Gerber L. J. Todt
Column	1-72	
Format	Alphanumeric	
Card 1	Title of problem	
Symbol	TITLE(I), I=1,12	

Steam generator input (and general data), cards 2 through 11

Word	1	2	3	4	5		Physical data (volume, pressure, and temperatures)
Column	1-12	13-24	25-36	37-48	49-60		
Format	DECIMAL	DEC.	DEC.	DEC.	DEC.		
Card 2	Volume of system ($ft.^3$)	Pressure of system (Psi.)	Temperature of sub-cooled water, A (^oF)	Temp. of sub-cooled water, B (^oF)	Temp. of superheated steam (^oF)		
Symbol	VOL	PS	TSUBA	TSUBB	FLOMF		

Word	1	2	3	4	5	6	Steam generator inventory
Column	1-12	13-24	25-36	37-48	49-60	61-72	
Format	DECIMAL	DEC.	DEC.	DEC.	DEC.	DEC.	
Card 3	Amount of sub-cooled water, A, initially (lb.)	Amt. of sub-cooled water, B, initially (lb.)	Amt. of saturated water initially (lb)	Amt. of saturated steam initially (lb.)	Amt. of superheated steam initially (lb.)	Amt. water available only for flashing to steam (lb.)	
Symbol	WSUBA1	WSUBB1	WSAT1	AWS	AWSUP	AWLSY	

Word	1	2	3	4	5		Control data
Column	1-12	13-24	25-36	37-48	49-60		
Format	DECIMAL	DEC.	DEC.	DEC.	DEC.		
Card 4	Number of water valves (≤ 3)	Number of time intervals (with different time steps)	Max. no. of iteraticns on pressure in each time step	Maximum allowable error in evergy eqn. (BTU)	Print Option 0.=print summary 1.=each step and summary		
Symbol	VALVN	TMAXN	STPIT	ERR	PRINOP		

Omit Ca 5 if no water valves. Repeat Card 5 for each valve (Maximum of 3)

Word	1	2	3	
Column	1-12	13-24	25-36	
Format	DECIMAL	DEC.	DEC.	
Card 5	Amt. of water available to valve (lb.)	Time to completely open valve (sec.)	Maximum diameter of valve (ft.)	
Symbol	AWL(I)	DRATE(I)	DMAX(I)	

Water valve data

NOTE:
Omit, if no valves.
Repeat, if more than 1 valve.
(Number of valves in word 1, card 4)

Word	1	2	3	
Column	1-12	13-24	25-36	
Format	DECIMAL	DEC.	DEC.	
Card 6	Maximum time for water flow into steam generator	Feed pump flow rate (of water entering steam gen.)	Pressure of dump tank (psi.)	
Symbol	TMF	FPFLO	FINALP	

Data for dump tank and feed pump

NOTES:
1) TMF(Word1)=feed pump cutoff time (sec)
2) Units of flow rate (word 2) are lb./sec.

Word	1	2	3	4	5	6
Column	1-12	13-24	25-36	37-48	49-60	61-72
Format	DECIMAL	DEC.	DEC.	DEC.	DEC.	DEC.
Card 7	Coeff. for sat. steam flow from water valves when M<1	Coeff. for sat. steam flow from water valves when M=1	Coeff. for superheated steam flow from steam valve, M<1	Coeff. for superheated steam flow from steam valve, M=1	Coeff. for sat. steam flow from steam valve when M<1	Coeff. for sat. steam flow from steam valve when M=1
Symbol	COEWPM	COEFWP	BWGMN	BWGMP	BWGM	BWG

Coefficients for water and steam dump valves

NOTE:
M = mach number

Word	1	2	3	4	5	
Column	1-12	13-24	25-36	37-48	49-60	
Format	DECIMAL	DEC.	DEC.	DEC.	DEC.	
Card 8	Coeff. of water flow equation	Exponent of pressure in water flow eqn.	Coeff. C_1 for heat transfer equation	Coeff. C_2 for heat transfer equation	Heat transfer time constant (α) in heat equation	
Symbol	COEFWW	EXPWW	QCOF1	QCOF2	CTIME	

Coeff. for water flow and heat transfer equation

NOTE:
Heat transfer eqn. $Q=e(C_1-C_2P)(1-e^{-\alpha t})$
where p=pressure
t=time
q=total heat in steam generator

Word	1	2	3	4		
Column	1-12	13-24	25-36	37-48		
Format	DECIMAL	DEC.	DEC.	DEC.		
Card 9	Number of steam generator tube ruptures	Eqns. for flow from rupture 0=steam 1=water 2=both	Amt. water available to rupture initially (lb.)	Coeff. of water from generator tube rupture equation		
Symbol	TUBHOL	GENER	AWSS	WSLOST		

Rupture data

Word	1	2	3	4		
Column	1-12	13-24	25-36	37-48		
Format	DECIMAL	DEC.	DEC.	DEC.		
Card 10	Coeff. for superheated steam flow from gen. rupture, M<1	Coeff. for superheated steam flow from gen. rupture, M=1	Coeff. for sat. steam flow from rupture, M<1	Coeff. for sat. steam flow from rupture M=1		
Symbol	BSLOSN	BSLOSP	BSLOSM	BSLOST		

Coefficients for steam flow from generator rupture

Repeat card 11 if more than 3 time intervals (3 time intervals per card)

Word	1	2	3	4	5	6
Column	1-12	13-24	25-36	37-48	49-60	61-72
Format	DECIMAL	DEC.	DEC.	DEC.	DEC.	DEC.
Card 11	Upper limit of time interval, I (sec.)	Time step for time interval, I (sec.)	Upper limit of interval, I+1 (sec.)	Time step for time interval, I+1 (sec.)	Upper limit of interval, I+2 (sec.)	Time step for time interval, I+2 (sec.)
Symbol	TMAXS(I)	DELTS(I)	TMAXS(I+1)	DELTS(I+1)	TMAXS(I+2)	DELTS(I+2)

Time Data

NOTE:
I=1,4,7,etc.
(No. of time intervals in word 2, card 4)

Word	
Column	
Format	
Card	
Symbol	

Primary system input, cards 12 through 15

Word	1	2	3	4	5	6
Column	1-12	13-24	25-36	37-48	49-60	61-72
Format	DECIMAL	DEC.	DEC.	DEC.	DEC.	DEC.
Card 12	Initial pressure in primary system (psf.)	Initial weight of helium in primary system (lb)	Initial temperature in primary system (degrees R)	Volume of primary system ($ft.^3$)	Minimum Temperature of primary system (degrees R)	Water flashed to steam 0-compute non-zero=NOTE
Symbol	PSIPS	WIHE	TIPS	VIPS	TEMPS	CWFS

Initial conditions and control data

NOTE:
If word 6 non-zero, value input is fraction of water entering primary system that flashes.

Word	1	2	3	4		
Column	1-12	13-24	25-36	37-48		
Format	DECIMAL	DEC.	DEC.	DEC.		
Card 13	Area of rupture in primary system ($ft.^2$)	Coeff. of time in function of heat added to system	Coeff. of time squared in function of heat added	Heat transfer coeff. for heat added in time step		
Symbol	AWOUT	ADQ	BDQ	H		

Rupture and heat data

NOTE:
Units of coefficients:
of time - $BTU/sec.^2$
of time squared-BTU/sec^3
heat transfer-
$BTU/hr\text{-}ft^2\text{-}deg.R$

Word	1	2	3	4	5	6
Column	1-12	13-24	25-36	37-48	49-60	61-72
Format	DECIMAL	DEC.	DEC.	DEC.	DEC.	DEC.
Card 14	Area of primary system (ft^2)	Initial surface temperature (degrees R)	Surface weight (lb.)	Specific heat of surface at constant temperature	Temperature of gas leaving primary system(^oR)	Maximum pressure for reaction of gases to occur(Psf.)
Symbol	ASYS	TSURF	WSURF	CPSURF	TEMPX	PX

Surface and miscellaneous data

NOTE:
1) Units of specific heat are $BTU/lb\text{-}^oR$
2) If TEMPX(word 5)=0.0, temperature of gas leaving primary system is at mixed gas temp.

Word	1	2	3	4	5	6
Column	1-12	13-24	25-36	37-48	49-60	61-72
Format	DECIMAL	DEC.	DEC.	DEC.	DEC.	DEC.
Card 15	Coeff. of hydorgen reaction equation	Exponent of hydrogen reaction equation	Coeff. of carbon monoxide reaction equation	Exponent of carbon monoxide reaction equation	Coeff. of steam reaction equation	Exponent of steam reaction equation
Symbol	AH2	BH2	ACO	BCO	AGR	BGR

Steam-graphite reaction data

Containment input, cards 16-19

Word	1	2	3	4	5	6
Column	1-12	13-24	25-36	37-48	49-60	61-72
Format	DECIMAL	DEC.	DEC.	DEC.	DEC.	DEC.
Card 16	Area of concrete ($ft.^2$)	Thickness of concrete (ft.)	Density of concrete ($lb./ft.^3$)	Specific heat of concrete at constant pressure	Thermal diffusivity of concrete ($ft.^2/hr.$)	Initial temperature of concrete (degrees R)
Symbol	AC	DC	RC	CPC	TD	TINCRT

Concrete data

NOTE:
Units of specific heat are:

BTU/lb-^oR

Word	1	2	3	4	5	6
Column	1-12	13-24	25-36	37-48	49-60	61-72
Format	DECIMAL	DEC.	DEC.	DEC.	DEC.	DEC.
Card 17	Angle for concrete heat transfer equation	Angle for concrete heat transfer equation	etc.	etc.	etc.	Initial containment temperature (degrees R
Symbol	PHI(1)	PHI(2)	PHI(3)	PHI(4)	PHI(5)	TICONT

Concrete data

NOTE:
All angles in radians

Word	1	2	3	4	5	6
Column	1-12	13-24	25-36	37-48	49-60	61-72
Format	DECIMAL	DEC.	DEC.	DEC.	DEC.	DEC.
Card 18	Specific heat of steel at constant pressure	Volume of steel ($ft.^3$)	Weight of steel (lb.)	Initial temperature of steel (degrees R)	Heat transfer coeff. for steel	Thickness of steel (ft.)
Symbol	CPS	VS	WS	TINQIP	HS	DS

Steel data

NOTES:
1) Units of specific heat
BTU/lb-^oR
2) Units of heat transfer coefficient
BTU/hr-ft^2-^oR

Word	1	2	3	4	
Column	1-12	13-24	25-36	37-48	
Format	DECIMAL	DEC.	DEC.	DEC.	
Card 19	Coeff. of ventilation heat eqn. (BTU/hr)	Weight of nitrogen in containment (lb.)	Initial containment pressure (psf.)	Containment volume ($ft.^3$)	
Symbol	CVENT	WIN2	PICONT	VICONT	

Initial conditions

SAMPLE PROBLEM

The sample problem is included in this report to familiarize the reader with the type of problem which can be considered and to see the output of such a problem.

SAMPLE CASE INPUT CARDS

OCTOBER 12,1964

STEAM	GENERATOR	RUPTURE	260	MW	BASE CASE		TITLE
399.42	2600.0	500.0		590.0	900.0		SG 2 B
2650.0	4740.0	176.0		790.0	520.0	0.0	SG 3 B
0.0	5.0	50.0		10.0	0.0		SG 4 B
15.0	200.0	0.0					SG 5 B
0.0	0.0			0.0	0.0	0.0	SG 6 B
0.0	0.792	15.2		0.002	0.000278		SG 7 B
10.0	0.0	0.0		0.0			SG 8
0.2305	0.135	0.231		0.1355			SG 9 B
1.0	0.1	10.0		0.5	60.0	2.0	SG 10 B
200.0	5.0	360.0		20.0			SG 10A
63360.0	4207.0	1160.0		29730.8	1060.0	0.0	PS 11 B
10.0	0.0	0.0		0.0			PS 12 B
0.0	0.0	0.0		0.0	0.0	63360.0	PS 13 B
0.00036	-0.05	0.005034		-0.05	0.00324	-0.05	PS 14 B
1.1	+52.5	145.0		0.15	0.0368	565.0	CO 15 B
1.12	3.8	6.7		9.7	12.7	565.0	CO 16 B
0.14	1530.0	7.65		+5565.0	1.0	0.054	CO 17 B
0.0	34628.0	2116.8		5.1	+5		CO 18 B

NO.

STEAM GENERATOR RUPTURE 260 MW BASE CASE

STEAM GENERATOR INPUT

FLOW EQUATION OF SATURATED WATER FROM VALVES = COEFWW * A * P**EXPWW

COEFWW, COEFFICIENT OF WATER FLOW EQUATION..... = 0.

EXPWW, EXPONENT OF PRESSURE IN WATER FLOW EQUATION = 7.920000-01

COEWPM, COEFFICIENT OF SATURATED STEAM FLOW EQN. OF WATER VALVES WHEN MACH NUMBER LESS THAN 1.0 (W=COEWPM*A*SQRT(P/V)*M/(1+.15*M*M)**3.83) = 0.

COEFWP, COEFFICIENT OF SATURATED STEAM FLOW EQN. OF WATER VALVES WHEN MACH NUMBER EQUAL TO 1.0 (W=COEFWP*A*SQRT(P/V))..... = 0.

BWGMN, COEFFICIENT OF SUPERHEATED-FLOW EQN. OF STEAM VALVE WHEN MACH NO. LESS THAN 1.0 (W=BWGMN*SQRT(P/V)*M/(1+.14*M*M)**4.07) = -0.

BWGMP, COEFFICIENT OF SUPERHEATED-FLOW EQN. OF STEAM VALVE WHEN MACH NUMBER EQUAL TO 1.0 (W=BWGMP*SQRT(P/V))..... = 0.

BWGN, COEFFICIENT OF SATURATED-FLOW EQN. OF STEAM VALVE WHEN MACH NO. LESS THAN 1.0 (W=BWGN*SQRT(P/V)*M/(1+.15*M*M)**3.83) = 0.

BWG, COEFFICIENT OF SATURATED-FLOW EQN. OF STEAM VALVE WHEN MACH NUMBER EQUAL TO 1.0 (W=BWG*SQRT(P/V))..... = 0.

BSLOSN, COEFFICIENT OF SUPERHEATED STEAM OF GEN. TUBE RUPTURE EQN. WHEN MACH NO. LESS THAN 1.0 (W=BSLOSN*SQRT(P/V)*M/(1+.14*M*M)**4.07) = 2.305000-01

BSLOSP, COEFFICIENT OF SUPERHEATED STEAM OF GEN. TUBE RUPTURE EQN. WHEN MACH NUMBER EQUAL TO 1.0 (W=BSLOSP*SQRT(P/V))..... = 1.350000-01

BSLOSM, COEFFICIENT OF SATURATED STEAM OF GEN. TUBE RUPTURE EQN. WHEN MACH NO. LESS THAN 1.0 (W=BSLOSM*SQRT(P/V)*M/(1+.15*M*M)**3.83) = 2.310000-01

BSLOST, COEFFICIENT OF SATURATED STEAM OF GEN. TUBE RUPTURE EQN. WHEN MACH NUMBER EQUAL TO 1.0 (W=BSLOST*SQRT(P/V))..... = 1.355000-01

EQUATION OF TOTAL HEAT IN STEAM GENERATOR (Q), IN BTU
Q = EXP(1.520000+01 - 2.000000-03 * PRESSURE) * (1 - EXP(-TIME * 2.780000-04))

WSLOST, COEFFICIENT OF WATER FROM GENERATOR TUBE RUPTURE EQUATION (W=WSLOST * P**EXPWW)..... = 0.

VOLUME OF SYSTEM = 3.994200+02 CUBIC FEET

ALLOWABLE ERROR OF ENERGY EQN. AT EACH TIME STEP = 1.000000+01 BTU

WEIGHT OF INITIAL WATER AVAILABLE TO STEAM GENERATOR RUPTURE = 0. LB

WEIGHT OF INITIAL WATER AVAILABLE ONLY FOR FLASHING TO STEAM = 0. LB

FLOW RATE OF WATER ENTERING STEAM GENERATOR..... = 2.000000+02 LB/SEC

MAXIMUM TIME FOR WATER FLOW INTO STEAM GENERATOR = 1.500000+01 SEC

PRESSURE OF DUMP TANK---------- = 0. PSI

STEAM SYSTEM INVENTORY

	AMOUNT (LB)	TEMPERATURE (DEG F)
SUBCOOLED WATER, A	2.650000+03	5.000000+02
SUBCOOLED WATER, B	4.740000+03	5.900000+02
SATURATED WATER	1.760000+02	
SATURATED STEAM	7.900000+02	
SUPERHEATED STEAM	5.200000-02	9.000000+02

NUMBER OF STEAM GENERATOR TUBE RUPTURES = 1.000000+01

MAXIMUM NUMBER OF ITERATIONS ON PRESSURE FOR EACH TIME STEP = 5.000000+01

TIME STEP (SEC)	UPPER LIMIT OF TIME INTERVAL (SEC)
1.000000-01	1.000000+00
5.000000-01	1.000000+01
2.000000+00	6.000000+01
5.000000+00	2.000000+02
2.000000+01	3.600000+02

EQUATION FOR STEAM FLOW FROM GENERATOR RUPTURE USED (GENER=0.0)

TIME	PRESSURE	SYS WATER SATURATED	SYS STEAM SATURATED	SYS STEAM SUPERHEATED	WATER DUMP SAT.	STEAM DUMP SATURATED	STEAM DUMP SUPERHEATED	CORE STEAM	WATER FLASHED
SEC	PSI	LBS	LBS	LBS	LBS	LBS	LBS	LBS	LBS
0.	2.6000+03	1.7600+02	7.9000+02	5.2000+02	0.	0.	0.	0.	0.

INITIAL CONDITIONS WERE ADJUSTED AS PRINTED BELOW TO SATISFY GIVEN TOTAL VOLUME

0.	2.6000+03	1.3171+02	8.3429+02	5.2000+02	0.	0.	0.	0.	4.4290+01

STEAM GENERATOR RUPTURE 260 MW BASE CASE

INPUT DATA FOR PRIMARY SYSTEM

INITIAL PRESSURE IN PRIMARY SYSTEM = 6.336000+04 PSF

INITIAL WEIGHT OF HELIUM IN PRIMARY SYSTEM = 4.207000+03 LB

INITIAL TEMPERATURE IN PRIMARY SYSTEM = 1.160000+03 DEG R

VOLUME OF PRIMARY SYSTEM = 2.973080+04 CUBIC FEET

MINIMUM TEMPERATURE OF PRIMARY SYSTEM = 1.060000+03 DEG R

AREA FOR EQUATION OF WEIGHT OF GASES LOST TO CONTAINMENT IN A TIME STEP = 1.000000+01 SQ.FT

COEFFICIENT OF TIME TERM IN FUNCTION OF HEAT ADDED IN TIME STEP = 0. BTU/(SEC**2)

COEFFICIENT OF TIME-SQUARED TERM IN FUNCTION = 0. BTU/(SEC**3)

HEAT TRANSFER COEFFICIENT FOR SYSTEM HEAT ADDED IN TIME STEP = 0. BTU/(HR*FT*FT*DEG R)

SYSTEM AREA = 0. SQ.FT

INITIAL SURFACE TEMPERATURE = 0. DEG R

SURFACE WEIGHT = 0. LB

SPECIFIC HEAT OF SURFACE AT CONSTANT PRESSURE = 0. BTU/(LB*DEG R)

MAXIMUM PRESSURE FOR REACTION OF GASES TO OCCUR = 6.336000+04 PSF

TEMPERATURE OF GAS LEAVING PRIMARY SYSTEM
IS AT MIXED GAS TEMPERATURE (TEMPX=0.0)

COEFFICIENT OF HYDROGEN REACTION EQUATION (W=AH2*PPG*PPH2**BH2) = 3.600000-04

EXPONENT OF HYDROGEN REACTION EQUATION = -5.000000-02

COEFFICIENT OF CARBON MONOXIDE REACTION EQUATION = 5.034000-03

EXPONENT OF CARBON MONOXIDE REACTION EQUATION = -5.000000-02

COEFFICIENT OF STEAM REACTION EQUATION = 3.240000-03

EXPONENT OF STEAM REACTION EQUATION = -5.000000-02

STEAM GENERATOR RUPTURE 260 MW BASE CASE

CONTAINMENT INPUT

AREA OF CONCRETE = 1.100000+05 FT*FT

THICKNESS OF CONCRETE = 2.500000+00 FT

DENSITY OF CONCRETE = 1.450000+02 LB/FT**3

SPECIFIC HEAT OF CONCRETE AT CONSTANT PRESSURE = 1.500000-01 BTU/(LB*DEG R)

THERMAL DIFFUSIVITY OF CONCRETE = 3.680000-02 FT*FT/HR

INITIAL CONCRETE TEMPERATURE = 5.650000+02 DEG R

ANGLES FOR CONCRETE HEAT TRANSFER EQUATION = 1.120000+00 RADIANS
3.800000+00
6.700000+00
9.700000+00
1.270000+01

SPECIFIC HEAT OF STEEL AT CONSTANT PRESSURE = 1.400000-01 BTU/(LB*DEG R)

VOLUME OF STEEL = 1.530000+03 FT**3

WEIGHT OF STEEL = 7.650000+05 LB

HEAT TRANSFER COEFFICIENT OF STEEL = 1.000000+00 BTU/(HR*FT*FT*DEG R)

THICKNESS OF STEEL = 5.400000-02 FT

INITIAL TEMPERATURE OF STEEL = 5.650000+02 DEG R

WEIGHT OF NITROGEN IN CONTAINMENT = 3.462800+04 LB

INITIAL CONTAINMENT TEMPERATURE = 5.650000+02 DEG R

INITIAL CONTAINMENT PRESSURE = 2.116800+03 PSF

CONTAINMENT VOLUME = 5.100000+05 FT**3

COEFFICIENT OF VENTILATION HEAT EQUATION = 0. BTU/HR

STEAM GENERATOR RUPTURE 260 MW BASE CASE

TIME = 0. SEC

STEAM SYSTEM

PRESSURE (PSI)	AMT. WATER SUBCOOLED A (LB)	AMT. WATER SUBCOOLED B (LB)	AMT. WATER SATURATED (LB)	AMT. STEAM SATURATED (LB)
2.600000+03	2.650000+03	4.740000+03	1.317098+02	8.342902+02

TOTAL AMT. DUMPED TO DUMP TANK WATER (LB)	STEAM (LB)	AMT. DUMPED TO PRIMARY SYSTEM IN TIME STEP WATER (LB)	SAT STEAM (LB)	SUP STEAM (LB)
0.	0.	0.	0.	0.

PRIMARY SYSTEM

PRESSURE (PSI)	TEMPERATURE (DEG F)	HEAT ADDED IN SYSTEM (BTU)	WEIGHT OUT IN TIME STEP (LB)	SYSTEM MOLECULAR WEIGHT (LB/LB-MOLE)
4.400000+02	7.000000+02	0.	0.	4.000000+00

WEIGHT OF SAT STEAM (LB)	WEIGHT OF HELIUM (LB)	WEIGHT OF HYDROGEN (LB)	WEIGHT OF CARBON MONOXIDE (LB)	WEIGHT OF WATER (LB)
0.	4.207000+03	0.	0.	0.

CONTAINMENT

PRESSURE (PSI)	TEMPERATURE (DEG F)	HEAT ABSORBED IN CONCRETE (BTU)	HEAT ABSORBED IN STEEL (BTU)
1.470000+01	1.050000+02	0.	0.

WEIGHT OF GASES IN SYSTEM (LB)	WEIGHT OF HELIUM (LB)	WEIGHT OF HYDROGEN (LB)	WEIGHT OF CARBON MONOXIDE (LB)	WEIGHT OF STEAM (LB)
3.462800+04	0.	0.	0.	0.

STEAM GENERATOR RUPTURE 260 MW BASE CASE

SUMMARY OF RESULTS FOLLOWS

STEAM SYSTEM SUMMARY (PART 1, INVENTORY)

TIME (SEC)	PRESSURE (PSI)	AMT. WATER SUBCOOLED A (LB)	AMT. WATER SUBCOOLED B (LB)	AMT. WATER SATURATED (LB)	AMT. STEAM SATURATED (LB)
0.	2.600000+03	2.650000+03	4.740000+03	1.317098+02	8.342902+02
1.0000-01	2.565645+03	2.670000+03	4.740000+03	1.504994+02	8.155006+02
2.0000-01	2.531557+03	2.690000+03	4.740000+03	1.679591+02	7.980409+02
3.0000-01	2.497685+03	2.710000+03	4.740000+03	1.843282+02	7.816718+02
4.0000-01	2.463933+03	2.730000+03	4.740000+03	1.999337+02	7.660663+02
5.0000-01	2.430456+03	2.750000+03	4.740000+03	2.145813+02	7.514187+02
6.0000-01	2.397265+03	2.770000+03	4.740000+03	2.283550+02	7.376450+02
7.0000-01	2.364365+03	2.790000+03	4.740000+03	2.413277+02	7.246722+02
8.0000-01	2.331763+03	2.810000+03	4.740000+03	2.535648+02	7.124351+02
9.0000-01	2.299457+03	2.830000+03	4.740000+03	2.651242+02	7.008757+02
10.0000-01	2.267444+03	2.850000+03	4.740000+03	2.760619+02	6.899380+02
1.5000+00	2.111223+03	2.950000+03	4.740000+03	3.232288+02	6.427711+02
2.0000+00	1.961920+03	3.050000+03	4.740000+03	3.606856+02	6.053144+02
2.5000+00	1.820972+03	3.150000+03	4.740000+03	3.906049+02	5.753951+02
3.0000+00	1.687867+03	3.250000+03	4.740000+03	4.145690+02	5.514310+02
3.5000+00	1.562565+03	3.350000+03	4.740000+03	4.338248+02	5.321751+02
4.0000+00	1.442861+03	3.450000+03	4.740000+03	4.507559+02	5.152440+02
4.5000+00	1.396901+03	3.550000+03	-0.	5.158761+03	5.472385+02
5.0000+00	1.359885+03	3.650000+03	-0.	5.122304+03	5.836959+02
5.5000+00	1.323894+03	3.750000+03	-0.	5.087036+03	6.189643+02
6.0000+00	1.311437+03	3.850000+03	-0.	5.074819+03	6.311811+02
6.5000+00	1.285934+03	3.950000+03	-0.	5.049893+03	6.135904+02
7.0000+00	1.260880+03	4.050000+03	-0.	5.025408+03	5.964636+02
7.5000+00	1.235275+03	4.150000+03	-0.	5.001354+03	5.797902+02
8.0000+00	1.212116+03	4.250000+03	-0.	4.977722+03	5.635594+02
8.5000+00	1.188400+03	4.350000+03	-0.	4.954503+03	5.477610+02
9.0000+00	1.165126+03	4.450000+03	-0.	4.931686+03	5.323845+02
9.5000+00	1.142288+03	4.550000+03	-0.	4.909265+03	5.174195+02
1.0000+01	1.119886+03	4.650000+03	-0.	4.887231+03	5.028559+02
1.2000+01	1.03+573+03	5.050000+03	-0.	4.802833+03	4.484248+02
1.4000+01	9.558521+02	5.450000+03	-0.	4.724144+03	3.994880+02
1.6000+01	8.725787+02	5.450000+03	-0.	4.639500+03	3.674497+02
1.8000+01	7.982655+02	5.450000+03	-0.	4.562151+03	3.385901+02
2.0000+01	7.319174+02	5.450000+03	-0.	4.491153+03	3.126254+02
2.2000+01	6.763881+02	-0.	-0.	9.873760+03	2.909826+02
2.4000+01	6.480729+02	-0.	-0.	9.799268+03	2.818195+02
2.6000+01	6.213710+02	-0.	-0.	9.727989+03	2.729915+02
2.8000+01	5.961750+02	-0.	-0.	9.659710+03	2.644975+02
3.0000+01	5.723853+02	-0.	-0.	9.594240+03	2.563330+02
3.2000+01	5.499091+02	-0.	-0.	9.531403+03	2.484909+02
3.4000+01	5.286601+02	-0.	-0.	9.471039+03	2.409624+02
3.6000+01	5.085526+02	-0.	-0.	9.412990+03	2.337482+02
3.8000+01	4.894886+02	-0.	-0.	9.357095+03	2.268651+02
4.0000+01	4.714392+02	-0.	-0.	9.303285+03	2.202472+02
4.2000+01	4.543385+02	-0.	-0.	9.251443+03	2.138831+02
4.4000+01	4.381276+02	-0.	-0.	9.201458+03	2.077630+02
4.6000+01	4.227503+02	-0.	-0.	9.153229+03	2.018776+02
4.8000+01	4.081546+02	-0.	-0.	9.106659+03	1.962181+02
5.0000+01	3.942918+02	-0.	-0.	9.061659+03	1.907762+02
5.2000+01	3.811166+02	-0.	-0.	9.018147+03	1.855435+02

STEAM SYSTEM SUMMARY (PART 1, INVENTORY)

TIME (SEC)	PRESSURE (PSI)	AMT. WATER SUBCOOLED A (LB)	AMT. WATER SUBCOOLED B (LB)	AMT. WATER SATURATED (LB)	AMT. STEAM SATURATED (LB)
5.4000+01	3.685869+02	-0.	-0.	8.976045+03	1.805123+02
5.6000+01	3.566634+02	-0.	-0.	8.935280+03	1.756749+02
5.8000+01	3.453098+02	-0.	-0.	8.895785+03	1.710238+02
6.0000+01	3.344920+02	-0.	-0.	8.857497+03	1.665519+02
6.5000+01	3.095859+02	-0.	-0.	8.766678+03	1.561080+02
7.0000+01	2.873978+02	-0.	-0.	8.682225+03	1.466335+02
7.5000+01	2.675594+02	-0.	-0.	8.603438+03	1.380299+02
8.0000+01	2.497583+02	-0.	-0.	8.529700+03	1.302286+02
8.5000+01	2.337330+02	-0.	-0.	8.460500+03	1.231443+02
9.0000+01	2.192671+02	-0.	-0.	8.395439+03	1.166553+02
9.5000+01	2.061697+02	-0.	-0.	8.334127+03	1.106981+02
1.0000+02	1.942749+02	-0.	-0.	8.276220+03	1.052169+02
1.0500+02	1.834440+02	-0.	-0.	8.221413+03	1.001658+02
1.1000+02	1.735558+02	-0.	-0.	8.169436+03	9.550359+01
1.1500+02	1.645057+02	-0.	-0.	8.120051+03	9.119378+01
1.2000+02	1.562026+02	-0.	-0.	8.073044+03	8.720389+01
1.2500+02	1.485673+02	-0.	-0.	8.028226+03	8.350481+01
1.3000+02	1.415309+02	-0.	-0.	7.985427+03	8.007038+01
1.3500+02	1.350327+02	-0.	-0.	7.944494+03	7.687707+01
1.4000+02	1.290196+02	-0.	-0.	7.905291+03	7.390360+01
1.4500+02	1.234443+02	-0.	-0.	7.867682+03	7.114197+01
1.5000+02	1.182658+02	-0.	-0.	7.831568+03	6.856235+01
1.5500+02	1.134476+02	-0.	-0.	7.796851+03	6.614617+01
1.6000+02	1.089570+02	-0.	-0.	7.763438+03	6.387939+01
1.6500+02	1.047648+02	-0.	-0.	7.731244+03	6.174954+01
1.7000+02	1.008453+02	-0.	-0.	7.700193+03	5.974554+01
1.7500+02	9.717503+01	-0.	-0.	7.670214+03	5.785744+01
1.8000+02	9.373328+01	-0.	-0.	7.641242+03	5.607632+01
1.8500+02	9.050134+01	-0.	-0.	7.613217+03	5.439410+01
1.9000+02	8.746236+01	-0.	-0.	7.586084+03	5.280352+01
1.9500+02	8.460113+01	-0.	-0.	7.559792+03	5.129796+01
2.0000+02	8.190901+01	-0.	-0.	7.534343+03	4.987409+01
2.2000+02	7.829883+01	-0.	-0.	7.486349+03	4.799316+01
2.4000+02	7.500463+01	-0.	-0.	7.440084+03	4.626557+01
2.6000+02	7.198955+01	-0.	-0.	7.395409+03	4.467471+01
2.8000+02	6.922200+01	-0.	-0.	7.352203+03	4.320617+01
3.0000+02	6.667466+01	-0.	-0.	7.310356+03	4.184734+01
3.2000+02	6.432391+01	-0.	-0.	7.269768+03	4.058721+01
3.4000+02	6.214888+01	-0.	-0.	7.230352+03	3.941657+01
3.6000+02	6.013194+01	-0.	-0.	7.192025+03	3.832635+01

STEAM SYSTEM SUMMARY (PART 2, DISTRIBUTION OF LOSSES)

TIME (SEC)	PRESSURE (PSI)	TOTAL AMT. DUMPED TO DUMP TANK WATER (LB)	STEAM (LB)	AMOUNT DUMPED TO PRIMARY SYSTEM IN TIME STEP WATER (LB)	SAT. STEAM (LB)	SUP. STEAM (LB)
0.	2.600000+03	0.	0.	0.	0.	0.
1.0000-01	2.565645+03	0.	0.	0.	0.	1.344300+01
2.0000-01	2.531557+03	0.	0.	0.	0.	1.324503+01
3.0000-01	2.497685+03	0.	0.	0.	0.	1.304913+01
4.0000-01	2.463933+03	0.	0.	0.	0.	1.285484+01
5.0000-01	2.430456+03	0.	0.	0.	0.	1.266233+01
6.0000-01	2.397265+03	0.	0.	0.	0.	1.247205+01
7.0000-01	2.364365+03	0.	0.	0.	0.	1.228402+01
8.0000-01	2.331763+03	0.	0.	0.	0.	1.209825+01
9.0000-01	2.299457+03	0.	0.	0.	0.	1.191474+01
10.0000-01	2.267444+03	0.	0.	0.	0.	1.173346+01
1.5000+00	2.111223+03	0.	0.	0.	0.	5.599035+01
2.0000+00	1.961920+03	0.	0.	0.	0.	5.175982+01
2.5000+00	1.820972+03	0.	0.	0.	0.	4.779484+01
3.0000+00	1.687867+03	0.	0.	0.	0.	4.409662+01
3.5000+00	1.562565+03	0.	0.	0.	0.	4.064861+01
4.0000+00	1.442861+03	0.	0.	0.	0.	3.741200+01
4.5000+00	1.396901+03	0.	0.	0.	0.	3.526861+01
5.0000+00	1.359885+03	0.	0.	0.	0.	3.418818+01
5.5000+00	1.323894+03	0.	0.	0.	0.	3.323907+01
6.0000+00	1.311437+03	0.	0.	0.	0.	1.384503+01
6.5000+00	1.285934+03	0.	0.	0.	4.251662+01	0.
7.0000+00	1.260880+03	0.	0.	0.	4.161164+01	0.
7.5000+00	1.236275+03	0.	0.	0.	4.072713+01	0.
8.0000+00	1.212116+03	0.	0.	0.	3.986271+01	0.
8.5000+00	1.188400+03	0.	0.	0.	3.901796+01	0.
9.0000+00	1.165126+03	0.	0.	0.	3.819253+01	0.
9.5000+00	1.142298+03	0.	0.	0.	3.738602+01	0.
1.0000+01	1.119836+03	0.	0.	0.	3.659808+01	0.
1.2000+01	1.034573+03	0.	0.	0.	1.388289+02	0.
1.4000+01	9.558521+02	0.	0.	0.	1.276258+02	0.
1.6000+01	8.725787+02	0.	0.	0.	1.166820+02	0.
1.8000+01	7.982655+02	0.	0.	0.	1.062085+02	0.
2.0000+01	7.319174+02	0.	0.	0.	9.696292+01	0.
2.2000+01	6.763831+02	0.	0.	0.	8.903570+01	0.
2.4000+01	6.480729+02	0.	0.	0.	8.365472+01	0.
2.6000+01	6.213710+02	0.	0.	0.	8.010769+01	0.
2.8000+01	5.961750+02	0.	0.	0.	7.677279+01	0.
3.0000+01	5.723853+02	0.	0.	0.	7.363452+01	0.
3.2000+01	5.499091+02	0.	0.	0.	7.067870+01	0.
3.4000+01	5.286601+02	0.	0.	0.	6.789231+01	0.
3.6000+01	5.085526+02	0.	0.	0.	6.526300+01	0.
3.8000+01	4.894836+02	0.	0.	0.	6.277787+01	0.
4.0000+01	4.714392+02	0.	0.	0.	6.042800+01	0.
4.2000+01	4.543385+02	0.	0.	0.	5.820651+01	0.
4.4000+01	4.381276+02	0.	0.	0.	5.610475+01	0.
4.6000+01	4.227503+02	0.	0.	0.	5.411482+01	0.
4.8000+01	4.081546+02	0.	0.	0.	5.222932+01	0.
5.0000+01	3.942918+02	0.	0.	0.	5.044142+01	0.
5.2000+01	3.811166+02	0.	0.	0.	4.874478+01	0.

STEAM SYSTEM SUMMARY (PART 2, DISTRIBUTION OF LOSSES)

TIME (SEC)	PRESSURE (PSI)	TOTAL AMT. DUMPED TO DUMP TANK WATER (LB)	STEAM (LB)	AMOUNT DUMPED TO PRIMARY SYSTEM IN TIME STEP WATER (LB)	SAT. STEAM (LB)	SUP. STEAM (LB)
5.4000+01	3.685869+02	0.	0.	0.	4.713354+01	0.
5.6000+01	3.566634+02	0.	0.	0.	4.560229+01	0.
5.8000+01	3.453098+02	0.	0.	0.	4.414599+01	0.
6.0000+01	3.344920+02	0.	0.	0.	4.276001+01	0.
6.5000+01	3.095859+02	0.	0.	0.	1.012622+02	0.
7.0000+01	2.873978+02	0.	0.	0.	9.392783+01	0.
7.5000+01	2.675594+02	0.	0.	0.	8.738991+01	0.
8.0000+01	2.497583+02	0.	0.	0.	8.153935+01	0.
8.5000+01	2.337330+02	0.	0.	0.	7.628468+01	0.
9.0000+01	2.192671+02	0.	0.	0.	7.154959+01	0.
9.5000+01	2.061697+02	0.	0.	0.	6.726939+01	0.
1.0000+02	1.942749+02	0.	0.	0.	6.338808+01	0.
1.0500+02	1.834440+02	0.	0.	0.	5.985803+01	0.
1.1000+02	1.735558+02	0.	0.	0.	5.663874+01	0.
1.1500+02	1.645057+02	0.	0.	0.	5.369507+01	0.
1.2000+02	1.562026+02	0.	0.	0.	5.099669+01	0.
1.2500+02	1.485673+02	0.	0.	0.	4.851719+01	0.
1.3000+02	1.415309+02	0.	0.	0.	4.623366+01	0.
1.3500+02	1.350327+02	0.	0.	0.	4.412602+01	0.
1.4000+02	1.290196+02	0.	0.	0.	4.217670+01	0.
1.4500+02	1.234443+02	0.	0.	0.	4.037040+01	0.
1.5000+02	1.182658+02	0.	0.	0.	3.869344+01	0.
1.5500+02	1.134476+02	0.	0.	0.	3.713356+01	0.
1.6000+02	1.089570+02	0.	0.	0.	3.568000+01	0.
1.6500+02	1.047648+02	0.	0.	0.	3.432323+01	0.
1.7000+02	1.008453+02	0.	0.	0.	3.305477+01	0.
1.7500+02	9.717503+01	0.	0.	0.	3.186704+01	0.
1.8000+02	9.373328+01	0.	0.	0.	3.075326+01	0.
1.8500+02	9.050134+01	0.	0.	0.	2.970733+01	0.
1.9000+02	8.746236+01	0.	0.	0.	2.872380+01	0.
1.9500+02	8.460113+01	0.	0.	0.	2.779772+01	0.
2.0000+02	8.190901+01	0.	0.	0.	2.687291+01	0.
2.2000+02	7.829883+01	0.	0.	0.	4.987409+01	0.
2.4000+02	7.500463+01	0.	0.	0.	4.799316+01	0.
2.6000+02	7.198955+01	0.	0.	0.	4.626557+01	0.
2.8000+02	6.922200+01	0.	0.	0.	4.467471+01	0.
3.0000+02	6.667466+01	0.	0.	0.	4.320617+01	0.
3.2000+02	6.432391+01	0.	0.	0.	4.184734+01	0.
3.4000+02	6.214888+01	0.	0.	0.	4.058721+01	0.
3.6000+02	6.013194+01	0.	0.	0.	3.941657+01	0.

PRIMARY SYSTEM SUMMARY (PART 1)

TIME (SEC)	PRESSURE (PSI)	TEMPERATURE (DEG F)	HEAT ADDED IN SYSTEM (BTU)	WEIGHT OUT IN TIME STEP (LB)	SYSTEM MOLECULAR WT. (LB/LB-MOLE)
0.	4.400000+02	7.000000+02	0.	0.	4.000000+00
1.0000-01	4.416767+02	7.028510+02	-0.	0.	4.009939+00
2.0000-01	3.748112+02	6.268690+02	-0.	3.915048+02	4.020712+00
3.0000-01	3.330883+02	6.000000+02	-0.	3.440724+02	4.032366+00
4.0000-01	3.039513+02	6.000000+02	-0.	3.100312+02	4.044942+00
5.0000-01	2.774285+02	6.000000+02	-0.	2.833130+02	4.058507+00
6.0000-01	2.532844+02	6.000000+02	-0.	2.589861+02	4.073134+00
7.0000-01	2.313044+02	6.000000+02	-0.	2.368349+02	4.088899+00
8.0000-01	2.112934+02	6.000000+02	-0.	2.166634+02	4.105881+00
9.0000-01	1.930739+02	6.000000+02	-0.	1.982932+02	4.124168+00
10.0000-01	1.764845+02	6.000000+02	-0.	1.815619+02	4.143848+00
1.5000+00	1.009152+02	6.000000+02	-0.	8.316091+02	4.307914+00
2.0000+00	5.904839+01	6.000000+02	-0.	4.839953+02	4.564346+00
2.5000+00	4.662949+01	6.000000+02	-0.	1.604343+02	4.858777+00
3.0000+00	4.722438+01	6.000000+02	-0.	4.513329+00	5.121528+00
3.5000+00	4.674982+01	6.000000+02	-0.	1.814622+01	5.361983+00
4.0000+00	4.641298+01	6.000000+02	-0.	1.614565+01	5.581320+00
4.5000+00	4.619612+01	6.000000+02	-0.	1.442955+01	5.785938+00
5.0000+00	4.606854+01	6.000000+02	-0.	1.329697+01	5.981927+00
5.5000+00	4.595971+01	6.000000+02	-0.	1.317432+01	6.170198+00
6.0000+00	4.465450+01	6.000000+02	-0.	2.627293+01	6.251969+00
6.5000+00	4.558729+01	6.000000+02	-0.	0.	6.488492+00
7.0000+00	4.639889+01	6.000000+02	-0.	1.787567+00	6.711757+00
7.5000+00	4.625193+01	6.000000+02	-0.	1.839429+01	6.927084+00
8.0000+00	4.617736+01	6.000000+02	-0.	1.738438+01	7.134412+00
8.5000+00	4.611272+01	6.000000+02	-0.	1.742739+01	7.334062+00
9.0000+00	4.605212+01	6.000000+02	-0.	1.754326+01	7.526361+00
9.5000+00	4.599937+01	6.000000+02	-0.	1.755191+01	7.711605+00
1.0000+01	4.595772+01	6.000000+02	-0.	1.746181+01	7.890065+00
1.2000+01	4.910250+01	6.000000+02	-0.	0.	8.513724+00
1.4000+01	5.204922+01	6.000000+02	-0.	0.	9.023667+00
1.6000+01	5.479824+01	6.000000+02	-0.	0.	9.444392+00
1.8000+01	5.735499+01	6.000000+02	-0.	0.	9.794335+00
2.0000+01	5.908874+01	6.000000+02	-0.	1.671268+01	1.009255+01
2.2000+01	5.882450+01	6.000000+02	-0.	6.599783+01	1.035798+01
2.4000+01	5.549139+01	6.000000+02	-0.	1.478999+02	1.061308+01
2.6000+01	5.136544+01	6.000000+02	-0.	1.710965+02	1.086692+01
2.8000+01	4.931138+01	6.000000+02	-0.	1.138042+02	1.111017+01
3.0000+01	4.859550+01	6.000000+02	-0.	7.535936+01	1.133766+01
3.2000+01	4.827293+01	6.000000+02	-0.	6.340707+01	1.154916+01
3.4000+01	4.805394+01	6.000000+02	-0.	5.974855+01	1.174569+01
3.6000+01	4.788331+01	6.000000+02	-0.	5.763832+01	1.192842+01
3.8000+01	4.773654+01	6.000000+02	-0.	5.620866+01	1.209846+01
4.0000+01	4.761442+01	6.000000+02	-0.	5.470334+01	1.225683+01
4.2000+01	4.750762+01	6.000000+02	-0.	5.345773+01	1.240449+01
4.4000+01	4.740947+01	6.000000+02	-0.	5.240469+01	1.254230+01
4.6000+01	4.732587+01	6.000000+02	-0.	5.114343+01	1.267106+01
4.8000+01	4.724560+01	6.000000+02	-0.	5.024280+01	1.279148+01
5.0000+01	4.717704+01	6.000000+02	-0.	4.906013+01	1.290422+01
5.2000+01	4.710912+01	6.000000+02	-0.	4.824951+01	1.300987+01

PRIMARY SYSTEM SUMMARY (PART 1)

TIME (SEC)	PRESSURE (PSI)	TEMPERATURE (DEG F)	HEAT ADDED IN SYSTEM (BTU)	WEIGHT OUT IN TIME STEP (LB)	SYSTEM MOLECULAR WT. (LB/LB-MOLE)
5.4000+01	4.705075+01	6.000000+02	-0.	4.714200+01	1.310898+01
5.6000+01	4.699141+01	6.000000+02	-0.	4.639932+01	1.320203+01
5.8000+01	4.694052+01	6.000000+02	-0.	4.534187+01	1.328948+01
6.0000+01	4.689128+01	6.000000+02	-0.	4.452969+01	1.337173+01
6.5000+01	4.985012+01	6.000000+02	-0.	0.	1.354902+01
7.0000+01	5.269492+01	6.000000+02	-0.	0.	1.369237+01
7.5000+01	5.525149+01	6.000000+02	-0.	6.589310+00	1.380980+01
8.0000+01	5.404658+01	6.000000+02	-0.	1.388820+02	1.391338+01
8.5000+01	5.354602+01	6.000000+02	-0.	1.089133+02	1.400561+01
9.0000+01	5.294757+01	6.000000+02	-0.	1.086413+02	1.408788+01
9.5000+01	5.243306+01	6.000000+02	-0.	1.019019+02	1.416148+01
1.0000+02	5.195103+01	6.000000+02	-0.	9.730678+01	1.422746+01
1.0500+02	5.150598+01	6.000000+02	-0.	9.275751+01	1.428675+01
1.1000+02	5.109132+01	6.000000+02	-0.	8.865396+01	1.434014+01
1.1500+02	5.070495+01	6.000000+02	-0.	8.481247+01	1.438831+01
1.2000+02	5.034330+01	6.000000+02	-0.	8.127483+01	1.443185+01
1.2500+02	5.000421+01	6.000000+02	-0.	7.797606+01	1.447128+01
1.3000+02	4.968522+01	6.000000+02	-0.	7.491412+01	1.450704+01
1.3500+02	4.938075+01	6.000000+02	-0.	7.219778+01	1.453953+01
1.4000+02	4.909947+01	6.000000+02	-0.	6.927400+01	1.456910+01
1.4500+02	4.883002+01	6.000000+02	-0.	6.690001+01	1.459603+01
1.5000+02	4.857617+01	6.000000+02	-0.	6.448663+01	1.462060+01
1.5500+02	4.833455+01	6.000000+02	-0.	6.230055+01	1.464305+01
1.6000+02	4.810506+01	6.000000+02	-0.	6.020955+01	1.466358+01
1.6500+02	4.788633+01	6.000000+02	-0.	5.825528+01	1.468239+01
1.7000+02	4.767778+01	6.000000+02	-0.	5.640253+01	1.469962+01
1.7500+02	4.747840+01	6.000000+02	-0.	5.466147+01	1.471544+01
1.8000+02	4.728422+01	6.000000+02	-0.	5.314174+01	1.472998+01
1.8500+02	4.710438+01	6.000000+02	-0.	5.133218+01	1.474335+01
1.9000+02	4.692792+01	6.000000+02	-0.	5.000763+01	1.475565+01
1.9500+02	4.676104+01	6.000000+02	-0.	4.849767+01	1.476699+01
2.0000+02	4.658949+01	6.000000+02	-0.	4.754869+01	1.477737+01
2.2000+02	4.514528+01	6.000000+02	-0.	1.707110+02	1.473442+01
2.4000+02	4.507815+01	6.000000+02	-0.	1.040292+02	1.470973+01
2.6000+02	4.509776+01	6.000000+02	-0.	9.215948+01	1.469476+01
2.8000+02	4.488071+01	6.000000+02	-0.	9.449225+01	1.468647+01
3.0000+02	4.483555+01	6.000000+02	-0.	8.208752+01	1.468344+01
3.2000+02	4.460963+01	6.000000+02	-0.	8.437126+01	1.468397+01
3.4000+02	4.452090+01	6.000000+02	-0.	7.500850+01	1.468733+01
3.6000+02	4.428291+01	6.000000+02	-0.	7.735898+01	1.469259+01

PRIMARY SYSTEM SUMMARY (PART 2, INVENTORY)

TIME (SEC)	PRESSURE (PSI)	WEIGHT OF SAT STEAM (LB)	WEIGHT OF HELIUM (LB)	WEIGHT OF HYDROGEN (LB)	WEIGHT OF CARBON MONOXIDE (LB)	WEIGHT OF WATER (LB)
0.	4.400000+02	0.	4.207000+03	0.	0.	0.
1.0000-01	4.416767+02	1.343122+01	4.207000+03	1.309504-03	1.831124-02	0.
2.0000-01	3.748112+02	2.543032+01	3.816743+03	1.188030-03	1.661262-02	0.
3.0000-01	3.330883+02	3.617150+01	3.474949+03	4.485678-03	6.272473-02	0.
4.0000-01	3.039513+02	4.579264+01	3.168118+03	8.513765-03	1.190508-01	0.
5.0000-01	2.774285+02	5.436959+01	2.888853+03	1.318761-02	1.844068-01	0.
6.0000-01	2.532844+02	6.200105+01	2.634668+03	1.832818-02	2.562890-01	0.
7.0000-01	2.313044+02	6.877677+01	2.403302+03	2.378672-02	3.326176-01	0.
8.0000-01	2.112934+02	7.477835+01	2.192697+03	2.944118-02	4.116859-01	0.
9.0000-01	1.930739+02	8.007999+01	2.000980+03	3.519202-02	4.921018-01	0.
10.0000-01	1.764945+02	8.474913+01	1.826449+03	4.095852-02	5.727366-01	0.
1.5000+00	1.009152+02	1.034573+02	1.031972+03	6.954499-02	9.724707-01	0.
2.0000+00	5.904839+01	1.106607+02	5.924801+02	9.509378-02	1.329728+00	0.
2.5000+00	4.662949+01	1.327345+02	4.575684+02	1.315317-01	1.839251+00	0.
3.0000+00	4.722438+01	1.752026+02	4.540815+02	1.990874-01	2.783906+00	0.
3.5000+00	4.674982+01	2.100251+02	4.410493+02	2.820105-01	3.943446+00	0.
4.0000+00	4.641298+01	2.413226+02	4.301825+02	3.794822-01	5.306427+00	0.
4.5000+00	4.619512+01	2.703852+02	4.210162+02	4.896091-01	6.846367+00	0.
5.0000+00	4.606854+01	2.982510+02	4.130042+02	6.110644-01	8.544717+00	0.
5.5000+00	4.595971+01	3.247519+02	4.054515+02	7.425502-01	1.038333+01	0.
6.0000+00	4.465450+01	3.257032+02	3.910822+02	8.700542-01	1.216640+01	0.
6.5000+00	4.558729+01	3.668422+02	3.910822+02	1.023127+00	1.430673+01	0.
7.0000+00	4.639389+01	4.060668+02	3.901781+02	1.191767+00	1.666488+01	0.
7.5000+00	4.625193+01	4.359283+02	3.813622+02	1.352691+00	1.891513+01	0.
8.0000+00	4.617736+01	4.649394+02	3.734466+02	1.525007+00	2.132468+01	0.
8.5000+00	4.611272+01	4.926371+02	3.658898+02	1.706599+00	2.386394+01	0.
9.0000+00	4.605212+01	5.190395+02	3.586294+02	1.896579+00	2.652050+01	0.
9.5000+00	4.599937+01	5.442598+02	3.516823+02	2.094440+00	2.928726+01	0.
1.0000+01	4.595772+01	5.684062+02	3.450600+02	2.299783+00	3.215863+01	0.
1.2000+01	4.910250+01	6.980749+02	3.450600+02	3.317579+00	4.639081+01	0.
1.4000+01	5.204922+01	8.146551+02	3.450600+02	4.544869+00	6.355241+01	0.
1.6000+01	5.479824+01	9.186481+02	3.450600+02	5.954754+00	8.326731+01	0.
1.8000+01	5.735499+01	1.010740+03	3.450600+02	7.523282+00	1.052006+02	0.
2.0000+01	5.908374+01	1.080848+03	3.411330+02	9.143372+00	1.278548+02	0.
2.2000+01	5.882450+01	1.107871+03	3.266915+02	1.056262+01	1.477006+02	0.
2.4000+01	5.549139+01	1.072112+03	2.963570+02	1.142001+01	1.596899+02	0.
2.6000+01	5.136544+01	1.017126+03	2.634222+02	1.192280+01	1.667205+02	0.
2.8000+01	4.931138+01	9.994753+02	2.428776+02	1.267035+01	1.771737+02	0.
3.0000+01	4.859550+01	1.005730+03	2.300979+02	1.364697+01	1.908301+02	0.
3.2000+01	4.827293+01	1.017305+03	2.199682+02	1.469364+01	2.054661+02	0.
3.4000+01	4.805394+01	1.028550+03	2.109504+02	1.575155+01	2.202591+02	0.
3.6000+01	4.788831+01	1.038579+03	2.027100+02	1.680904+01	2.350465+02	0.
3.8000+01	4.773654+01	1.047108+03	1.950791+02	1.785991+01	2.497411+02	0.
4.0000+01	4.761442+01	1.054365+03	1.880109+02	1.890513+01	2.643567+02	0.
4.2000+01	4.750762+01	1.060334+03	1.814231+02	1.994191+01	2.788544+02	0.
4.4000+01	4.740947+01	1.065031+03	1.752516+02	2.096783+01	2.932002+02	0.
4.6000+01	4.732587+01	1.068737+03	1.694856+02	2.198550+01	3.074306+02	0.
4.8000+01	4.724560+01	1.071329+03	1.640536+02	2.299030+01	3.214810+02	0.
5.0000+01	4.717704+01	1.073114+03	1.589592+02	2.398611+01	3.354058+02	0.
5.2000+01	4.710912+01	1.073944+03	1.541399+02	2.496788+01	3.491341+02	0.

PRIMARY SYSTEM SUMMARY (PART 2, INVENTORY)

TIME (SEC)	PRESSURE (PSI)	WEIGHT OF SAT STEAM (LB)	WEIGHT OF HELIUM (LB)	WEIGHT OF HYDROGEN (LB)	WEIGHT OF CARBON MONOXIDE (LB)	WEIGHT OF WATER (LB)
5.4000+01	4.705075+01	1.074116+03	1.496045+02	2.594009+01	3.627290+02	0.
5.6000+01	4.699141+01	1.073474+03	1.452994+02	2.689750+01	3.761167+02	0.
5.8000+01	4.694052+01	1.072310+03	1.412371+02	2.784528+01	3.893698+02	0.
6.0000+01	4.689128+01	1.070534+03	1.373805+02	2.877993+01	4.024394+02	0.
6.5000+01	4.585012+01	1.133785+03	1.373805+02	3.300343+01	4.614979+02	0.
7.0000+01	5.269492+01	1.187730+03	1.373805+02	3.744594+01	5.236191+02	0.
7.5000+01	5.525149+01	1.229349+03	1.369006+02	4.193972+01	5.864571+02	0.
8.0000+01	5.404658+01	1.182456+03	1.273685+02	4.377917+01	6.121787+02	0.
8.5000+01	5.354602+01	1.152113+03	1.203117+02	4.592183+01	6.421402+02	0.
9.0000+01	5.294757+01	1.119854+03	1.136446+02	4.781743+01	6.686470+02	0.
9.5000+01	5.243306+01	1.089836+03	1.077057+02	4.962590+01	6.939355+02	0.
1.0000+02	5.195103+01	1.060934+03	1.023065+02	5.132227+01	7.176564+02	0.
1.0500+02	5.150598+01	1.033264+03	9.739517+01	5.292481+01	7.400652+02	0.
1.1000+02	5.109132+01	1.006696+03	9.290658+01	5.443986+01	7.612507+02	0.
1.1500+02	5.070495+01	9.811896+02	8.879252+01	5.587623+01	7.813359+02	0.
1.2000+02	5.034330+01	9.566707+02	8.500864+01	5.723977+01	8.004028+02	0.
1.2500+02	5.000421+01	9.330915+02	8.151864+01	5.853654+01	8.185360+02	0.
1.3000+02	4.968522+01	9.103971+02	7.829035+01	5.977126+01	8.358014+02	0.
1.3500+02	4.938075+01	8.884746+02	7.529055+01	6.094388+01	8.521986+02	0.
1.4000+02	4.909947+01	8.674734+02	7.251168+01	6.207070+01	8.679553+02	0.
1.4500+02	4.883002+01	8.471696+02	6.991756+01	6.314346+01	8.829561+02	0.
1.5000+02	4.857617+01	8.276200+02	6.749765+01	6.417152+01	8.973318+02	0.
1.5500+02	4.833455+01	8.087507+02	6.523271+01	6.515501+01	9.110842+02	0.
1.6000+02	4.810506+01	7.905457+02	6.310992+01	6.609772+01	9.242665+02	0.
1.6500+02	4.788633+01	7.729675+02	6.111618+01	6.700148+01	9.369040+02	0.
1.7000+02	4.767778+01	7.559918+02	5.924070+01	6.786876+01	9.490315+02	0.
1.7500+02	4.747840+01	7.395880+02	5.747326+01	6.870123+01	9.606722+02	0.
1.8000+02	4.728422+01	7.236797+02	5.580103+01	6.949593+01	9.717848+02	0.
1.8500+02	4.710438+01	7.083969+02	5.422785+01	7.026861+01	9.825894+02	0.
1.9000+02	4.692792+01	6.935527+02	5.273414+01	7.100584+01	9.928984+02	0.
1.9500+02	4.676104+01	6.792303+02	5.132131+01	7.171891+01	1.002869+03	0.
2.0000+02	4.658949+01	6.651707+02	4.996947+01	7.238991+01	1.012252+03	0.
2.2000+02	4.514528+01	5.617379+02	4.522982+01	7.554753+01	1.056406+03	0.
2.4000+02	4.507815+01	5.001015+02	4.252399+01	7.947510+01	1.111327+03	0.
2.6000+02	4.509776+01	4.522675+02	4.026316+01	8.275095+01	1.157134+03	0.
2.8000+02	4.488071+01	4.113433+02	3.806706+01	8.500748+01	1.188688+03	0.
3.0000+02	4.483555+01	3.796107+02	3.625357+01	8.710697+01	1.218046+03	0.
3.2000+02	4.460963+01	3.518369+02	3.447627+01	8.850453+01	1.237588+03	0.
3.4000+02	4.452090+01	3.297713+02	3.296611+01	8.987680+01	1.256777+03	0.
3.6000+02	4.428291+01	3.100195+02	3.147422+01	9.072545+01	1.268644+03	0.

CONTAINMENT SUMMARY (PART 1, THERMAL DATA)

TIME (SEC)	PRESSURE (PSI)	TEMPERATURE (DEG F)	HEAT ABSORBED IN CONCRETE (BTU)	HEAT ABSORBED IN STEEL (BTU)
0.	1.470000+01	1.050000+02	0.	0.
1.0000-01	1.469987+01	1.050000+02	0.	0.
2.0000-01	1.759089+01	1.666471+02	0.	0.
3.0000-01	2.005751+01	2.114545+02	4.241401+02	0.
4.0000-01	2.227501+01	2.473851+02	5.552475+02	2.599350+02
5.0000-01	2.433062+01	2.781253+02	6.494397+02	8.773353+01
6.0000-01	2.622967+01	3.045974+02	7.534245+02	7.505983+01
7.0000-01	2.797779+01	3.274756+02	8.281348+02	5.520051+02
8.0000-01	2.958802+01	3.474629+02	8.842760+02	1.117257+02
9.0000-01	3.106760+01	3.649672+02	9.108325+02	9.760811+01
10.0000-01	3.242245+01	3.802786+02	9.645020+02	7.202569+02
1.5000+00	3.871987+01	4.444925+02	3.525453+03	7.843205+02
2.0000+00	4.228132+01	4.760308+02	6.127532+03	2.285088+03
2.5000+00	4.337709+01	4.848418+02	5.728364+03	2.273980+03
3.0000+00	4.337792+01	4.844383+02	4.884528+03	1.099592+03
3.5000+00	4.346189+01	4.847333+02	4.314149+03	1.844119+03
4.0000+00	4.353285+01	4.849745+02	4.399971+03	9.351388+02
4.5000+00	4.358535+01	4.849985+02	4.401134+03	1.862672+03
5.0000+00	4.362869+01	4.849477+02	4.383237+03	1.856542+03
5.5000+00	4.367373+01	4.849748+02	4.372521+03	9.257495+02
6.0000+00	4.378114+01	4.854664+02	4.382287+03	1.856731+03
6.5000+00	4.375399+01	4.848800+02	4.421318+03	9.518147+02
7.0000+00	4.373207+01	4.842886+02	4.289975+03	1.826504+03
7.5000+00	4.379089+01	4.843830+02	4.275360+03	1.820488+03
8.0000+00	4.384614+01	4.844991+02	4.389507+03	9.318857+02
8.5000+00	4.389455+01	4.844964+02	4.394432+03	1.860372+03
9.0000+00	4.394152+01	4.844842+02	4.372381+03	1.853092+03
9.5000+00	4.399143+01	4.845610+02	4.339477+03	9.257424+02
1.0000+01	4.403419+01	4.845132+02	4.390516+03	1.859209+03
1.2000+01	4.391769+01	4.820141+02	1.748206+04	5.556320+03
1.4000+01	4.380205+01	4.795337+02	1.665472+04	6.212141+03
1.6000+01	4.369258+01	4.771858+02	1.643067+04	5.214558+03
1.8000+01	4.357953+01	4.747608+02	1.628584+04	6.069107+03
2.0000+01	4.352946+01	4.729696+02	1.600432+04	5.073746+03
2.2000+01	4.363911+01	4.725688+02	1.609918+04	5.110845+03
2.4000+01	4.399712+01	4.742224+02	1.673413+04	6.214253+03
2.6000+01	4.441333+01	4.763173+02	1.789378+04	5.720187+03
2.8000+01	4.463454+01	4.786305+02	1.836123+04	6.771199+03
3.0000+01	4.474509+01	4.761471+02	1.729134+04	5.513395+03
3.2000+01	4.481544+01	4.753166+02	1.673124+04	6.230426+03
3.4000+01	4.487854+01	4.745109+02	1.644743+04	5.216455+03
3.6000+01	4.492892+01	4.735530+02	1.635774+04	6.101328+03
3.8000+01	4.497888+01	4.726701+02	1.614992+04	5.128180+03
4.0000+01	4.502257+01	4.717383+02	1.616124+04	5.123521+03
4.2000+01	4.505756+01	4.706950+02	1.600084+04	5.977173+03
4.4000+01	4.509393+01	4.697395+02	1.580129+04	5.013687+03
4.6000+01	4.512088+01	4.686526+02	1.582730+04	5.905265+03
4.8000+01	4.515038+01	4.676671+02	1.556227+04	4.934916+03
5.0000+01	4.517104+01	4.665557+02	1.557972+04	5.828199+03
5.2000+01	4.519451+01	4.655436+02	1.536700+04	4.860039+03

CONTAINMENT SUMMARY (PART 1, THERMAL DATA)

TIME (SEC)	PRESSURE (PSI)	TEMPERATURE (DEG F)	HEAT ABSORBED IN CONCRETE (BTU)	HEAT ABSORBED IN STEEL (BTU)
5.4000+01	4.520977+01	4.644130+02	1.535679+04	5.749826+03
5.6000+01	4.522838+01	4.633876+02	1.510883+04	4.785203+03
5.8000+01	4.524313+01	4.623282+02	1.517657+04	4.799904+03
6.0000+01	4.525186+01	4.611826+02	1.500253+04	5.626383+03
6.5000+01	4.498728+01	4.557964+02	3.934009+04	1.337543+04
7.0000+01	4.477030+01	4.513794+02	3.227424+04	1.095621+04
7.5000+01	4.456676+01	4.470490+02	3.267105+04	1.110566+04
8.0000+01	4.469115+01	4.456808+02	3.180992+04	1.081491+04
8.5000+01	4.470846+01	4.430180+02	3.662877+04	1.245114+04
9.0000+01	4.473977+01	4.406818+02	3.360019+04	1.225598+04
9.5000+01	4.475718+01	4.382804+02	3.369787+04	1.146014+04
1.0000+02	4.476724+01	4.358831+02	3.300459+04	1.122634+04
1.0500+02	4.476915+01	4.334691+02	3.248724+04	1.104211+04
1.1000+02	4.476481+01	4.310609+02	3.185918+04	1.084030+04
1.1500+02	4.475445+01	4.286537+02	3.131633+04	1.065691+04
1.2000+02	4.473899+01	4.262556+02	3.076116+04	1.046975+04
1.2500+02	4.471881+01	4.238656+02	3.025686+04	1.029055+04
1.3000+02	4.469094+01	4.214174+02	2.969659+04	1.089004+04
1.3500+02	4.466524+01	4.190954+02	2.896420+04	9.857102+03
1.4000+02	4.463357+01	4.167424+02	2.880277+04	9.804652+03
1.4500+02	4.460032+01	4.144300+02	2.818885+04	9.588031+03
1.5000+02	4.456413+01	4.121312+02	2.775832+04	9.451965+03
1.5500+02	4.452598+01	4.098586+02	2.727030+04	9.287840+03
1.6000+02	4.448578+01	4.076071+02	2.683464+04	9.141254+03
1.6500+02	4.444394+01	4.053805+02	2.638869+04	8.990973+03
1.7000+02	4.440043+01	4.031750+02	2.599162+04	8.848301+03
1.7500+02	4.435222+01	4.009285+02	2.553448+04	9.431418+03
1.8000+02	4.430862+01	3.988155+02	2.485605+04	8.467586+03
1.8500+02	4.426049+01	3.966654+02	2.490255+04	8.486344+03
1.9000+02	4.421360+01	3.945776+02	2.425255+04	8.265672+03
1.9500+02	4.416466+01	3.924924+02	2.403500+04	8.193391+03
2.0000+02	4.411665+01	3.904537+02	2.356394+04	8.034277+03
2.2000+02	4.369744+01	3.784443+02	1.212787+05	4.209948+04
2.4000+02	4.350826+01	3.724419+02	6.441112+04	2.194102+04
2.6000+02	4.312454+01	3.630248+02	8.920234+04	3.111733+04
2.8000+02	4.293227+01	3.572453+02	6.169977+04	2.105296+04
3.0000+02	4.260329+01	3.491719+02	7.804661+04	2.668980+04
3.2000+02	4.242368+01	3.439148+02	5.588208+04	1.971040+04
3.4000+02	4.212962+01	3.367200+02	7.036948+04	2.410117+04
3.6000+02	4.197611+01	3.321569+02	4.955897+04	1.754022+04

CONTAINMENT SUMMARY (PART 2, INVENTORY)

TIME (SEC)	PRESSURE (PSI)	WEIGHT OF HELIUM (LB)	WEIGHT OF HYDROGEN (LB)	WEIGHT OF CARBON MONOXIDE (LB)	WEIGHT OF STEAM (LB)	WEIGHT OF ALL GASES (LB)
0.	1.470000+01	0.	0.	0.	0.	3.462800+04
1.0000-01	1.469987+01	0.	0.	0.	0.	3.462800+04
2.0000-01	1.759089+01	3.902570+02	1.214745-04	1.698619-03	1.245930+00	3.501950+04
3.0000-01	2.005751+01	7.320505+02	2.278639-04	3.186296-03	3.523243+00	3.536358+04
4.0000-01	2.227501+01	1.038882+03	6.239407-04	8.724770-03	6.717116+00	3.567351+04
5.0000-01	2.433062+01	1.318147+03	1.374417-03	1.921893-02	1.075367+01	3.595692+04
6.0000-01	2.622967+01	1.572332+03	2.534771-03	3.544455-02	1.553755+01	3.621591+04
7.0000-01	2.797779+01	1.803698+03	4.144279-03	5.795084-02	2.098224+01	3.645274+04
8.0000-01	2.958802+01	2.014303+03	6.228747-03	8.709865-02	2.700926+01	3.666940+04
9.0000-01	3.106760+01	2.206020+03	8.802910-03	1.230940-01	3.354743+01	3.686770+04
1.0000+00	3.242245+01	2.380551+03	1.187246-02	1.660165-01	4.053223+01	3.704926+04
1.5000+00	3.871887+01	3.175028+03	2.968879-02	4.151482-01	7.739681+01	3.788087+04
2.0000+00	4.228132+01	3.614520+03	5.930630-02	8.292998-01	1.214567+02	3.836486+04
2.5000+00	4.337799+01	3.749431+03	8.095980-02	1.132088+00	1.466549+02	3.852530+04
3.0000+00	4.337792+01	3.752918+03	8.196211-02	1.146104+00	1.476664+02	3.852981+04
3.5000+00	4.346189+01	3.765951+03	8.767597-02	1.226002+00	1.526948+02	3.854796+04
4.0000+00	4.353285+01	3.776817+03	9.462430-02	1.323163+00	1.578695+02	3.856410+04
4.5000+00	4.358535+01	3.785984+03	1.027103-01	1.436232+00	1.630116+02	3.857853+04
5.0000+00	4.362869+01	3.793996+03	1.120275-01	1.566518+00	1.681570+02	3.859183+04
5.5000+00	4.367373+01	3.801548+03	1.232022-01	1.722778+00	1.736112+02	3.860500+04
6.0000+00	4.378114+01	3.815918+03	1.495184-01	2.090766+00	1.851205+02	3.863127+04
6.5000+00	4.375399+01	3.815918+03	1.495184-01	2.090766+00	1.851205+02	3.863127+04
7.0000+00	4.373207+01	3.816822+03	1.518836-01	2.123839+00	1.859685+02	3.863306+04
7.5000+00	4.379089+01	3.825637+03	1.738111-01	2.500375+00	1.951434+02	3.865146+04
8.0000+00	4.384614+01	3.833553+03	2.068876-01	2.892978+00	2.041916+02	3.866884+04
8.5000+00	4.389455+01	3.841110+03	2.377466-01	3.324490+00	2.135998+02	3.868627+04
9.0000+00	4.394152+01	3.848370+03	2.716109-01	3.798025+00	2.233752+02	3.870381+04
9.5000+00	4.399143+01	3.855317+03	3.083498-01	4.311757+00	2.334296+02	3.872136+04
1.0000+01	4.403419+01	3.861940+03	3.477887-01	4.863246+00	2.436782+02	3.873882+04
1.2000+01	4.391769+01	3.861940+03	3.477887-01	4.863246+00	2.436782+02	3.873882+04
1.4000+01	4.380205+01	3.861940+03	3.477887-01	4.863246+00	2.436782+02	3.873882+04
1.6000+01	4.369258+01	3.861940+03	3.477887-01	4.863246+00	2.436782+02	3.873882+04
1.8000+01	4.357953+01	3.861940+03	3.477887-01	4.863246+00	2.436782+02	3.873882+04
2.0000+01	4.352946+01	3.865866+03	4.334082-01	6.060491+00	2.551810+02	3.875554+04
2.2000+01	4.363911+01	3.880308+03	8.204836-01	1.147310+01	3.009376+02	3.882153+04
2.4000+01	4.399712+01	3.910643+03	1.801263+00	2.518766+01	4.038076+02	3.896943+04
2.6000+01	4.441333+01	3.943577+03	3.070392+00	4.293432+01	5.229536+02	3.914053+04
2.8000+01	4.463454+01	3.964122+03	4.000266+00	5.593706+01	6.022805+02	3.925433+04
3.0000+01	4.474509+01	3.976902+03	4.666955+00	6.525958+01	6.548709+02	3.932969+04
3.2000+01	4.481544+01	3.987031+03	5.267740+00	7.366057+01	6.991465+02	3.939310+04
3.4000+01	4.487854+01	3.996049+03	5.870117+00	8.209380+01	7.408517+02	3.945285+04
3.6000+01	4.492892+01	4.004289+03	6.485424+00	9.068785+01	7.810302+02	3.951048+04
3.8000+01	4.497888+01	4.011920+03	7.118192+00	9.953605+01	8.201270+02	3.956669+04
4.0000+01	4.502257+01	4.018988+03	7.765301+00	1.085848+02	8.580663+02	3.962140+04
4.2000+01	4.505756+01	4.025576+03	8.427728+00	1.178477+02	8.950108+02	3.967485+04
4.4000+01	4.509393+01	4.031748+03	9.106088+00	1.273335+02	9.310800+02	3.972726+04
4.6000+01	4.512088+01	4.037514+03	9.799957+00	1.369801+02	9.661209+02	3.977840+04
4.8000+01	4.515038+01	4.042946+03	1.050059+01	1.468333+02	1.000374+03	3.982864+04
5.0000+01	4.517104+01	4.048040+03	1.121452+01	1.568164+02	1.033643+03	3.987770+04
5.2000+01	4.519451+01	4.052859+03	1.194173+01	1.669851+02	1.066177+03	3.992595+04

CONTAINMENT SUMMARY (PART 2, INVENTORY)

TIME (SEC)	PRESSURE (PSI)	WEIGHT OF HELIUM (LB)	WEIGHT OF HYDROGEN (LB)	WEIGHT OF CARBON MONOXIDE (LB)	WEIGHT OF STEAM (LB)	WEIGHT OF ALL GASES (LB)
5.4000+01	4.520977+01	4.057395+03	1.267637+01	1.772579+02	1.097776+03	3.997310+04
5.6000+01	4.522838+01	4.061700+03	1.342284+01	1.876961+02	1.128686+03	4.001949+04
5.8000+01	4.524313+01	4.065762+03	1.417484+01	1.982115+02	1.158698+03	4.006484+04
6.0000+01	4.525186+01	4.069619+03	1.493519+01	2.088437+02	1.187978+03	4.010937+04
6.5000+01	4.498728+01	4.069619+03	1.493519+01	2.088437+02	1.187978+03	4.010937+04
7.0000+01	4.477030+01	4.069619+03	1.493519+01	2.088437+02	1.187978+03	4.010937+04
7.5000+01	4.456676+01	4.070099+03	1.506600+01	2.106729+02	1.192128+03	4.011595+04
8.0000+01	4.469115+01	4.079631+03	1.798615+01	2.515064+02	1.277724+03	4.025484+04
8.5000+01	4.470846+01	4.086687+03	2.041172+01	2.854239+02	1.343237+03	4.036375+04
9.0000+01	4.473977+01	4.093355+03	2.295650+01	3.210084+02	1.407082+03	4.047239+04
9.5000+01	4.475718+01	4.099293+03	2.545536+01	3.559508+02	1.465604+03	4.057429+04
1.0000+02	4.476724+01	4.104693+03	2.794309+01	3.907375+02	1.520237+03	4.067160+04
1.0500+02	4.476915+01	4.109604+03	3.040685+01	4.251891+02	1.571168+03	4.076436+04
1.1000+02	4.476481+01	4.114092+03	3.284596+01	4.592960+02	1.618787+03	4.085301+04
1.1500+02	4.475445+01	4.118206+03	3.525665+01	4.930055+02	1.663366+03	4.093782+04
1.2000+02	4.473899+01	4.121990+03	3.763781+01	5.263020+02	1.705179+03	4.101910+04
1.2500+02	4.471881+01	4.125480+03	3.998777+01	5.591623+02	1.744455+03	4.109707+04
1.3000+02	4.469094+01	4.128709+03	4.230592+01	5.915778+02	1.781407+03	4.117199+04
1.3500+02	4.466524+01	4.131708+03	4.459613+01	6.236026+02	1.816290+03	4.124418+04
1.4000+02	4.463357+01	4.134487+03	4.684548+01	6.550560+02	1.849082+03	4.131346+04
1.4500+02	4.460032+01	4.137081+03	4.906607+01	6.861073+02	1.880116+03	4.138036+04
1.5000+02	4.456413+01	4.139501+03	5.125153+01	7.166672+02	1.909437+03	4.144484+04
1.5500+02	4.452598+01	4.141766+03	5.340486+01	7.467780+02	1.937209+03	4.150714+04
1.6000+02	4.448578+01	4.143889+03	5.552512+01	7.764263+02	1.963527+03	4.156735+04
1.6500+02	4.444394+01	4.145883+03	5.761324+01	8.056252+02	1.988502+03	4.162561+04
1.7000+02	4.440043+01	4.147758+03	5.966932+01	8.343761+02	2.012222+03	4.168201+04
1.7500+02	4.435222+01	4.149525+03	6.169418+01	8.626903+02	2.034777+03	4.173667+04
1.8000+02	4.430862+01	4.151198+03	6.369310+01	8.906419+02	2.056296+03	4.178981+04
1.8500+02	4.426049+01	4.152771+03	6.565238+01	9.180391+02	2.076698+03	4.184115+04
1.9000+02	4.421360+01	4.154264+03	6.758793+01	9.451046+02	2.096211+03	4.189115+04
1.9500+02	4.416466+01	4.155677+03	6.949028+01	9.717058+02	2.114792+03	4.193965+04
2.0000+02	4.411665+01	4.157029+03	7.137941+01	9.981221+02	2.132684+03	4.198720+04
2.2000+02	4.369744+01	4.161769+03	7.824566+01	1.094135+03	2.195776+03	4.215791+04
2.4000+02	4.350826+01	4.164474+03	8.276521+01	1.157334+03	2.229381+03	4.226194+04
2.6000+02	4.312454+01	4.166735+03	8.699059+01	1.216418+03	2.255969+03	4.235410+04
2.8000+02	4.293227+01	4.168931+03	9.150413+01	1.279533+03	2.280638+03	4.244859+04
3.0000+02	4.260329+01	4.170745+03	9.555382+01	1.336161+03	2.300234+03	4.253068+04
3.2000+02	4.242368+01	4.172522+03	9.982416+01	1.395875+03	2.318844+03	4.261505+04
3.4000+02	4.212962+01	4.174032+03	1.037009+02	1.450085+03	2.334255+03	4.269006+04
3.6000+02	4.197611+01	4.175524+03	1.077683+02	1.506960+03	2.349179+03	4.276742+04

END-OF-DATA ENCOUNTERED ON SYSTEM INPUT FILE.

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3. Schneider, P. J., Conduction Heat Transfer, Addison-Wesley Publishing Company, Reading, Mass., 1957, p. 384.