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Computer Fire Modeling for the Prediction of Flashover

U.S. DEPARTMENT OF COMMERCE
National Bureau of Standards
National Engineering Laboratory
Center for Fire Research
Washington, DC 20234

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U.S. DEPARTMENT OF COMMERCE, Malcolm Baldrige, *Secretary*
NATIONAL BUREAU OF STANDARDS, Ernest Ambler, *Director*

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COMPUTER FIRE MODELING FOR THE PREDICTION OF FLASHOVER

Richard D. Peacock
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Abstract

This study presents an initial look at the potential for the use of fire growth models. A technique is presented, based upon numerous fire growth predictions to estimate the minimum energy required to produce temperature levels capable of promoting flashover in a variety of room configurations. The parameters investigated included room size, room ventilation, ceiling height and room lining material. A comparison is presented of the predictions made with available full-scale fire test data and with other predictions. The technique, although needing refinement, shows promise to estimate flash-over potential.

Key words: Compartment fires; computers; fire growth; flashover; mathematical models.

1. INTRODUCTION

Recent advances in computing and mathematical modeling of physical phenomena have led to the development of a number of computer programs for the prediction of the growth of a fire within a room. Owing to the complexity of the problem, many of the models require large computing facilities not always available to the fire safety engineering designer. Until recently, the application of these models has been limited to experiments designed to verify the prediction capabilities of the models. Nonetheless, the successful use of the computer for the prediction of fire phenomena shows great promise for the designer who will be able to anticipate the fire performance of a new building design before construction and without expensive full scale fire testing.

One area of considerable interest is the prediction of flashover, the rapid transition from slow initial fire growth to full room involvement. Since it clearly signals a greatly increased risk to building occupants as well as to other building areas not initially involved on the fire, it is a logical criterion for fire safety design of building construction and use.

As a part of the Fire/Life Safety Program at the Center for Fire Research (CFR) at the National Bureau of Standards (NBS), the United States Department of Health and Human Services (HHS) has sponsored a project to investigate the potential of the prediction of the occurrence of flashover as a design criterion for building construction. The operation of any hospital, nursing home, or in some cases, board and care homes involves a degree of risk resulting from the need to maintain storage, laboratories and other areas where the fire potential is significantly more than that of the typical bedroom or similar area. The segregation of these hazardous areas is a key element in facility protection. However, the current treatment of hazardous areas in building codes lumps a wide variety of possible hazards into a two level category of hazardous areas, resulting in mandating requirements for safety that are directed at the worst problem in each level. While the protection of hazardous areas is vital to fire safety, there is currently no rational way to determine what is truly a life threatening hazard or to regulate safeguards appropriate to the true threat.

This report presents the results of the application of one of the computer fire models to the prediction of flashover to enable the designer or regulator to classify the hazard of an area based upon the potential of the space to flash over. By presenting a variety of room configurations, the intent is to provide a design tool to determine the critical energy release rate in a room necessary to produce flashover in terms of room size, shape, ventilation and room lining material. While further work will be needed to extend and refine the approach and relate it to real-world burning rates, the approach presented here provides the basis for the development of proposed adjustments to hazardous area criteria in the Life Safety Code and important professional insight to a critical problem in fire safety.

2. REVIEW OF PREVIOUS WORK

The occurrence of flashover within a room is of considerable interest to the fire protection specialist since it is perhaps the ultimate signal of untenable conditions within the room of fire origin as well as a sign of greatly increased risk to other rooms within the building. A number of experimental studies of full scale fires have been performed that provide an adequate definition of flashover in terms of measurable physical properties. Computer simulations of the growth of a fire within a room are available. A brief review of these efforts is presented below to provide a background for the study presented here.

2.1 A Working Definition of Flashover

Visually, flashover has been observed in full-scale fire tests. Quantification of the process in terms of measureable physical parameters, however, is not as easy to obtain. A considerable body of full-scale fire test data studying flashover exists from a variety of sources.

2.1.1 Temperature

Harmathy [1,2][1] presents a review of compartment fire tests and develops some theoretical predictions for comparison. For a series of full-scale compartment burnout tests, he presents average upper gas temperature rises of from 198-959°C (356-1725°F) with an average of 584°C for fully developed fires in an enclosure with a surface area of 55 m^2.

Heselden [3] and Thomas and Heselden [4] report the results of an experimental study of the behavior of fully-developed fires in single compartments carried out by a number of laboratories. Gas temperatures measured centrally in the compartment a quarter of the height below the ceiling reached an average of 1070-1145°C during three different series of tests.

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[1] Numbers in brackets refer to the literature references listed in section 9 at the end of this report.

Hagglund, et al. [5] report that flashover defined by them as flames exiting the doorway was experimentally observed when the gas temperature about 10 mm below the ceiling reached 600°C. Babrauskas [6] applied this criterion to a series of full-scale mattress fires. Of the ten mattresses tested, only two exhibited potential to flashover the test room. These two mattress fires led to maximum gas temperatures of 938°C and 1055°C (1720°F and 1931°F).

Fang [7] reported on experiments conducted in a full-scale enclosure at NBS. An average upper room temperature ranging from 450°C to 650°C (840°F to 1200°F) provided a level of radiation transfer sufficient to result in the ignition of paper flashover indicators at floor level in the compartment. The average upper room gas temperature necessary for spontaneous ignition of newsprint was 540 ± 40°C (1004 ± 70°F). It should be noted that this average included low temperatures at the mid-height of the room and that temperatures measured 25 mm (1 in) below the ceiling in his test series almost always exceeded 600°C (1110°F).

Budnick and Klein [8-11] performed several series of tests to study the fire safety of mobile homes. During tests in the living room of a mobile home, ignition of paper flashover indicators was observed with upper room temperatures ranging from 673°C to 771°C (1240°F to 1420°F). For tests where full room involvement was not noted, maximum upper room temperatures ranged from 311°C to 520°C (592°F to 968°C) [8]. Results of tests conducted in the master bedroom of a typically constructed single-width mobile home indicated peak temperatures ranging from 300°C to 375°C (572°F to 702°F) for tests where flashover was not observed and temperatures ranging from 634°C to 734°C (1173°F to 1353°F) at flashover. All temperatures reported were measured 25 mm (1 in) below the ceiling in the center of the bedroom [9].

Lee and Breese [12] report ignition of newsprint on the floor as a flashover indicator in full scale and 1/4 scale tests of submarine hull insulation at room air and doorway air temperatures of at least 650°C

(1200°F) and 550°C (1020°F) respectively. For tests where flashover was not obtained, these temperatures reached a maximum of 427°C (801°F) and 324°C (615°F). They note, however, that ignition of newsprint or some designated minimum doorway or interior air temperatures are only rough indicators of flashover because of the variation in the thermal and physical properties of crumpled newsprint, the non-uniform distribution of temperatures throughout the compartment, and the differences between tests of the combined thermal radiation from the smoke, the hot air and the heated surfaces. The hot air inside the compartment usually became well mixed by the time it exited through the doorway. Thus, they concluded that doorway temperatures may be more reliable flashover indicators than interior air temperatures.

Babrauskas [13] observed flashover during a test of a urethane foam block chair resulting in maximum temperatures over 800°C (1470°F). For other tests of upholstered chairs that did not achieve flashover, temperatures were below 600°C (1110°F).

Fang and Breese [14] observed ignition of paper flashover indicators at floor level with an average upper room gas temperature of 706 $\pm$ 92°C with a 90% confidence level for a series of sixteen full-scale fire tests of residential basement rooms.

To assess the relative fire risk of cellular plastic materials as compared to wood for use in furniture Quintiere and McCaffrey [15,16] studied the burning of wood and plastic cribs in a room. They found a gap between lower temperature fires (ceiling layer gas temperature less than 450°C) and high temperature fires (ceiling layer gas temperature greater than 600°C). They measured the potential for flashover from the fact that cellulose filter paper tell-tabs did indeed ignite or were destroyed in the five cases (out of sixteen) involving high gas temperatures.

Thomas [17] describes the calculation of the rate of heat release required to cause flashover in a compartment. He presents a simple model of flashover in a room and with it studies the influence of wall lining materials and thermal feedback to the burning items. He predicts a temperature rise of 520°C (936°F) and a black body radiation level of 22 kW/m^{-2} to an ambient surface away from the neighborhood of a burning wood fuel at the predicted critical heat release rate necessary to cause flashover.

2.1.2 Heat Flux

Heat flux to exposed items within the fire room has also been used as a criterion for the definition of flashover. Parker and Lee [18] have suggested using a criterion level of 20 kW/m^2 as the heat flux at floor level at which cellulosic fuels in the lower part of the room are likely to ignite.

A range of materials tested for ignition time and fluxes are reported by Babrauskas [6]. For some common materials, the following ignition fluxes are given for a 60-second exposure:

	Flux (kW/m^2)	
	Piloted	Unpiloted
Newspaper Want Ads	46	48
Box Cardboard	33	43
Polyurethane Foam	19	--

The unpiloted values are considered more appropriate for determination of full room involvement since ignition at considerable distance from the flames is involved. A value of 20 kW/m^2 represents, according to Smith [6,19], an unpiloted ignition time of approximately 180 seconds for box cardboard and is close to an ultimate asymptotic value.

Fang [7] found in a series of room burns that strips of newsprint placed at floor level ignited at fluxes of 17 to 25 kW/m^2 while 6.4 mm (1/4 in) thick fir plywood ignited at 21 to 33 kW/m^2.

Budnick [8] found that, for tests in which flashover occurred, the minimum total incident heat flux at the center of the floor was 15 kW/m^2.

Lee and Breese [12] report average heat fluxes at floor level of 17 to 30 kW/m^2 at flashover for full-scale tests of submarine compartments.

Fang and Breese [14] found good agreement between the time to ignition of newsprint flashover indicators and the time at which the incident heat flux measured at the center of the floor in the burn room reached a level of 20 kW/m^2 during tests in a basement recreation room.

A nominal incident floor heat flux of 20 kW/m^2 may be used as an indicator of the potential onset of flashover according to Quintiere and McCaffrey [15]. Ignition of filter paper flashover indicators was observed at a minimum of 17.7 kW/m^2 applied for roughly 200 seconds or more. Under more controlled laboratory conditions, with radiant exposure to the same target configuration, the paper charred black at 25 kW/m^2 and ripped at 120 seconds, but only decomposed to a brown color under 15 kW/m^2.

While the researchers used different definitions for the onset of flashover, fairly good agreement was evident from a number of researchers on two criteria for the onset of flashover. A working definition, for the purpose of defining flashover in terms of measureable physical parameters would be:

Upper Gas Temperature $\geq$ 600°C, or
Heat Flux at Floor Level $\geq$ 20 kW/m^2.

2.2 Mathematical Modeling of Fires

Considerable effort and resources have been directed at the mathematical modeling of the growth of a fire within a room from ignition to flashover. Friedman [20] and Levine [21] present overviews of the accomplishments to date. In the mid 1960's, Thomas [22] developed an approximate theory of the growth to flashover of fires in compartments. Since the late 1960's, researchers have successfully utilized the digital computer for the prediction of the various processes that take place during the growth of a fire [23]. More recently, more sophisticated models have evolved which have considered such effects as: ventilation, growth of the fire, energy feedback to the fire, turbulence, heat loss to the ceiling, and radiation induced ignitions of secondary objects within the room [20]. The Japanese Building Research Institute has used computer modeling to study radiative ignition and the spread of fire on walls and other surfaces [24,25]. Emmons and Mitler [26-31] have developed a room fire model to predict the response of a room to a fire within the room. Pape, et al [32-39], have studied the burning of furniture items within a room by computer modeling. They present burning rate curves for typical furniture items [32]. Quintiere [40] and McCaffrey [15,41] have developed a series of quasi-steady state models. Cooper [42] has applied computer modeling to estimate the time available for safe egress from a fire by coupling the detection of fire with a fire growth model to estimate untenable conditions within the room.

Certainly, one of the most comprehensive models is the Harvard University Computer Fire Code V developed by Emmons and Mitler [26-31]. This version of the mathematical model permits the computation of the development of a fire in a vented enclosure. The fire can be one of three kinds: a growing fire (ignited at a point), a pool fire, or a burner fire. The room may have up to five vents. Mass flows through the vents are calculated; species concentrations (CO, CO_2, H_2O, O_2, soot) are found for the hot layer, as well as its depth, temperature, and absorptivity. The surface temperatures of up to four objects (besides the original one) can be found, and they may ignite either by piloted ignition, by radiation, or by contact with a (growing) flame. The calculation can be carried forward as far as desired. For a limited fuel mass, this means through flashover, burnout, and cooldown. No provision is yet made for the burning of walls or ceiling.

Figure 1 is an illustration of the processes occurring in a fire in a compartment with an opening in it [21,26]. The fire over the burning object generates a plume of hot gas that entrains air, $\dot{M}_{ip}$, from the lower layer, and adds a flux of hot, partly unburned gas, $\dot{M}_p$, to the hot ceiling layer. Early in the fire, before the ceiling layer has grown below the doorway height, H_i, air flows out the doorway to make room for the hot, lower density gas in the ceiling layer. Later, for a short time, both hot ceiling layer gas and air flow out the doorway; then as the ceiling layer approaches the thickness h_L, ceiling layer gas flows out and outside air flows in. At the neutral plane, the pressure outside and inside the room are equal. Buoyancy forces cause the pressure above the neutral plane inside the room to be greater than the outside pressure, and lower than the outside pressure below the neutral plane.

The outflow of the room ceiling layer gases is of key concern to the safety of the rest of the structure, since this is the source of smoke and toxic gases. The other rooms in the structure are generally made untenable by smoke or toxicity before they are untenable due to heat [43].

As figure 1 indicates, many processes occurring within the room interact. Thermal radiation from the fire, the hot ceiling layer, and the upper walls and ceiling affect the combustion rate (of the outside surfaces) of the burning object, and also heat up other objects in the room, shown here as a "target", until they may eventually ignite. If the flame is spreading, the rate of flame spread, as well as the rate of burning of already ignited surfaces, will be affected by the heating due to this radiation.

The plume above the fire and its entrainment of lower layer air is, of course, affected by the burning rate of the fire, which in turn is affected by the thermal radiation, the reduction of the oxygen content of the lower layer air caused by mixing between the two layers (not shown in figure 1), and drafts due to the incoming cooler air $\overset{o}{M}_i$. The upper layer gases are cooled by convective and radiative heat transfer to the ceiling and upper walls, and this cooling can have a significant influence on the temperature of the upper layer, its radiation, and hence the growth rate of the fire.

Since the mathematical model must reproduce the interactions described above, where each process is affected by the other processes, it consists of a set of mathematical equations that must be solved simultaneously, usually interactively, and is only practically done on a computer.

2.3 Estimating Room Flashover Potential

Two approaches have been taken to estimate the onset of flashover within a room. Babrauskas [44] developed a simple combustion model with a flashover criterion of $\Delta T = 575°C$ and compared the results of the predictions using the model with experimental results. He provides a simple rule to estimate the minimum heat release rate to produce flashover:

$$\dot{q} = 0.6\ A(h)^{1/2}$$

where $\dot{q}$ is the estimated rate of heat release in MW, A is the door area in m^2 and h is the door height in m. The $A(h)^{1/2}$ factor is usually called the "ventilation factor." He reports adequate agreement with experimental data with 2/3 of the data studied falling between $\dot{q} = 0.45\ A(h)^{1/2}$ and $\dot{q} = 1.05\ A(h)^{1/2}$.

McCaffrey, Quintiere and Harkelroad [45] performed a regression analysis to provide a correlation to predict gas temperature. Using data from over 100 experiments, they found a correlation based on two dimensionless quantities:

$$\Delta T = 480 \left[\frac{\dot{q}}{\sqrt{g}C_p \rho_o T_o A\sqrt{H}}\right]^{2/3} \cdot \left[\frac{h_k A_w}{\sqrt{g}C_p \rho_o A\sqrt{H}}\right]^{-1/3} \quad {}^\circ C$$

where ΔT is the temperature rise relative to ambient in °C, h_K is the effective heat transfer coefficient to ceilings/walls, A_w is the effective surface area for heat transfer including door area g is the gravitational constant, C_p is the specific heat of gas, ρ_o is the ambient gas density, and T_o is the initial ambient absolute temperature. A means to calculate the effective heat transfer coefficient, h_k is given in reference [39]. They report a multiple correlation coefficient of 0.959 or 0.947 depending upon whether the floor is included in the calculation of the wall area and the effective heat transfer coefficient.

By substituting typical values for C_p, ρ_o, T_o and a flashover criterion of $\Delta T = 500°C$, the above equation can be reduced to

$$\dot{q} = 0.61 \left[h_k A_w A(h)^{1/2}\right]^{1/2}$$

where $\dot{q}$ is in MW, A_w and A are in m^2, h is in m and h_k is in kW/m^2K^{-1}.

Thomas [17] obtained an equation to predict the minimum flashover energy by adjusting a simple model of a room fire with an "effective calorific value" for the heat of combustion of the burning material of approximately 70% of the actual value. In our notation, he predicts

$$\dot{q} = 0.0078\, A_w + 0.378\, A\, (h)^{1/2}$$

where $\dot{q}$ is in MW, A_w and A are on m^2 and h is in m.

3. MODEL USED FOR THIS STUDY - ASSUMPTIONS AND PARAMETERS INVESTIGATED

Of all the computer fire models available, certainly one of the most comprehensive is the Harvard Fire Code V [26-31]. The physical basis of the model has been described in detail by Mitler [26]. Instructions are available for its use [27]. The Harvard model was chosen for use in this study for several reasons:

- as one of the most advanced models, variation of many parameters is possible;
- the prediction capabilities follow the course of the fire from ignition through flashover and to extinguishment; and
- it was available and working on computers at the National Bureau of Standards.

The model allows variation of up to 50 parameters describing the physical and thermal properties of the room, the venting from the room, the objects within the room and the initial fire involving one or more of the objects. Table 1 presents the various parameters that may be changed through appropriate data input.

3.1 Parameters Investigated

Obviously, a systematic variation of all the parameters in table 1 would be a monumental undertaking, involving up to 3×10^{64} computer runs. However, a smaller number of variables are most important to the engineer designing for fire protection. For this initial study, the following parameters were investigated:

- room size (length, width and ceiling height);
- door/vent size (width, height and placement of doors and windows);
- room lining materials (physical and thermal properties); and
- fire size (rate of heat release, maximum fire size).

Since the object of this investigation was to determine the minimum predicted fire size necessary to achieve flashover within a given room configuration, this led to four series of computer runs:

- a ventilation factor series (variation of the size of vent openings for different rooms);
- an aspect ratio series (variation of the length and width of a single room);
- a room height series (variation of the ceiling height of a single room); and
- a wall material series (variation of the thickness and thermal properties of the wall lining).

Figure 2 illustrates the basic room configuration. Each one of these series of computer runs is described in detail below.

3.1.1 Ventilation Factor Series

During this series of computer runs, the largest number of runs, nine different rooms sizes and eleven different vent sizes were investigated. Table 2 describes the room and vent sizes. Rooms as small as 1.8 m x 1.8 m (6 x 6 ft) and as large as 8.5 m x 12.8 m (28 x 42 ft) were included. Room vent size ranged from 10% to 100% of the length of the short wall plus a "standard door", 0.76 m (30 in) in width. Ceiling height and door height were held constant at 2.4 m (8 ft) and 2.03 m (6.6 ft) respectively. The wall lining material was gypsum wallboard, 12.7 mm (1/2 in) in thickness.

3.1.2 Aspect Ratio Series

For this series, three room sizes studied in the ventilation factor series were chosen - total room surface areas of 48 m^2, 131 m^2 and 323 m^2 (520 ft^2, 1410 ft^2, and 3480 ft^2) - and the ratio of room length to room width was varied from 1 to 16. This ratio is referred to as the "aspect ratio" for the room. Besides maintaining a constant total room surface area for a given series of runs, the ceiling height was held constant at 2.4 m (8 ft); and the vent size was held constant at 1.73 m x 2.03 m (5.7 ft x 6.6 ft). Gypsum wallboard, 12.7 mm (1/2 in) thick, lined the rooms.

3.1.3 Room Height Series

The same three rooms used for the aspect ratio series (48 m^2, 131 m^2 and 323 m^2) were further studied by varying the ceiling height within the room from 2.4 m (8 ft) to 12.2 m (40 ft). The aspect ratio was 1.5 and the vent size was 1.73 m x 2.03 m (5.7 ft x 6.6 ft) as before. Similarly, gypsum wallboard was used as the wall lining.

3.1.4 Wall Material Series

The properties of several wall lining materials were input for the three rooms as well. The materials investigated were:

- concrete, 150 mm (6 in) thick
- brick, 100 mm (4 in) thick
- chipboard, 1.3 mm (1/2 in) thick
- gypsum wallboard, 13 mm (1/2 in) thick
- fibre insulation, 13 mm (1/2 in) thick
- expanded polystyrene, 13 mm (1/2 in) thick.

Thermal properties of the lining materials are given in table 3. Room size, vent size, aspect ratio, and ceiling height were held constant as before. The models do not however, have the capability to predict the behavior of combustible wall linings. Thus, only comparisons of the effect of different heat transfer properties are possible.

3.2 Fire Algorithm

For modeling purposes, a fire is described as a time varying source of heat generation within the room. The physics which specify how the rate of heat release of the fire changes is, unfortunately, very complex. However, in the simplest case, a fire which is of a constant heat output is the most severe, and thus appropriate for this study to predict the minimum fire size necessary to produce flashover.

In the Harvard model, this is simulated by a gas burner algorithm which builds to a maximum value in a short period of time after ignition. The buildup to a maximum value is necessary for the numerical solution techniques used in the model to converge to a solution.

3.3 Flashover

Each computer run must have an end point at which calculation stops. For these series, the end point of the calculations was flashover as evidenced by an upper gas layer temperature rise of 500°C above room temperature. While this chosen value is lower than the typical value of 600°C (a rise of 573°C above room temperature), it was chosen for two reasons: 1) a somewhat lower limit would incorporate a margin of safety into the calculations, and 2) it would allow a more valid comparison to the predictions of McCaffrey, et al [39] and Thomas [17], who used this limit in their calculations. Additionally, a burning time limit of 15 minutes was placed on the calculations. The 15 minute limit was chosen as a reasonable "worst case" time necessary for appropriate safety actions such as evacuation or closing of protective doors.

4. Computer Runs and Results

A total of four hundred forty computer runs were made to gain data for the four series of investigations. Since the computer program contains initial values for all of the parameters used, the only data cards read by the program are those which override the initial values in order to tailor the model to a specific design. The initial values built into the program were determined from a series of seven thoroughly instrumented full scale fires [26]. Thus, they represent values which provide "best agreement" between prediction and experiment. For the tests that were run, the changes made were for room dimensions, objects (e.g. gas burner, flashover indicator) in the room, vent dimensions and position, and wall lining material. The program asks for the information in "blocks". First a series of code numbers, representing which information is to be changed, are entered. These numbers are followed by a blank card and the values with which the initial conditions are to be replaced.

As you can see in the listing of the typical set of data cards in Appendix A, the physical room characteristics are described in the block of cards from card 20 through 28, Object 1 (the gas burner) is described in the block of cards from 29 through 37, the gas burner fire algorithm in the block from 38 through 47, and so on.

Appendix A also has a listing of the output produced using the data cards in the appendix. The output begins with a summary of all the values of the parameters at the time of program execution. The summary is followed by the output listing of the values of all the variables examined by the program. Of particular interest are the variables ZKLZZ from ROOM=1 and TEOZZ from OBJ=1. ZKLZZ is the average temperature (K) of the upper gas layer. This temperature is used to decide if flashover has been reached. TEOZZ is the energy output of the gas burner (W). It is a negative number because it represents the amount of heat being given off by the burner.

The listing of the variables is produced at T = 2.000 seconds and at multiples of the output interval (data card 85) until the maximum time (data card 86) or flashover is reached. In the example, flashover is reached at T = 558.00 seconds, the average upper gas temperature (ZKLZZ) is 800.13K and the energy output of the burner is 4.4276 MW.

Four hundred forty sets of data cards and corresponding computer output were produced. The results of the tests are summarized in tables 4 through 8.

5. DISCUSSION OF RESULTS

The data presented in tables 4-8 represent the minimum energy levels that were predicted to produce flashover for the various room configurations studied. Table 5 shows the effect of room ventilation (door and window openings) on the minimum energy necessary for flashover for different size rooms with gypsum wallboard lining and a 2.4 m (8 ft) ceiling height. Table 6 shows the effect of the room length to width ratio on the minimum flashover energy. Room ceiling height and wall lining material effects are presented in tables 7 and 8, respectively.

5.1 Effect of Room Ventilation

Figure 3 shows only the predicted minimum flashover energy extracted from tables 5 and 6 for the six different size rooms with a length to width ratio of 1.5. The curves drawn for each room size were placed so as to represent a minimum energy level curve for the room size. The room opening size is expressed in terms of the "ventilation factor":

$$A(h)^{1/2}$$

where A is the area of the opening and h is the height of the opening. For room sizes ranging from 2.4 m x 3.7 m (8 x 12 ft) to 8.5 m x 12.8 m (28 x 42 ft), a ten-fold change in the ventilation factor resulted in only a 25 to 100 percent change in the minimum rate of heat release. The following table shows the effect of the increased opening sizes:

Increase in Minimum Energy Required for Flashover for a Ten-Fold Increase in $A(h)^{1/2}$

Room Size (m)	Wall Area (m^2)	Minimum Flashover Energy Range (MW)	Minimum Flashover Energy Percent Increase
2.4 x 3.7	48	0.74 - 1.48	100
3.7 x 4.9	85	0.98 - 1.97	101
4.9 x 7.3	131	1.72 - 2.46	43
6.1 x 9.1	186	2.21 - 3.20	45
7.3 x 11.0	250	2.95 - 4.18	42
8.5 x 12.8	323	3.94 - 4.92	25

For larger rooms with small openings, the fires are of sufficient size that attainment of flashover is difficult due to insufficient oxygen early in the fire buildup. Proportionally larger fires are thus required to reach the 800 K criterion for flashover at the small opening sizes.

5.2 Effect of Room Geometry

Not surprisingly, changing the room length to width ratio (the "Aspect Ratio") had little effect on the energy required for flashover as predicted by the model. Table 6 shows the results of the runs. As a zone model, the prediction of the properties of the upper gas layer are based upon the assumption that the entire layer is well mixed and of uniform properties throughout. Thus, the only effect accounted for in the prediction are changes in view factors for radiative heat transfer. Effects that may be more significant in long, narrow hallways such as (1) the flow of gases from one end of the room to the other or (2) buildup of heat at one end of the room, are not accounted for in the model.

The lack of effect from changing the aspect ratio does simplify the resulting predictions. The curves in figure 3 are presented based upon total room surface area rather than room length and width. Total room surface area is calculated as:

$$2\,(l)(w) + 2\,(l)(H) + 2\,(w)(H)$$

where l is the length of the room, w is the width of the room and H is the room height. The room height used in the series discussed so far is 2.4 m.

5.3 Effect of Room Height

Figure 4, which is extracted from table 7, shows the increase in minimum flashover energy for ceiling heights 2.4 m (8 ft) and greater. An increase in ceiling height from 2.4 m (8 ft) to 12.2 m (40 ft), a 400 percent increase, resulted in only a 49 to 56% increase in minimum flashover energy. Figure 5 presents the effect of room height expressed as a percentage of the minimum flashover energy necessary to produce flashover in a room of the same size (length and width), the same door size with a 2.4 m ceiling. A linear regression provides a satisfactory fit to the equation

$$P_{HEIGHT} = 100 + 5.3\ \Delta H$$

where P_{HEIGHT} is the percentage increase in the minimum flashover energy for room heights greater than 2.4 m (8 ft) and ΔH is the increase in ceiling height in meters. The correlation coefficient for the above equation is 0.91. For For example, for a 12.19 m ceiling height, $\Delta H = 9.75$ and $P_{HEIGHT} = 100 + 5.3 \times (9.75) = 152$; the minimum energy required to produce flashover within a room with a ceiling height of 12.19 m is 152% of that required to produce flashover within a room with a 2.4 m ceiling.

Much of the spread in the data can be accounted for by the limited number of computer runs made to establish "minimum" flashover energies for a given geometry. From table 5, the difference in fire size for any two adjacent fire sizes is 0.24 MW. For the larger fires, this is less than 4%. However, for the smaller fires, this is as much as 32%. The difference between the curves in figure 4 is well below 32%.

5.4 Effect of Wall Lining

Figures 6 and 7 illustrate the effect of changing the heat response (but not combustibility or ignition susceptibility) of the wall and ceiling lining material. For materials ranging from 12.7 mm thick expanded polystyrene insulation to 15 cm thick concrete, the minimum flashover energy increased less than 70% for a given room geometry. In figure 7, the minimum flashover energy for a given wall lining is expressed as a percentage of the minimum energy required to produce flashover in the equivalent room with a 12.7 mm thick gypsum wall lining. In this figure, P_{WALL} is the percentage of the minimum flashover energy for gypsum wall lining ($k\rho C = 0.18$) that would be necessary to produce flashover in rooms lined with other materials, k is the thermal conductivity in W/mK, ρ is the density in kg/m^3 and C is the specific heat in J/kgK. For concrete ($k\rho C = 2.88$), $P_{WALL} = 160$. Thus, the minimum energy required to produce flashover within a room with a ceiling height of 2.4 m (8 ft) with a concrete lining is predicted to be 160% of that required to produce flashover within the equivalent room with a gypsum lining. For all of these predictions it is assumed in the model that the wall lining does not ignite.

5.5 Comparison with Test Data

A number of full-scale fire tests have been performed in a wide variety of configurations. Table 9 summarizes some of the data [44] for tests where flashover was observed. In all cases, the predicted minimum flashover energy is lower than the observed maximum rate of heat release from the full-scale tests.

The predicted values average 70% of the observed with a range from 57% to 83%. It is not surprising that the predicted minimum energy necessary to produce flashover is significantly less than the observed maximum rate of heat release. Several reasons why this should be expected are apparent:

- The predicted minimum flashover energy is just that -- a minimum energy necessary to produce flashover for a given configuration. The rate of heat release for full-scale room fires was based upon maximum rates and thus may not be the minimum energy level.

- The fire algorithm simulates a fire which grows immediately upon ignition to a maximum size and remains constant at that level. Real fires would exhibit changes in fire size as the fire progressed. Thus, during most of the fire, the rate of heat release would be below the maximum level.

- The temperature limit selected as a definition of flashover was chosen purposely to be a conservative estimate. A higher temperature criterion would, of course, raise the predicted minimum flashover energy.

5.6 Comparison with Other Predictions

Three approaches were described in section 2 that have been applied to predict flashover. From Babrauskas [44] the relationship:

$$\dot{q} = 0.6\ A(h)^{1/2}$$

from McCaffrey et al [45]:

$$\dot{q} = 0.61 \left[(h_k A_w A(h)^{1/2} \right]^{1/2}$$

and from Thomas [17]:

$$\dot{q} = 0.0078\ A_w + 0.378\ A\ (h)^{1/2}$$

The table below presents a comparison of these two predictions with those from figure 2. The value for $h_k = \sqrt{k\rho C/t}$ where t is a "characteristic fire exposure time"; taken here to be 537 s, which is the average of all "times to reach flashover" in table 5. The room size was chosen for this comparison rather arbitrarily simply as being in the middle of the range of room sizes studied. At small values of $A(h)^{1/2}$, both McCaffrey and Babrauskas present more conservative predictions. For values of $A(h)^{1/2}$ greater than 3-4 $m^{5/2}$, the predictions of figure 2 are more conservative. Babrauskas assumes a ratio of $A_w/A(h)^{1/2}$ of 50. In the table below, this ratio ranges from 16 to 66 so the disagreement is not surprising. In addition, the criterion for flashover differs in the above formulations.

A Comparison of Techniques for the Prediction of Flashover[a]

$A(h)^{1/2}$ ($m^{5/2}$)	from fig. 2[c] $\dot{q}$ (MW)	from ref. [44][d] $\dot{q}$ (MW)	from ref. [45][a,b,c] $\dot{q}$ (MW)	from ref. [17][a,c] $\dot{q}$ (MW)
2	1.8	1.2	1.4	1.8
4	2.2	2.4	1.9	2.5
6	2.3	3.6	2.4	3.3
8	2.4	4.8	2.7	4.0

a - room size 131 m^2 b - $h_k = 0.019\ kW/m^2K$
c - flashover at $\Delta T = 500°C$ d - flashover at $\Delta T = 575°C$

6. USING THE MODEL PREDICTIONS TO DETERMINE MINIMUM FLASHOVER ENERGY

The use of figures 3, 5 and 7 to predict a minimum energy necessary for flashover is straightforward. For any room with wall linings similar to the types studied above, a calculation is made of the total surface area of an equivalently sized room with a 2.4 m (8 ft) ceiling by

$$A_w = 2(2.4 \times 1) + 2(2.4 \times w) + 2(1 \times w)$$

Figure 2 is used to determine the minimum flashover energy for the room area A_w with the appropriate ventilation factor - $A(h)^{1/2}$. If the ceiling height is greater than 2.4 m (8 ft), this minimum flashover energy is modified by a percentage

$$P_{HEIGHT} = 100 + 5.3\ \Delta H$$

where ΔH is the increase in height over 2.4 m in meters. If the wall material is other than the 13 mm (1/2 in) gypsum wallboard, the minimum flashover energy is further modified by a percentage, P_{WALL} from figure 7 based upon $k\rho C$ where k is the thermal conductivity in W/mK, ρ is the density in kg/m^3 and C is the specific heat in J/kgK. By definition, P_{WALL} for 1/2" gypsum wallboard is 100. From the predictions made, the limitations of these calculations are:

A_w -- 48 to 323 (m^2)
ΔH -- 0 to 9.75 (m)
A material similar to the ones studied in both thickness and properties.

or

A_w -- 48 m^2 to 323 m^2
P_{HEIGHT} -- 100% to 152%
P_{WALL} -- 87% to 160%

As an example, consider a room 5 m long x 7 m wide x 4 m high with a doorway 2 m wide x 2 m high that is lined with 4 in. thick brick ($k\rho C = 1.66 \times 10^6$). From above,

$$A_w = 2\ (2.4 \times 5) + 2\ (2.4 \times 7) + 2\ (5 \times 7)$$

$$= 128\ m^2$$

$$A(h)^{1/2} = 2\ (2 \times (2)^{1/2}$$

$$= 5.7$$

From figure 2, the minimum flashover energy is predicted to be 2.25 MW. Since the ceiling height is more than 2.4 m (8 ft), this is modified by

$$P_{HEIGHT} = 100 + 5.3\ (1.6)$$

$$= 108\%$$

and modified for the brick wall surface by

$$P_{WALL}\ (k\rho C = 1.66) = 142\%$$

Therefore the minimum flashover energy would be 2.25 MW (1.08)(1.42) = 3.45 MW.

7. CONCLUSIONS, RECOMMENDATIONS AND LIMITATIONS

A technique has been presented to estimate the minimum energy necessary to produce flashover in a variety of room configurations. Using a series of curves developed from a computer fire growth model, the minimum flashover energy is estimated. The effects of raising the ceiling height and of variation in the room lining material were investigated. The limitations on the parameters studied were:

- room size -- 48 m^2 to 323 m^2
- ventilation factor -- 0.5 $m^{5/2}$ to 24.7 $m^{5/2}$
- ceiling height -- 2.4 m to 12.2 m
- wall materials similar to those studied in both properties and thickness

7.1 Limitations of this Study

This study presents an initial look at the potential for the use of fire growth models to predict the occurrence of flashover. A number of limitations of the study are apparent:

- the study centered on one fire model - a steady fire. Although a "worst-case" simulation, it does not accurately model most fires. A growing fire as proposed by Cooper [42] or a fire which grows to a peak then dies down would represent a more typical fire.

- An investigation of additional room sizes, ceiling heights and wall lining materials would extend the study and increase the usefulness of the predictions.

- The definition of flashover used for this study ($\Delta T = 500°C$) is certainly not the only one that could be chosen. A temperature limit of 600-650°C should be investigated. A definition in terms of the heat flux at floor level would perhaps give more information on the ignition of other items within the room.

- In all the predictions presented here, the wall lining material was assumed not to ignite. Certainly many typical lining materials do ignite. As the sophistication of the models increase, this effect should be studied.

- The model predictions presented here are more conservative than all other predictions at large ventilation factors. The reasons for this should be investigated and should provide insight into the effects of large openings during fires.

7.2 The Link With Room Furnishings

One important area of information which limits the usefulness of this study is the relationship of the burning behavior of actual room furnishing items to the minimum flashover energy. Two major stumbling blocks are foreseen -- 1) a catalog of the rates of heat release of typical furnishing items and 2) how should this rate of heat release be interpreted for the fire growth model.

In the first area, some information is available. Babrauskas [6,13] has provided mass burning rates and heats of combustion for mattresses and upholstered chairs. Lawson [49] has begun actual measurement of the rate of heat release of furnishings. The following table provides an indication of the range of burning behavior of furnishings.

Maximum Rate of Heat Release of Selected Furnishings

	RHR (MW)	Time Above 50% of Maximum	Reference
Mattresses	0.08 to 1.7	150-800[c]	Babrauskas [6]
Chairs	0.2 to 3.9	n.a.	Babrauskas [13]
Chairs	1 to 3	n.a.	Lawson [49]
Metal Wardrobe[a]	0.2	60	Lawson [49]
Wooden Wardrobe[a,b]	6.4	55	Lawson [49]

[a]Wardrobes with clothing, cardboard box, newspaper inside.

[b]1/8 thick plywood.

[c]2 specimens resulted in flashover.

Considerably more information is necessary on furnishings to be able to determine how these rate of heat release data compare to the minimum flashover energy. One possible method would be to define (from the furnishing RHR curves) a maximum rate of heat release and a duration of the fire for various furnishing categories. These could be used to define an appropriate fire model for predictions such as those made in this study. The details of how this would be accomplished are, of course, still to be determined.

8. ACKNOWLEDGEMENTS

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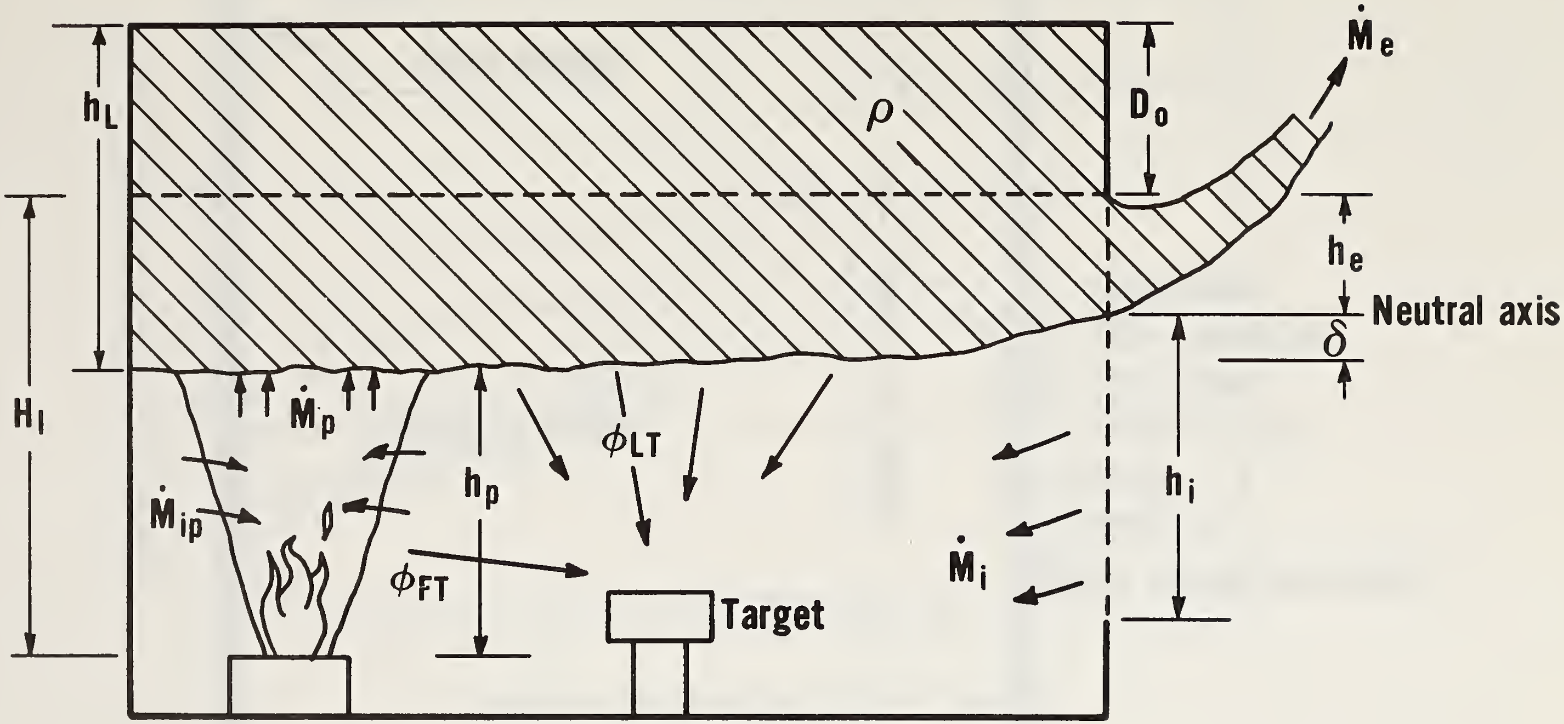

Figure 1. Mathematical Modeling of Fires in an Enclosure

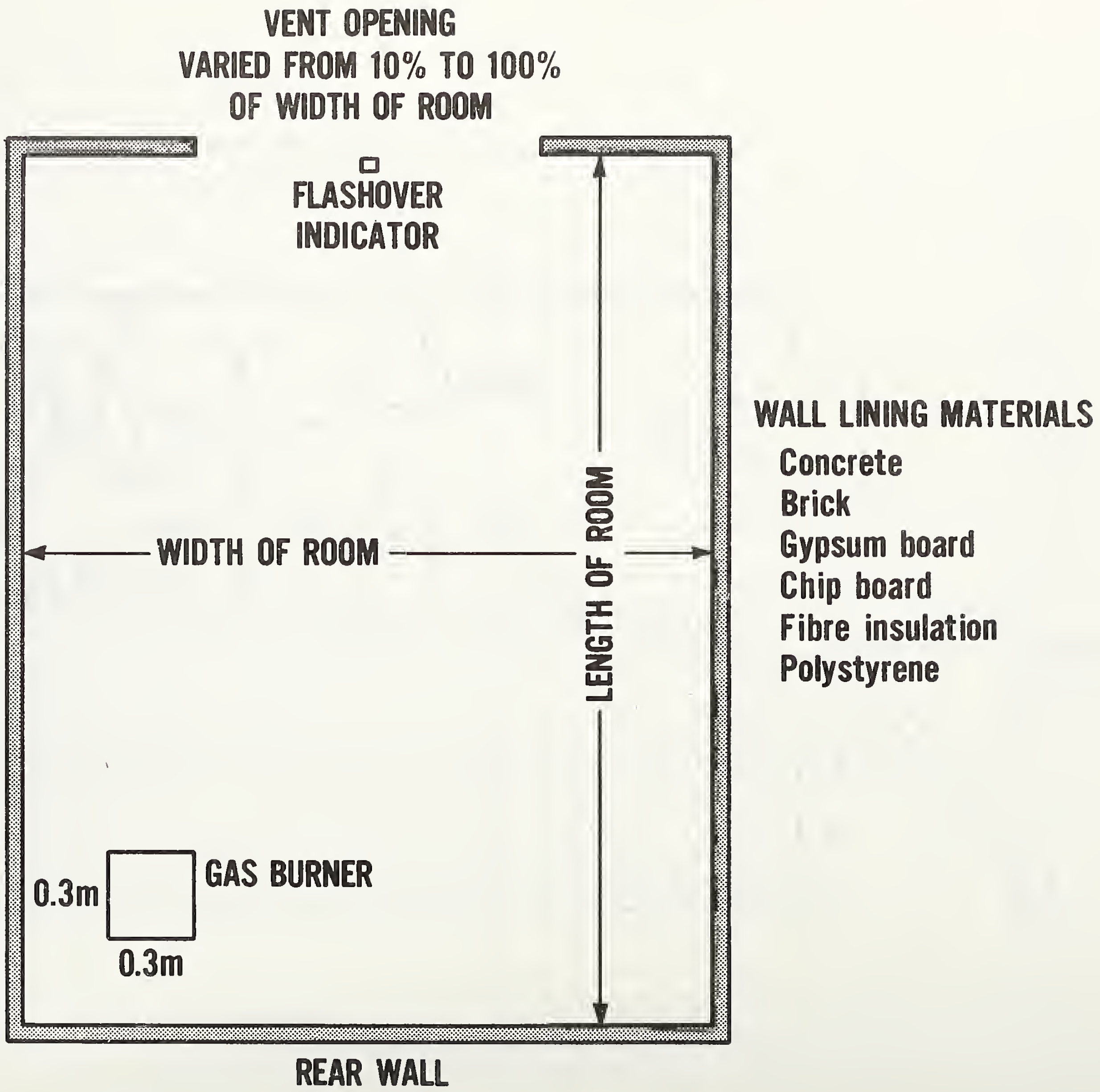

Figure 2. Basic Room Configuration for Computer Modeling Predictions

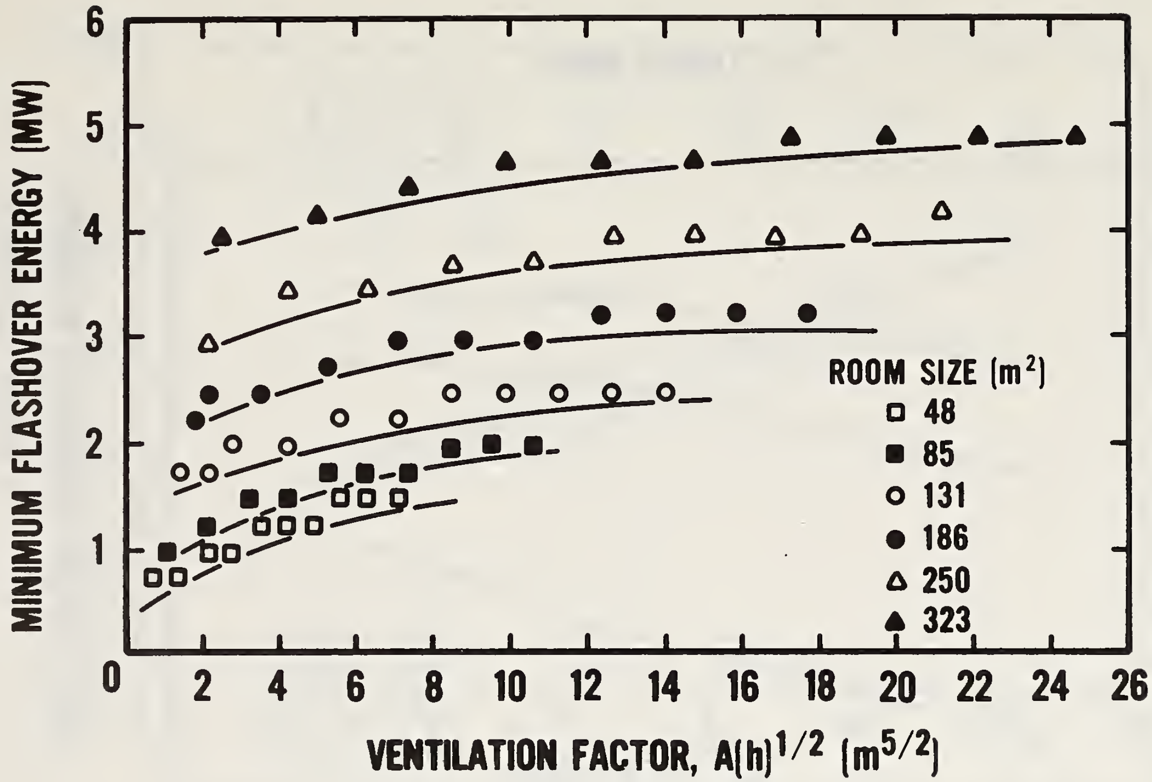

Figure 3. Room Flashover Modeling Prediction for Various Ventilation Factors (Gypsum Wall Lining / 2.4 m Ceiling Height)

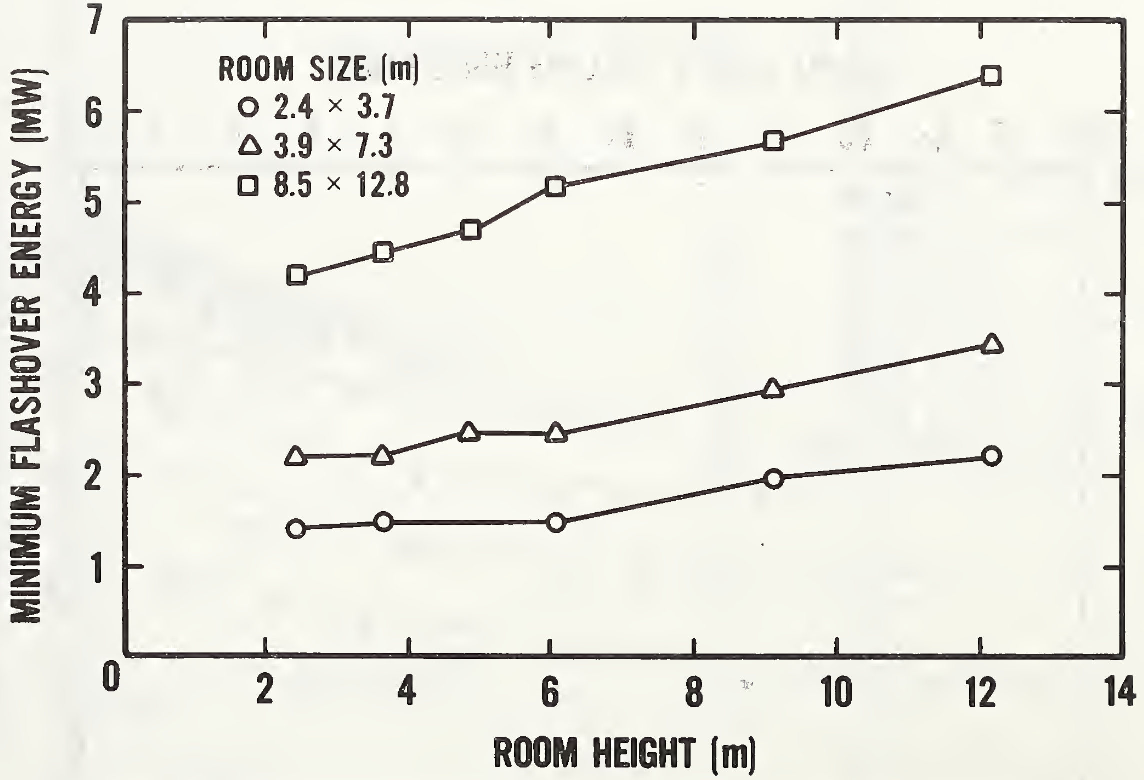

Figure 4. Room Flashover Modeling Prediction for Various Room Heights (Gypsum Wall Lining / Ventilation Factor, $A(h)^{1/2} = 5.0$)

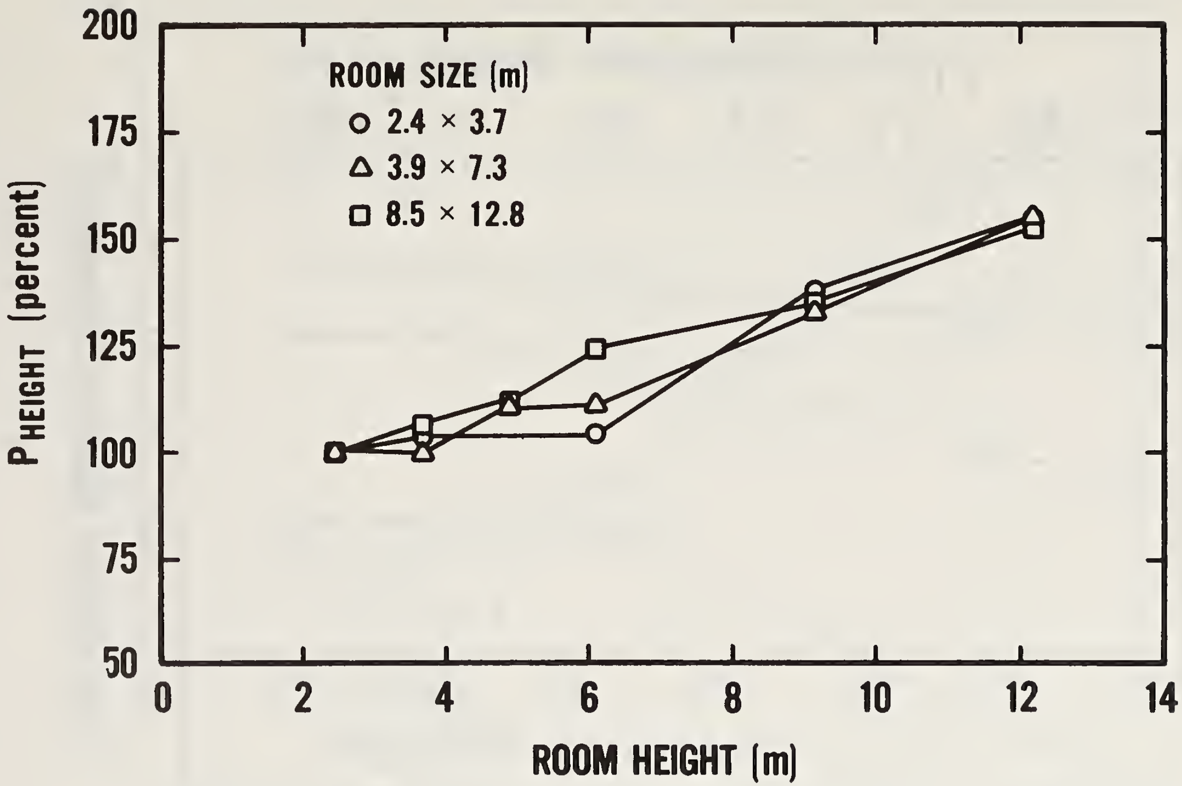

Figure 5. P_{height} -- Percentage of Minimum Flashover Energy for Rooms With Ceiling Heights Greater Than 2.4 m

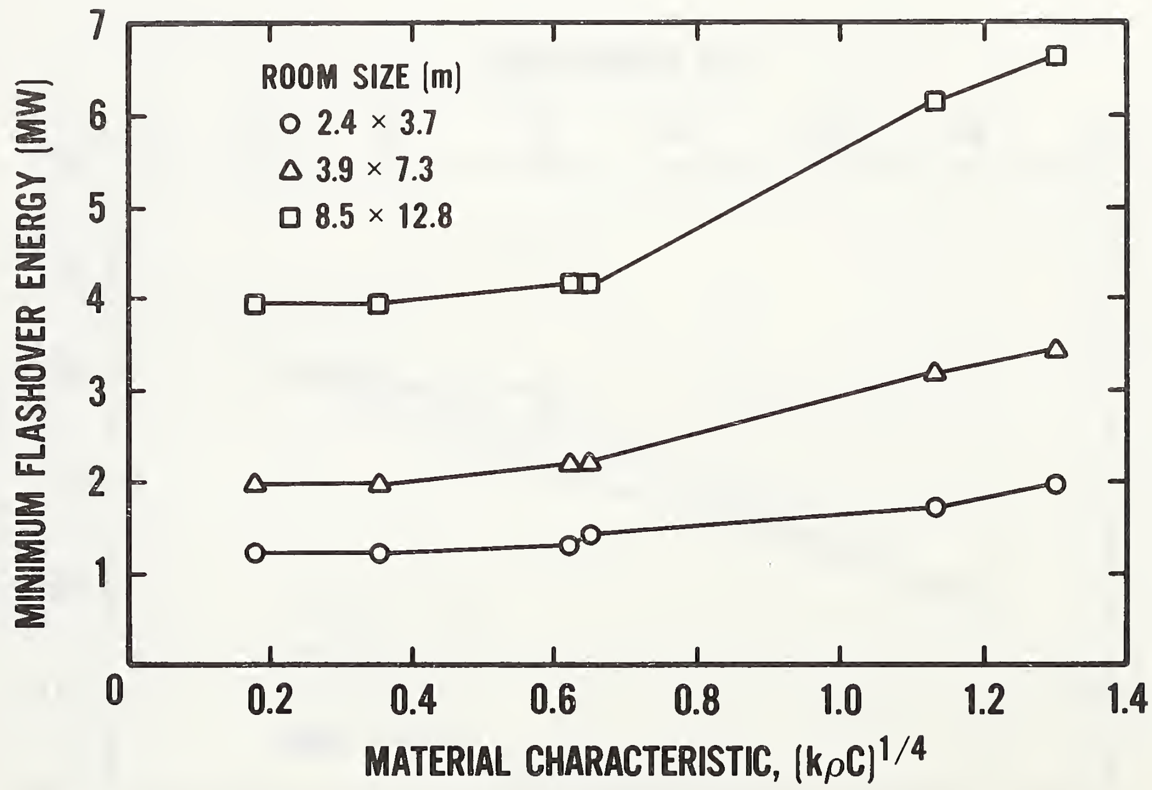

Figure 6. Room Flashover Modeling Prediction for Various Wall Lining Materials (2.4 m Ceiling Height / Ventilation Factor, $A(h)^{1/2} = 5.0$)

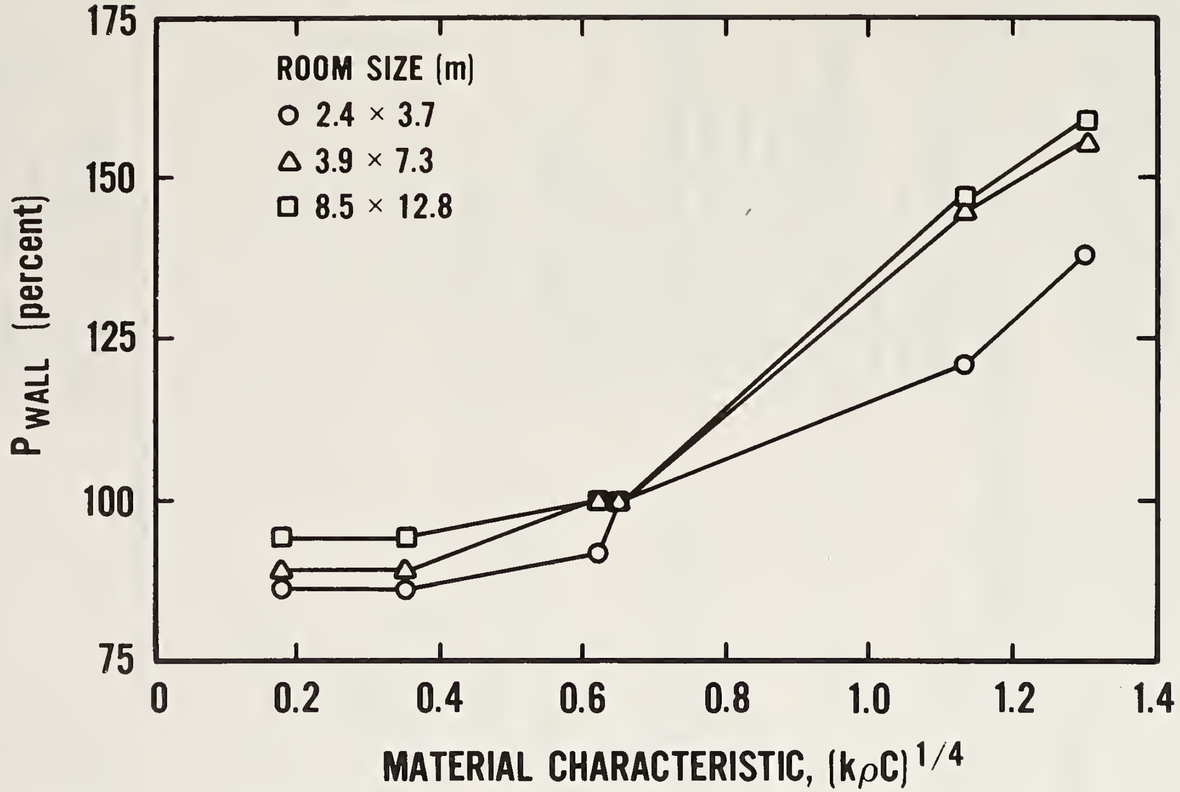

Figure 7. P_{wall} -- Percentage of Minimum Flashover Energy for Wall Lining Materials Other Than Gypsum Board

Table 1. Parameters that Can Be Varied in the Harvard Model

Room Characteristics

Length of room
Width of room
Height of room
Number of objects in room
Ambient air temperature
Vent width
Vent height
Vent transom depth
Wall thickness
Wall thermal conductivity
Wall specific heat
Wall density
Specific heat of air
Absorption coefficient of flame
Outside ambient temperature
Maximum heat transfer coefficient
Minimum heat transfer coefficient
Plume entrainment coefficient
Vent flow coefficient

Object Characteristics

Location of object (X, Y and Z)
Angle with horizontal
Angle with XZ-plane
Thickness
Initial burning radius
Object radius
Maximum burning radius
Length and width of object
Burning algorithm
Air/fuel ratio
Stochiometric A/F ratio
Gas flow rate
Fire spread parameter
Thermal conductivity
Specific heat
Emissivity
Combustion efficiency
Heat of combustion
Heat of vaporization
Initial fuel mass
Ignition temperature
Pyrolization temperature
CO_2/fuel ratio
CO/fuel ratio
Smoke/fuel ratio
Water/fuel ratio

Default Conditions (all units S.I.)

Room number 1:

Length along X = 2.4384
Length along y + 3.6576
Height = 2.4384
Ambient temperature = 300.0

Object number 1 (ID = 1):

X-coord = .8400; Y-coord = 2.8180; height = .6100
Angle with horizontal = .00
Thickness = .1000
Initial mass = 6.8520
Maximum radius = .9677
Specific heat = 1900.
Emissivity = .98
Heat of combustion = .287 + 008
Pyrolization temp = 600.0
Air/fuel mass ratio = 14.45
FCO_2(CO_2 mass/fuel mass) = 1.504
FS(smoke mass/fuel mass) = .241
A(fire spread parameter) = .0109
Angle with XZ-plane = .00
Density = 48.00
Initial radius = .0370
Object radius = .8598
Thermal conductivity = .0540
Chi (fraction of heat released) = .65
Heat of vaporization = .205 + 007
Ignition temp = 727.0
Stochiometric mass ratio = 9.85
FCO(CO mass/fuel mass) = .013
FH_2O(H_2O mass/fuel mass) = .714

Table 1. Continued

Object number 2 (ID = 2):

X-coord = 2.0800; Y-coord = 2.8180; height = .8640

Angle with horizontal = .00	Angle with XZ-plane = .00
Thickness = .1000	Density = 48.00
Initial mass = 1.0963	Initial radius = .0370
Maximum radius = .4657	Object radius = 3.439
Specific heat = 1900.	Thermal conductivity = .0540
Emissivity = .98	Chi (fraction of heat released) = .65
Heat of combustion = .287 + 008	Heat of vaporization = .205 + 007
Pyrolization temp = 600.0	Ignition temp = 740.0
Air/fuel mass ration = 14.45	Stochiometric mass ratio = 9.85
FCO_2(CO_2 mass/fuel mass) = 1.504	FCO(CO mass/fuel mass) = .013
FS(smoke mass/fuel mass) = .241	FH_2O (H_2O mass/fuel mass) = .714
A (fire spread parameter) = .0109	

Vent number 1:

Width = .7620; height = 2.0320; transom depth = .4064

Wall number 1:

Thickness = .0254	Density = 800.00
Specific heat = 1062	Thermal conductivity = .1340

Physical constants:

Specific heat of air = 1004	Absorption coeff. of flame = 1.55

For air:

Heat transfer coeff. = 10.00	Plume entrainment coeff. = .10

For layer gases:

Max. heat transfer coeff. = 50.00	Min. heat transfer coeff. = 5.00

For vents:

Flow coefficient = .68

Table 2. Room and Vent Sizes Investigated

Ventilation Factor Series

Room Size (m)	Room Area (m^2)	Ventilation Factor $A(h)^{1/2}$ ($m^{5/2}$)
2.4 x 3.6	48	0.7 - 7.1
3.6 x 5.5	85	1.1 - 10.6
4.9 x 7.3	131	1.4 - 14.1
6.1 x 9.1	186	1.8 - 17.7
7.3 x 11	250	2.1 - 21.2
8.5 x 12.8	323	2.2 - 24.7

Room Height Series

Room surface areas: 48 m^2, 131 m^2, 323 m^2

Ceiling height: 2.4 m - 12.2 m

Wall Lining Series

Room surface areas: 48 m^2, 131 m^2, 323 m^2

Six materials, each with a typical characteristic thickness.

Table 3. Thermal Properties of Room Lining Materials[a]

	Density	Specific Heat	Thermal Conductivity	
	ρ	c	$k \times 10^3$	$k\rho c$
	$\frac{kg}{m^3}$	$\frac{kJ}{kg.K}$	$\frac{kW}{m.K}$	
Aluminum (pure)	2710	.895	206	500
Concrete	2400	.75	1.6	2.88
Asbestos-cement board (heavy)	2100	1.0	1.1	2.31
Brick	2600	0.8	0.8	1.66
Brick/concrete block	1900	.84	.73	1.17
Gypsum board	960	1.1	.17	0.180
Plasterboard	950	.84	.16	0.127
Plywood	540	2.5	.12	0.162
Chipboard	800	1.25	.15	0.150
Aerated concrete	500	.96	.26	0.1248
Cement-asbestos board	658	1.06	.14	0.0976
Calcium silicate board	700	1.12	.11-.14	0.0862
Fibre insulation board	240	1.25	.053	0.0159
Alumina silicate block	260	<1>	.14	0.0464
Glass fibre insulation	60	.8	.037	1.78×10^{-3}
Expanded polystyrene	20	1.5	.034	1.02×10^{-3}

[a]From reference [39].

Table 4. Key to Values Appearing in Tables 5, 6, 7 and 8

Unless otherwise specified:

Room height = 2.44 m

Vent (door) size: width = 1.73 m
height = 2.03 m
$A(h)^{1/2} = 5.00$

Flashover is defined as having occurred at an energy level if the temperature reaches 800 K (ΔT = 500 degrees) within 900 seconds.

The numbers below the steady state energy are the times in seconds required to reach flashover for that energy output level.

A boxed number is the time in seconds required to reach flashover with the minimum energy output level (of those energy levels investigated).

A number in parentheses is the temperature (K) at time t = 900s when flashover has not occurred at that energy level.

+ room width and length were exchanged to accommodate door width.

* steady state fire energy output level not reached.

\# fire is oxygen starved at some time.

s standard width door (0.76 m)

Table 5A. Effect of Vent Size on Time and Energy Needed to Achieve Flashover
Room size: length = 2.44 m, width = 3.66 m, height = 2.44 m

Vent Characteristics			Steady State Energy Output (MW)					
Vent (Door) Width (% of room length)	Vent Width (m)	$A(h)^{1/2}$	0.49	0.74	0.98	1.23	1.48	1.72
10	0.24	0.7	(755)	252		113#*		
20	0.49	1.4	(684)	774		56		
30	0.73	2.1		(673)	244	76		
31[s]	0.76	2.2		(665)	268	78		
40	0.98	2.8		(630)	558	96		
50	1.22	3.5		(610)	(673)	134		
60	1.46	4.2		(585)	(652)	200		
70	1.71	4.9		(576)	(634)	324		
80	1.95	5.6				(676)	66	64*
90	2.19	6.3				(664)	84	32
100	2.44	7.1				(653)	112	68*

Table 5B. Effect of Vent Size on Time and Energy Needed to Achieve Flashover
Room size: length 3.66 m, width = 5.49 m, height = 2.44 m

Vent Characteristics			Steady State Energy Output (MW)				
Vent (Door) Width (% of room length)	Vent Width (m)	$A(h)^{1/2}$	0.98	1.23	1.48	1.72	1.97
10	0.37	1.1	900	304			
20	0.73	2.1		708			
21[s]	0.76	2.2		772			
30	1.10	3.2		(774)	412	146	
40	1.46	4.2		(751)	788	208	
50	1.83	5.3		(736)	(786)	302	
60	2.19	6.3		(724)		430	
70	2.56	7.4		(715)		628	
80	2.93	8.5		(622)		(720)	192
90	3.29	9.5		(702)		(711)	230
100	3.66	10.6		(697)		(786)	282

Table 5C. Effect of Vent Size on Time and Energy Needed to Achieve Flashover
Room size: length = 4.88 m, width = 7.32 m, height = 2.44 m

Vent Characteristics			Steady State Energy Output (MW)					
Vent (Door) Width (% of room length)	Vent Width (m)	$A(h)^{1/2}$	1.48	1.72	1.97	2.21	2.46	2.71
10	0.49	1.4	(793)	460				
16[s]	0.76	2.2		712				
20	0.98	2.8		(794)	430	216		
30	1.46	4.2		(768)	770	324		
40	1.95	5.6		(752)	(787)	470		
50	2.44	7.1		(741)		670		
60	2.93	8.5		(733)		(798)	334	152
70	3.41	9.9		(726)		(791)	410	172
80	3.90	11.3		(721)		(785)	496	196
90	4.39	12.7		(717)		(781)	594	224
100	4.88	14.1		(714)		(777)	708	250

Table 5D. Effect of Vent Size on Time and Energy Needed to Achieve Flashover
Room size: length = 6.10 m, width = 9.14 m, height = 2.44 m

Vent Characteristics			Steady State Energy Output (MW)				
Vent (Door) Width (% of room length)	Vent Width (m)	$A(h)^{1/2}$	2.21	2.46	2.71	2.95	3.20
10	0.61	1.8	764	446	282		
12^s	0.76	2.2	(798)	518	316		
20	1.22	3.5		838	452		
30	1.83	5.3			702		
40	2.44	7.1			(795)	508	282
50	3.05	8.8			(786)	658	342
60	3.66	10.6			(779)	850	406
70	4.27	12.4			(774)	(796)	472
80	4.88	14.1			(770)		540
90	5.49	15.9			(766)		612
100	6.10	17.7			(764)		688

Table 5E. Effect of Vent Size on Time and Energy Needed to Achieve Flashover
Room size: length = 7.32 m, width = 10.97 m, height = 2.44 m

Vent Characteristics			Steady State Energy Output (MW)					
Vent (Door) Width (% of room length)	Vent Width (m)	$A(h)^{1/2}$	2.95	3.20	3.44	3.69	3.94	4.18
10	0.73	2.1	822	532		462*		
10^s	0.76	2.2	850	546		392*		
20	1.46	4.2		(798)	572	378		
30	2.19	6.3		(782)	866	516		
40	2.93	8.5		(773)	(791)	670		
50	3.66	10.6				858		
60	4.39	12.7				(796)	572	352
70	5.12	14.8				(792)	654	390
80	5.85	16.9				(788)	740	426
90	6.58	19.1				(786)	834	462
100	7.32	21.2				(783)	(799)	496

Table 5F. Effect of Vent Size on Time and Energy Needed to Achieve Flashover
Room size: length = 8.53 m, width = 12.80 m, height = 2.44 m

Vent Characteristics			Steady State Energy Output (MW)								
Vent (Door) Width (% of room length)	Vent Width (m)	$A(h)^{1/2}$	2.95	3.20	3.44	3.69	3.94	4.18	4.43	4.67	4.92
9[s]	0.76	2.2	(744)	(763)	(779)#*		(779)#*	(778)#*	(777)#*	(777)#*	(776)#*
10	0.85	2.5			(777)	(794)	880#*	890#*	900#*	900#*	(799)#*
20	1.71	5.0						808	552		
30	2.56	7.4							760		
40	3.41	9.9							(797)	636	438
50	4.27	12.4							(791)	764	506
60	5.12	14.8							(787)	900	568
70	5.97	17.3							(783)	(796)	630
80	6.83	19.8							(781)	(794)	692
90	7.68	22.2							(779)		752
100	8.53	24.7							(777)		814

Table 5G. Effect of Vent Size on Time and Energy Needed to Achieve Flashover
Room size: length = 1.83 m, width = 1.83 m, height = 2.44 m

Vent Characteristics			Steady State Energy Output (MW)				
Vent (Door) Width (% of room length)	Vent Width (m)	$A(h)^{1/2}$	0.25	0.49	0.74	0.98	1.23
10	0.18	0.5	(644)	134	66*		
20	0.37	1.1		(728)	48		
30	0.55	1.6		(649)	70		
40	0.73	2.1		(601)	148		
42[s]	0.76	2.2		(595)	190		
50	0.91	2.6			(670)	25.5	13.6
60	1.10	3.2			(639)	34.5	13.8
70	1.28	3.7			(618)	50	11.9
80	1.46	4.2			(601)	80	10.3
90	1.65	4.8			(588)	(658)	9.5
100	1.83	5.3			(577)	(644)	11.8

Table 5H. Effect of Vent Size on Time and Energy Needed to Achieve Flashover
Room size: length = 1.83 m, width = 9.14 m, height = 2.44 m

Vent Characteristics			Steady State Energy Output (MW)				
Vent (Door) Width (% of room length)	Vent Width (m)	$A(h)^{1/2}$	0.98	1.23	1.48	1.72	1.97
10	0.18	0.5	702#*		736#*		(746)#*
20	0.37	1.1	760		140		92.5#*
30	0.55	1.6	(776)	400	168		64
40	0.73	2.1	(751)	596	208		68
42[s]	0.76	2.2	(747)	642	216		68
50	0.91	2.6	(732)	(718)	266		72
60	1.10	3.2	(718)	(711)	346		76
70	1.28	3.7			(732)	154	82
80	1.46	4.2			(718)	178	86
90	1.65	4.8			(706)	206	92
100	1.83	5.3			(696)	238	98

Table 5I. Effect of Vent Size on Time and Energy Needed to Achieve Flashover
Room size: length = 1.83 m, width = 12.19 m, height = 2.44 m

Vent Characteristics			Steady State Energy Output (MW)					
Vent (Door) Width (% of room length)	Vent Width (m)	$A(h)^{1/2}$	0.98	1.23	1.48	1.72	1.97	2.21
10	0.18	0.5	(754)#*	(753)#*		(748)#*		
20	0.37	1.1		672		185#*		
30	0.55	1.6		(791)	418	210		
40	0.73	2.1		(769)	562	252		
42[s]	0.76	2.2		(766)	592	260		
50	0.91	2.6		(752)	782	308		
60	1.10	3.2		(739)	(719)	378		
70	1.28	3.7				(756)	196	108
80	1.46	4.2				(744)	222	116
90	1.65	4.8				(733)	248	124
100	1.83	5.3				(725)	286	132

Table 6. Effect of Aspect Ratio on Time and Energy Needed to Achieve Flashover

Total Surface Area = 48 m^2 (walls + floor + ceiling)

	Room Characteristics					Steady State Energy Output (MW)		
Aspect Ratio	Room Size Length (m)	Room Size Width (m)	Burner Position X	Burner Position Y	Flashover Indicator Position (Center of Door) X	0.98	1.23	1.48
1.0	3.01	3.01	0.30	2.71	1.51	(637)	350	74*
1.5	2.44	3.66	0.30	3.35	1.22	(633)	(690)	74*
2.0	2.07	4.15	0.30	3.84	1.04	(639)	(690)	76*
4.0+	5.41	1.35	0.30	1.05	2.70		(689)	80*
8.0+	6.65	0.83	0.30	0.53	3.33		(687)	37*
16.0+	7.74	0.48	0.30	0.18	3.87		(681)	24.5*

Total Surface Area = 131 m^2

Aspect Ratio	Length (m)	Width (m)	X	Y	X	1.97	2.21
1.0	6.01	6.01	0.30	5.70	3.00	(793)	410
1.5	4.88	7.32	0.30	7.01	2.44	(795)	398
2.0	4.18	8.35	0.30	8.05	2.09	(797)	378
4.0	2.80	11.19	0.30	10.88	1.40	742	304
8.0	1.80	14.40	0.30	14.09	0.90	(757)	226
16.0+	17.70	1.11	0.30	0.80	8.85	(764)	162

Total Surface Area = 323 m^2

Aspect Ratio	Length (m)	Width (m)	X	Y	X	3.44	3.69	3.94	4.18	4.43
1.0	10.49	10.49	0.30	10.19	5.25			(787)	842	570
1.5	8.53	12.80	0.30	12.50	4.27			(788)	816	558
2.0	7.34	14.67	0.30	14.37	3.67			(790)	770	532
4.0	5.01	20.02	0.30	19.72	2.50			(799)	614	440
8.0	3.32	26.59	0.30	26.28	1.66		(798)	628		332
16.0	2.13	34.14	0.30	33.83	1.07	886	596	430		240

Table 7. Effect of Room Height on Time and Energy Needed to Achieve Flashover

Room size: length = 2.44 m, width = 3.66 m

Room Height (m)	Transom Depth (m)	Steady State Energy Output (MW) 1.23	1.48	1.72	1.97	2.21
2.44	0.41	(690)	74*			
3.66	1.63	(671)	226			
4.88	2.84	(762)	(713)			
6.10	4.06		898			
9.14	7.11		(749)	(725)	452	270
12.19	10.16		(706)	(758)	824	514

Room size: length = 4.88 m, width = 7.32

Room Height (m)	Transom Depth (m)	2.21	2.46	2.71	2.95	3.20	3.44
2.44	0.41	398					
3.66	1.63	772					
4.88	2.84	(787)	654				
6.10	4.06	(767)	900				
9.14	7.11	(718)	(751)		804		
12.19	10.16	(674)	(706)		(765)	(793)	770

Room Size: length = 8.53 m, width = 12.80 m

Room Height (m)	Transom Depth (m)	4.18	4.43	4.67	4.92	5.17	5.42	5.66	5.91	6.15	6.40
2.44	0.41	816	558								
3.66	1.63		820								
4.88	2.84		(790)	830							
6.10	4.06		(775)	(790)		696					
9.14	7.11		(736)	(751)		(780)		832#			
12.19	10.16		(697)	(712)#		(741)#		(768)#		(792)#	878#

Table 8. Effect of Wall Lining Material on Time and Energy Needed to Achieve Flashover

Room size: length = 2.44 m, width = 3.66 m, height = 2.44 m

Wall Lining Material	Thickness (mm)	Thermal Conductivity (W/m K)	Specific Heat (J/kg K)	Density (kg/m^3)	Steady State Energy Output (MW) 0.98	1.23	1.48	1.72	1.97	2.21
Expanded Polystyrene	12.7	0.034	1500	20	(763)	14	11.75			
Fibre insulation Board	12.7	0.053	1250	240	(643)	62*	50*			
Chip board	12.7	0.15	1250	800	(635)	296	70*			
Gypsum board	12.7	0.17	1100	960		(690)	74*			
Brick	101.6	0.8	800	2600			(699)	126	80*	72*
Concrete	152.4	1.6	750	2400			(682)	(749)	52	76*

Room size: length = 4.88 m, width = 7.32 m, height = 2.44 m

Wall Lining Material	Thickness (mm)	Thermal Conductivity (W/m K)	Specific Heat (J/kg K)	Density (kg/m^3)	1.72	1.97	2.21	2.46	2.71	2.95	3.20	3.44
Expanded Polystyrene	12.7	0.034	1500	20	(780)	27.5	16					
Fibre insulation Board	12.7	0.053	1250	240	(777)	220	56					
Chip board	12.7	0.15	1250	800		(796)	350					
Gypsum board	12.7	0.17	1100	960		(795)	398					
Brick	101.6	0.8	800	2600			(706)		(762)	(789)	642	
Concrete	152.4	1.6	750	2400			(722)		(739)		(790)	690

Table 8. Continued

Room size: length = 8.53 m, width = 12.80 m, height = 2.44 m

Wall Lining Material Characteristics					Steady State Energy Output (MW)													
Wall Lining Material	Thickness (mm)	Thermal Conductivity (W/m K)	Specific Heat (J/kg K)	Density (kg/m^3)	3.44	3.69	3.94	4.18	4.43	4.67	4.92	5.17	5.42	5.66	5.91	6.15	6.40	6.64
Expanded Polystyrene	12.7	0.034	1500	20	(782)	(798)	48		23.5									
Fibre insulation Board	12.7	0.053	1250	240	(779)	(795)	302		80									
Chip board	12.7	0.15	1250	800				754	502									
Gypsum board	12.7	0.17	1100	960			(788)	816	558									
Brick	101.6	0.8	800	2600					(724)			(764)		(788)		732		
Concrete	152.4	1.6	750	2400					(698)			(736)		(760)		(782)	(793)	852

Table 9. Comparison of Predictions with Full-Scale Fire Tests Where Flashover Occurred

Minimum Precicted Heat Release Rate[a] (MW)	Ventilation $A(h)^{1/2}$ ($m^{5/2}$)	Wall Area[b] (m^2)	Heat Release[c] Rate (MW)	Fuel Type	Reference
1.6	3.4	88	2.8	Polyethylene	Bohm, test 9 [40]
1.6	3.4	88	2.2	Wood	Bohm, test 17 [40]
1.1	2.3	46	1.9	Polyurethane	FMRC, test 1 [41]
1.1	2.3	46	1.6	Polyurethane	FMRC, test 2 [41]
0.7	0.78	46	1.0	Polyurethane	FMRC, test 6 [41]
1.1	2.9	46	1.6	Polyurethane	FMRC, test 7 [41]
0.8	0.89	58	0.96	Furniture	Hagglund, test 8 [1]
0.8	1.11	58	1.04	Furniture	Hagglund, test 10 [1]
0.8	1.33	58	1.02	Furniture	Hagglund, test 13 [1]
1.1	1.78	58	1.35	Furniture	Hagglund, test 20 [1]
2.3	7.51	128	3.84	Wood	Heselden, text G, X [43]

Notes: [a] - from figure 2

[b] - including floor and ceiling

[c] - from reference [38] with assumed heats of combustion

APPENDIX A

Typical Set of Data Cards

Card Number	Card			Description	
1	START.2842R· (STREAM.2842R4)				
2	. ROOM FLASHOVER PREDICTION MODELING				
3	.				
4	.	ROOM SIZE:	8.5344 X 12.8016 X 2.4384 METERS		
5	.		ASPECT RATIO = 1.5		
6	.	VENT SIZE:	1.7262 X 2.032 METERS		
7	.		A * H**0.5 = 5.00		
8	.	WALL MATERIAL:	0.0127 M THICK GYPSUM WALLBOARD		
9	.		(THERMAL PROPERTIES FROM QUINTIERE ET AL)		
10	.	GAS FLOW RATE:	0.090 KG/SEC		
11	.				
12	.	GAS BURNER ALGORITHM -- CONSTANT FIRE			
13	.	SECOND OBJECT ADDED AS A FLASHOVER INDICATOR			
14	.	FLASHOVER IS REACHED WHEN DELTA T = 500 C			
15					
16	Y				
17	005				
18	N				
19	Y				
20	001			CHANGE ROOM LENGTH	
21	002			CHANGE ROOM WIDTH	
22	003			CHANGE ROOM HEIGHT	
23	004			CHANGE NUMBER OF OBJECTS IN ROOM	
24					Room Characteristics
25	8.5344			ROOM LENGTH	
26	12.8016			ROOM WIDTH	
27	2.4384			ROOM HEIGHT	
28	2			NUMBER OF OBJECTS IN ROOM	
29	001			CHANGE X LOCATION OF BURNER	
30	002			CHANGE Y LOCATION OF BURNER	
31	003			CHANGE HEIGHT OF BURNER ABOVE FLOOR	
32	010			CHANGE DIMENSIONS OF BURNER	Object 1 (Gas Burner) Physical Characteristics
33					
34	0.3048			BURNER IS 1 FT FROM LEFT WALL	
35	12.4968			BURNER IS 1 FT FROM BACK WALL	
36	0.0			BURNER IS AT FLOOR	
37	0.3047	0.3047		BURNER IS 1 FT SQUARE	
38	001			CHANGE FIRE ALGORITHM	
39	019			CHANGE GAS BURNER RATE	
40	008			CHANGE CHI	
41	009			CHANGE HEAT OF COMBUSTION	
42					Object 1 Fire Algorithm
43	5			OBJECT IS FLAMING	
44	3			THIS IS A GAS BURNER	
45	0.090			GAS BURNER FLOW RATE IN KG/SEC	
46	0.98			CHI	
47	50200000.			HEAT OF COMBUSTION	
48	001			CHANGE X LOCATION OF FLASHOVER INDICATOR	
49	002			CHANGE Y LOCATION OF FLASHOVER INDICATOR	
50	003			CHANGE HEIGHT OF FLASHOVER INDICATOR	
51	006			CHANGE THICKNESS OF FLASHOVER INDICATOR	
52	008			CHANGE FLASHOVER INDICATOR RADIUS	
53	009			CHANGE MAXIMUM RADIUS	Object 2 (Flashover Indicator) Physical Characteristics
54					
55	4.2672			X COORDINATE IS AT MIDDLE OF DOOR	
56	0.01			Y COORDINATE IS NEAR FRONT WALL	
57	0.01			FLASHOVER INDICATOR IS NEAR FLOOR	

0.01	FLASHOVER INDICATOR THICKNESS	Object 2 (cont.)
0.05	FLASHOVER INDICATOR RADIUS	
0.05	MAXIMUM RADIUS	
011	CHANGE MASS OF OBJECT TO A LIGHT OBJECT	
012	CHANGE IGNITION TEMPERATURE	Object 2 Fire Algorithm
0.01	FLASHOVER INDICATOR IS LIGHT	
2000.0	BUT IT WON'T BURN	
1	NUMBER OF VENTS	
001	CHANGE VENT WIDTH	
002	CHANGE VENT HEIGHT	
003	CHANGE VENT TRANSOM DEPTH	Vent Characteristics
1.7262	VENT WIDTH	
2.0320	VENT HEIGHT	
0.40640	VENT TRANSOM DEPTH	
001	CHANGE WALL THICKNESS	
002	CHANGE THERMAL CONDUCTIVITY	
003	CHANGE SPECIFIC HEAT	
004	CHANGE DENSITY	Wall Lining Material Characteristics
0.0127	WALL LINING THICKNESS (M)	
0.17	THERMAL CONDUCTIVITY (KW/M*K)	
1100.	SPECIFIC HEAT (J/KG*K)	
960.	DENSITY (KG/M**3)	
000	NO CHANGE IN NON-INDEXED VARIABLES	
N	DON'T USE SHORT FORM OUTPUT	
10.0	DISC OUTPUT INTERVAL	Computer Output Directives
900.0	MAXIMUM TIME TO CALCULATE IS 15 MINUTES	
800.0	MAXMIMUM LAYER DELTA T IS 500 C (FLASHOVER)	
2.0	BASIC TIME INCREMENT	

```
RUN START.2842R-  (STREAM.2842R4)
---------------
  . ROOM FLASHOVER PREDICTION MODELING
  .
  .       ROOM SIZE:        8.5344 X 12.8016 X 2.4384 METERS
  .                         ASPECT RATIO = 1.5
  .       VENT SIZE:        1.7262 X 2.032 METERS
  .                         A * H**0.5 = 5.00
  .       WALL MATERIAL:    0.0127 M THICK GYPSUM WALLBOARD
  .                         (THERMAL PROPERTIES FROM QUINTIERE ET AL)
  .       GAS FLOW RATE:    0.090 KG/SEC
  .
  .       GAS BURNER ALGORITHM -- CONSTANT FIRE
  .       SECOND OBJECT ADDED AS A FLASHOVER INDICATOR
  .       FLASHOVER IS REACHED WHEN DELTA T = 500 C

PHYSICS SUBROUTINES IN USE (ONLY FOR SUBROUTINES WITH MULTIPLE VERSIONS):
  TMPO, VERSION   2
 ABSRB, VERSION   2

        GEOMETRIC AND PHYSICAL PARAMETERS:

 ROOM NUMBER 1:
    LENGTH ALONG X=     8.5344
    LENGTH ALONG Y=    12.8016
    HEIGHT=      2.4384
    AMBIENT TEMPERATURE= 300.0
  OBJECT NUMBER 1 (ID= 1) :
    X-COORD=     .3048 Y-COORD=   12.4968   HEIGHT=     .0000
    ANGLE WITH HORIZONTAL=    .00       ANGLE WITH XZ-PLANE=    .00
    THICKNESS=     .1000                DENSITY= 48.00
    INITIAL MASS=   6.8520              INITIAL RADIUS=     .2614
    MAXIMUM RADIUS=     .2614           OBJECT RADIUS=     .1719
    SPECIFIC HEAT= 1900.                THERMAL CONDUCTIVITY=  .0540
    EMISSIVITY=  .98                    CHI(FRACTION OF HEAT RELEASED)=  .98
    HEAT OF COMBUSTION=  .502+008       HEAT OF VAPORIZATION=  .205+007
    PYROLIZATION TEMP= 600.0            IGNITION TEMP= 727.0
    AIR/FUEL MASS RATIO= 14.45          STOCHIOMETRIC MASS RATIO=  9.85
    FCO2(CO2 MASS/FUEL MASS)= 1.504  FCO(CO MASS/FUEL MASS)=  .013
    FS(SMOKE MASS/FUEL MASS)=  .241  FH2O(H2O MASS/FUEL MASS)=  .714
    A(FIRE SPREAD PARAMETER)=     .0109
    GAS FLOW RATE OF THE GAS BURNER (IN KG/SEC) =   .090
  OBJECT NUMBER 2 (ID= 2) :
    X-COORD=   4.2672 Y-COORD=     .0100   HEIGHT=     .0100
    ANGLE WITH HORIZONTAL=    .00       ANGLE WITH XZ-PLANE=    .00
    THICKNESS=     .0100                DENSITY= 48.00
    INITIAL MASS=     .0100             INITIAL RADIUS=     .0370
    MAXIMUM RADIUS=     .0500           OBJECT RADIUS=     .0500
    SPECIFIC HEAT= 1900.                THERMAL CONDUCTIVITY=  .0540
    EMISSIVITY=  .98                    CHI(FRACTION OF HEAT RELEASED)=  .65
    HEAT OF COMBUSTION=  .287+008       HEAT OF VAPORIZATION=  .205+007
    PYROLIZATION TEMP= 600.0            IGNITION TEMP=2000.0
    AIR/FUEL MASS RATIO= 14.45          STOCHIOMETRIC MASS RATIO=  9.85
    FCO2(CO2 MASS/FUEL MASS)= 1.504  FCO(CO MASS/FUEL MASS)=  .013
    FS(SMOKE MASS/FUEL MASS)=  .241  FH2O(H2O MASS/FUEL MASS)=  .714
    A(FIRE SPREAD PARAMETER)=     .0109
 VENT NUMBER 1:
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    WIDTH=   1.7262   HEIGHT=   2.0320    TRANSOM DEPTH=     .4064
 WALL NUMBER 1:
    THICKNESS=     .0127             DENSITY=960.00
    SPECIFIC HEAT= 1100.             THERMAL CONDUCTIVITY=  .1700
 PHYSICAL CONSTANTS:
    SPECIFIC HEAT OF AIR= 1004.      ABSORPTION COEFF OF FLAME= 1.55
  FOR AIR:
    HEAT TRANSFER COEFF= 10.00       PLUME ENTRAINMENT COEFF=  .10
  FOR LAYER GASES:
    MAX. HEAT TRANSFER COEFF= 50.00  MIN. HEAT TRANSFER COEFF= 5.00
  FOR VENTS:
    FLOW COEFFICIENT=  .68


----------------------------------------------------------------------
T=   2.000      DT= 2.000     NT=   1     NIT=   33      IT= 33     G.S.
ROOM= 1:     TELZR=-8.4455+000   TELZD=-4.8864+005   ZMLZZ= 3.5646+000
             TMLZZ= 3.5646+000   ZELZZ= 1.4558+006   TELZZ= 1.4555+006
             ZHLZZ= 3.7590-002   ZKLZZ= 4.0679+002   ZYLOZ= 2.1898-001
             ZYLDZ= 8.1655-003   ZYLMZ= 6.7809-005   ZYLSZ= 1.2287-003
             ZYLWZ= 3.6377-003   ZPRZZ= 1.0704-002
  OBJ= 1:    FQLOR=  .0000       FQWOR= 4.0257+002   FQPOR= 3.7428+004
  (ID= 1)    ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-1.8174-002
             TEOZZ=-8.9407+005
             ZHPZZ= 2.4008+000   TMPZZ= 3.5646+000   TEPZZ= 1.9442+006
             TEPZR= 2.3543+004
             ZRFZZ= 2.6143-001
  OBJ= 2:    FQLOR=  .0000       FQWOR= 5.1996+002   FQPOR=  .0000
  (ID= 2)    ZKOZZ= 3.0110+002   ZMOZZ= 1.0000-002   TMOZZ=  .0000
             TEOZZ=  .0000
VENT= 1:     TEUZZ=  .0000       TMUZZ=  .0000       TMDZZ= 1.2859+000
WALL= 1,1:   FQLWR=  .0000       FQPWR= 6.9971+001   FQLWD= 4.3762+003
             ZKWZZ= 3.1931+002
WALL= 1,2:   FQLWR=  .0000       FQPWR=  .0000       FQLWD=  .0000
             ZKWZZ= 3.0000+002
----------------------------------------------------------------------
----------------------------------------------------------------------
T=  10.000      DT= 2.000     NT=   5     NIT=  123      IT= 20     G.S.
ROOM= 1:     TELZR=-4.7474+005   TELZD=-1.3290+006   ZMLZZ= 3.7156+001
             TMLZZ= 3.9596+000   ZELZZ= 2.1019+007   TELZZ= 2.7568+006
             ZHLZZ= 5.4267-001   ZKLZZ= 5.6343+002   ZYLOZ= 2.0540-001
             ZYLDZ= 1.6280-002   ZYLMZ= 1.3959-004   ZYLSZ= 2.5293-003
             ZYLWZ= 7.4883-003   ZPRZZ= 1.8382-001
  OBJ= 1:    FQLOR= 7.6942+002   FQWOR= 4.5606+002   FQPOR= 3.7428+004
  (ID= 1)    ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-7.0394-002
             TEOZZ=-3.4631+006
             ZHPZZ= 1.8957+000   TMPZZ= 4.2518+000   TEPZZ= 4.7202+006
             TEPZR= 2.3543+004
             ZRFZZ= 2.6143-001
  OBJ= 2:    FQLOR= 1.0745+003   FQWOR= 5.6608+002   FQPOR=  .0000
  (ID= 2)    ZKOZZ= 3.2443+002   ZMOZZ= 1.0000-002   TMOZZ=  .0000
             TEOZZ=  .0000
VENT= 1:     TEUZZ= 1.5964+005   TMUZZ= 2.8220-001   TMDZZ= 4.9714+000
WALL= 1,1:   FQLWR= 2.3086+003   FQPWR= 4.8045+001   FQLWD= 9.3659+003
             ZKWZZ= 3.7612+002
WALL= 1,2:   FQLWR=  .0000       FQPWR=  .0000       FQLWD=  .0000
             ZKWZZ= 3.0000+002
----------------------------------------------------------------------
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-----------------------------------------------------------------
T=  20.000     DT= 2.000      NT=  10      NIT=  220      IT= 13      G.S.
ROOM= 1:      TELZR=-1.5501+006   TELZD=-1.6045+006   ZMLZZ= 6.5420+001
              TMLZZ= 1.3849+000   ZELZZ= 4.1928+007   TELZZ= 1.3874+006
              ZHLZZ= 1.0825+000   ZKLZZ= 6.3834+002   ZYLOZ= 1.8930-001
              ZYLDZ= 2.5904-002   ZYLMZ= 2.2473-004   ZYLSZ= 4.0721-003
              ZYLWZ= 1.2056-002   ZPRZZ= 3.4735-002
  OBJ= 1:     FQLOR= 3.1565+003   FQWOR= 3.1535+002   FQPOR= 3.7428+004
  (ID= 1)     ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
              TEOZZ=-4.4276+006
              ZHPZZ= 1.3559+000   TMPZZ= 3.1504+000   TEPZZ= 5.3530+006
              TEPZR= 2.3542+004
              ZRFZZ= 2.6143-001
  OBJ= 2:     FQLOR= 3.8456+003   FQWOR= 4.0644+002   FQPOR=  .0000
  (ID= 2)     ZKOZZ= 3.9340+002   ZMOZZ= 1.0000-002   TMOZZ=  .0000
              TEOZZ=  .0000
VENT= 1:      TEUZZ= 8.1117+005   TMUZZ= 1.2657+000   TMDZZ= 1.5457+000
WALL= 1,1:    FQLWR= 6.9915+003   FQPWR= 1.8575+001   FQLWD= 9.6355+003
              ZKWZZ= 4.4564+002
WALL= 1,2:    FQLWR=  .0000       FQPWR=  .0000       FQLWD=  .0000
              ZKWZZ= 3.0000+002
-----------------------------------------------------------------
-----------------------------------------------------------------
T=  30.000     DT= 2.000      NT=  15      NIT=  311      IT= 22      G.S.
ROOM= 1:      TELZR=-1.9378+006   TELZD=-1.4529+006   ZMLZZ= 7.8084+001
              TMLZZ= 7.5398-001   ZELZZ= 5.1397+007   TELZZ= 6.0720+005
              ZHLZZ= 1.3270+000   ZKLZZ= 6.5561+002   ZYLOZ= 1.7687-001
              ZYLDZ= 3.3338-002   ZYLMZ= 2.9048-004   ZYLSZ= 5.2636-003
              ZYLWZ= 1.5583-002   ZPRZZ=-3.8186-003
  OBJ= 1:     FQLOR= 4.4974+003   FQWOR= 1.9770+002   FQPOR= 3.7428+004
  (ID= 1)     ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
              TEOZZ=-4.4276+006
              ZHPZZ= 1.1114+000   TMPZZ= 2.5279+000   TEPZZ= 5.1655+006
              TEPZR= 2.3542+004
              ZRFZZ= 2.6143-001
  OBJ= 2:     FQLOR= 4.9806+003   FQWOR= 2.9999+002   FQPOR=  .0000
  (ID= 2)     ZKOZZ= 4.3429+002   ZMOZZ= 1.0000-002   TMOZZ=  .0000
              TEOZZ=  .0000
VENT= 1:      TEUZZ= 1.1676+006   TMUZZ= 1.7739+000   TMDZZ=-4.2185-001
WALL= 1,1:    FQLWR= 8.8603+003   FQPWR= 1.1854+001   FQLWD= 8.3541+003
              ZKWZZ= 4.8853+002
WALL= 1,2:    FQLWR=  .0000       FQPWR=  .0000       FQLWD=  .0000
              ZKWZZ= 3.0000+002
-----------------------------------------------------------------
-----------------------------------------------------------------
T=  40.000     DT= 2.000      NT=  20      NIT=  358      IT=  5      G.S.
ROOM= 1:      TELZR=-2.1491+006   TELZD=-1.3189+006   ZMLZZ= 8.3024+001
              TMLZZ= 3.0293-001   ZELZZ= 5.5748+007   TELZZ= 3.0575+005
              ZHLZZ= 1.4393+000   ZKLZZ= 6.6879+002   ZYLOZ= 1.6653-001
              ZYLDZ= 3.9516-002   ZYLMZ= 3.4514-004   ZYLSZ= 6.2540-003
              ZYLWZ= 1.8515-002   ZPRZZ=-3.2590-002
  OBJ= 1:     FQLOR= 5.3706+003   FQWOR= 1.4985+002   FQPOR= 3.7428+004
  (ID= 1)     ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
              TEOZZ=-4.4276+006
              ZHPZZ= 9.9907-001   TMPZZ= 2.2519+000   TEPZZ= 5.0824+006
              TEPZR= 2.3542+004
              ZRFZZ= 2.6143-001
  OBJ= 2:     FQLOR= 5.6479+003   FQWOR= 2.5764+002   FQPOR=  .0000
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  (ID= 2)    ZKOZZ= 4.5911+002   ZMOZZ= 1.0000-002   TMOZZ=   .0000
             TEOZZ=   .0000
VENT= 1:     TEUZZ= 1.3086+006   TMUZZ= 1.9489+000   TMDZZ=-1.1467+000
WALL= 1,1:   FQLWR= 1.0073+004   FQPWR= 8.9896+000   FQLWD= 7.4937+003
             ZKWZZ= 5.1892+002
WALL= 1,2:   FQLWR=   .0000      FQPWR=   .0000      FQLWD=-4.3559-002
             ZKWZZ= 3.0001+002
----------------------------------------------------------------------
----------------------------------------------------------------------
T=  50.000      DT= 2.000     NT=  25      NIT=  384     IT=  5     G.S.
ROOM= 1:     TELZR=-2.2974+006   TELZD=-1.2108+006   ZMLZZ= 8.4982+001
             TMLZZ= 1.1178-001   ZELZZ= 5.8039+007   TELZZ= 1.6704+005
             ZHLZZ= 1.4985+000   ZKLZZ= 6.8023+002   ZYLOZ= 1.5765-001
             ZYLDZ= 4.4825-002   ZYLMZ= 3.9210-004   ZYLSZ= 7.1049-003
             ZYLWZ= 2.1035-002   ZPRZZ=-5.6497-002
  OBJ= 1:    FQLOR= 6.0379+003   FQWOR= 1.2921+002   FQPOR= 3.7428+004
  (ID= 1)    ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
             TEOZZ=-4.4276+006
             ZHPZZ= 9.3992-001   TMPZZ= 2.1092+000   TEPZZ= 5.0394+006
             TEPZR= 2.3542+004
             ZRFZZ= 2.6143-001
  OBJ= 2:    FQLOR= 6.1666+003   FQWOR= 2.3891+002   FQPOR=   .0000
  (ID= 2)    ZKOZZ= 4.7728+002   ZMOZZ= 1.0000-002   TMOZZ=   .0000
             TEOZZ=   .0000
VENT= 1:     TEUZZ= 1.3641+006   TMUZZ= 1.9973+000   TMDZZ=-1.4645+000
WALL= 1,1:   FQLWR= 1.1053+004   FQPWR= 7.1680+000   FQLWD= 6.8613+003
             ZKWZZ= 5.4301+002
WALL= 1,2:   FQLWR=   .0000      FQPWR=   .0000      FQLWD=-4.4778-001
             ZKWZZ= 3.0009+002
----------------------------------------------------------------------
----------------------------------------------------------------------
T=  60.000      DT= 2.000     NT=  30      NIT=  409     IT=  5     G.S.
ROOM= 1:     TELZR=-2.4085+006   TELZD=-1.1209+006   ZMLZZ= 8.5588+001
             TMLZZ= 1.9745-002   ZELZZ= 5.9303+007   TELZZ= 9.2745+004
             ZHLZZ= 1.5311+000   ZKLZZ= 6.9013+002   ZYLOZ= 1.5003-001
             ZYLDZ= 4.9385-002   ZYLMZ= 4.3243-004   ZYLSZ= 7.8358-003
             ZYLWZ= 2.3199-002   ZPRZZ=-7.2364-002
  OBJ= 1:    FQLOR= 6.5757+003   FQWOR= 1.1947+002   FQPOR= 3.7428+004
  (ID= 1)    ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
             TEOZZ=-4.4276+006
             ZHPZZ= 9.0728-001   TMPZZ= 2.0311+000   TEPZZ= 5.0159+006
             TEPZR= 2.3542+004
             ZRFZZ= 2.6143-001
  OBJ= 2:    FQLOR= 6.6023+003   FQWOR= 2.2980+002   FQPOR=   .0000
  (ID= 2)    ZKOZZ= 4.9182+002   ZMOZZ= 1.0000-002   TMOZZ=   .0000
             TEOZZ=   .0000
VENT= 1:     TEUZZ= 1.3937+006   TMUZZ= 2.0114+000   TMDZZ=-1.6332+000
WALL= 1,1:   FQLWR= 1.1885+004   FQPWR= 6.1327+000   FQLWD= 6.3600+003
             ZKWZZ= 5.6293+002
WALL= 1,2:   FQLWR=   .0000      FQPWR=   .0000      FQLWD=-1.8966+000
             ZKWZZ= 3.0038+002
----------------------------------------------------------------------
----------------------------------------------------------------------
T=  70.000      DT= 2.000     NT=  35      NIT=  435     IT=  6     G.S.
ROOM= 1:     TELZR=-2.4944+006   TELZD=-1.0451+006   ZMLZZ= 8.5533+001
             TMLZZ=-2.5514-002   ZELZZ= 6.0002+007   TELZZ= 5.0813+004
             ZHLZZ= 1.5492+000   ZKLZZ= 6.9871+002   ZYLOZ= 1.4354-001
             ZYLDZ= 5.3262-002   ZYLMZ= 4.6673-004   ZYLSZ= 8.4573-003
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           ZYLWZ= 2.5039-002   ZPRZZ=-8.2340-002
  OBJ= 1:  FQLOR= 7.0224+003   FQWOR= 1.1454+002   FQPOR= 3.7428+004
  (ID= 1)  ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
           TEOZZ=-4.4276+006
           ZHPZZ= 8.8923-001   TMPZZ= 1.9882+000   TEPZZ= 5.0030+006
           TEPZR= 2.3542+004
           ZRFZZ= 2.6143-001
  OBJ= 2:  FQLOR= 6.9793+003   FQWOR= 2.2504+002   FQPOR=  .0000
  (ID= 2)  ZKOZZ= 5.0401+002   ZMOZZ= 1.0000-002   TMOZZ=  .0000
           TEOZZ=  .0000
VENT= 1:   TEUZZ= 1.4127+006   TMUZZ= 2.0138+000   TMDZZ=-1.7296+000
WALL= 1,1: FQLWR= 1.2607+004   FQPWR= 5.4826+000   FQLWD= 5.9456+003
           ZKWZZ= 5.7980+002
WALL= 1,2: FQLWR=  .0000       FQPWR=  .0000       FQLWD=-5.1556+000
           ZKWZZ= 3.0103+002
-----------------------------------------------------------------------
-----------------------------------------------------------------------
T=  80.000    DT= 2.000    NT=  40     NIT=  467     IT=  6      G.S.
ROOM= 1:   TELZR=-2.5622+006   TELZD=-9.8056+005   ZMLZZ= 8.5159+001
           TMLZZ=-4.6708-002   ZELZZ= 6.0379+007   TELZZ= 2.6780+004
           ZHLZZ= 1.5589+000   ZKLZZ= 7.0620+002   ZYLOZ= 1.3810-001
           ZYLDZ= 5.6516-002   ZYLMZ= 4.9552-004   ZYLSZ= 8.9790-003
           ZYLWZ= 2.6583-002   ZPRZZ=-8.8441-002
  OBJ= 1:  FQLOR= 7.4014+003   FQWOR= 1.1190+002   FQPOR= 3.7428+004
  (ID= 1)  ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
           TEOZZ=-4.4276+006
           ZHPZZ= 8.7949-001   TMPZZ= 1.9652+000   TEPZZ= 4.9960+006
           TEPZR= 2.3542+004
           ZRFZZ= 2.6143-001
  OBJ= 2:  FQLOR= 7.3106+003   FQWOR= 2.2240+002   FQPOR=  .0000
  (ID= 2)  ZKOZZ= 5.1448+002   ZMOZZ= 1.0000-002   TMOZZ=  .0000
           TEOZZ=  .0000
VENT= 1:   TEUZZ= 1.4265+006   TMUZZ= 2.0119+000   TMDZZ=-1.7862+000
WALL= 1,1: FQLWR= 1.3241+004   FQPWR= 5.0474+000   FQLWD= 5.5946+003
           ZKWZZ= 5.9431+002
WALL= 1,2: FQLWR=  .0000       FQPWR=  .0000       FQLWD=-1.0804+001
           ZKWZZ= 3.0216+002
-----------------------------------------------------------------------
-----------------------------------------------------------------------
T=  90.000    DT= 2.000    NT=  45     NIT=  492     IT=  5      G.S.
ROOM= 1:   TELZR=-2.5168+006   TELZD=-9.2523+005   ZMLZZ= 8.4642+001
           TMLZZ=-5.5164-002   ZELZZ= 6.0573+007   TELZZ= 1.3066+004
           ZHLZZ= 1.5639+000   ZKLZZ= 7.1278+002   ZYLOZ= 1.3359-001
           ZYLDZ= 5.9211-002   ZYLMZ= 5.1936-004   ZYLSZ= 9.4109-003
           ZYLWZ= 2.7862-002   ZPRZZ=-9.2092-002
  OBJ= 1:  FQLOR= 7.7291+003   FQWOR= 1.1045+002   FQPOR= 3.7428+004
  (ID= 1)  ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
           TEOZZ=-4.4276+006
           ZHPZZ= 8.7451-001   TMPZZ= 1.9534+000   TEPZZ= 4.9925+006
           TEPZR= 2.3542+004
           ZRFZZ= 2.6143-001
  OBJ= 2:  FQLOR= 7.6049+003   FQWOR= 2.2088+002   FQPOR=  .0000
  (ID= 2)  ZKOZZ= 5.2363+002   ZMOZZ= 1.0000-002   TMOZZ=  .0000
           TEOZZ=  .0000
VENT= 1:   TEUZZ= 1.4374+006   TMUZZ= 2.0085+000   TMDZZ=-1.8200+000
WALL= 1,1: FQLWR= 1.3803+004   FQPWR= 4.7435+000   FQLWD= 5.2923+003
           ZKWZZ= 6.0693+002
WALL= 1,2: FQLWR=  .0000       FQPWR=  .0000       FQLWD=-1.9149+001
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           ZKWZZ= 3.0383+002
------------------------------------------------------------------
------------------------------------------------------------------
T= 100.000     DT= 2.000     NT=  50     NIT=  523     IT=  7     G.S.
ROOM= 1:   TELZR=-2.6616+006   TELZD=-8.7741+005   ZMLZZ= 8.4078+001
           TMLZZ=-5.6927-002   ZELZZ= 6.0661+007   TELZZ= 5.3613+003
           ZHLZZ= 1.5662+000   ZKLZZ= 7.1861+002   ZYLOZ= 1.2990-001
           ZYLDZ= 6.1415-002   ZYLMZ= 5.3885-004   ZYLSZ= 9.7641-003
           ZYLWZ= 2.8908-002   ZPRZZ=-9.4231-002
  OBJ= 1:  FQLOR= 8.0169+003   FQWOR= 1.0963+002   FQPOR= 3.7428+004
  (ID= 1)  ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
           TEOZZ=-4.4276+006
           ZHPZZ= 8.7222-001   TMPZZ= 1.9480+000   TEPZZ= 4.9908+006
           TEPZR= 2.3542+004
           ZRFZZ= 2.6143-001
  OBJ= 2:  FQLOR= 7.8689+003   FQWOR= 2.1998+002   FQPOR=   .0000
  (ID= 2)  ZKOZZ= 5.3170+002   ZMOZZ= 1.0000-002   TMOZZ=   .0000
           TEOZZ=   .0000
VENT= 1:   TEUZZ= 1.4465+006   TMUZZ= 2.0049+000   TMDZZ=-1.8402+000
WALL= 1,1: FQLWR= 1.4307+004   FQPWR= 4.5252+000   FQLWD= 5.0289+003
           ZKWZZ= 6.1803+002
WALL= 1,2: FQLWR=   .0000      FQPWR=   .0000      FQLWD=-3.0265+001
           ZKWZZ= 3.0605+002
------------------------------------------------------------------
------------------------------------------------------------------
T= 110.000     DT= 2.000     NT=  55     NIT=  554     IT=  7     G.S.
ROOM= 1:   TELZR=-2.6989+006   TELZD=-8.3575+005   ZMLZZ= 8.3515+001
           TMLZZ=-5.5285-002   ZELZZ= 6.0692+007   TELZZ= 1.1779+003
           ZHLZZ= 1.5670+000   ZKLZZ= 7.2382+002   ZYLOZ= 1.2692-001
           ZYLDZ= 6.3196-002   ZYLMZ= 5.5461-004   ZYLSZ= 1.0050-002
           ZYLWZ= 2.9753-002   ZPRZZ=-9.5457-002
  OBJ= 1:  FQLOR= 8.2730+003   FQWOR= 1.0918+002   FQPOR= 3.7428+004
  (ID= 1)  ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
           TEOZZ=-4.4276+006
           ZHPZZ= 8.7143-001   TMPZZ= 1.9461+000   TEPZZ= 4.9903+006
           TEPZR= 2.3542+004
           ZRFZZ= 2.6143-001
  OBJ= 2:  FQLOR= 8.1077+003   FQWOR= 2.1943+002   FQPOR=   .0000
  (ID= 2)  ZKOZZ= 5.3888+002   ZMOZZ= 1.0000-002   TMOZZ=   .0000
           TEOZZ=   .0000
VENT= 1:   TEUZZ= 1.4544+006   TMUZZ= 2.0014+000   TMDZZ=-1.8522+000
WALL= 1,1: FQLWR= 1.4761+004   FQPWR= 4.3652+000   FQLWD= 4.7973+003
           ZKWZZ= 6.2788+002
WALL= 1,2: FQLWR=   .0000      FQPWR=   .0000      FQLWD=-4.4063+001
           ZKWZZ= 3.0881+002
------------------------------------------------------------------
------------------------------------------------------------------
T= 120.000     DT= 2.000     NT=  60     NIT=  589     IT=  8     G.S.
ROOM= 1:   TELZR=-2.7304+006   TELZD=-7.9950+005   ZMLZZ= 8.2978+001
           TMLZZ=-5.1932-002   ZELZZ= 6.0691+007   TELZZ=-1.0671+003
           ZHLZZ= 1.5670+000   ZKLZZ= 7.2850+002   ZYLOZ= 1.2454-001
           ZYLDZ= 6.4622-002   ZYLMZ= 5.6722-004   ZYLSZ= 1.0278-002
           ZYLWZ= 3.0430-002   ZPRZZ=-9.6164-002
  OBJ= 1:  FQLOR= 8.5031+003   FQWOR= 1.0892+002   FQPOR= 3.7428+004
  (ID= 1)  ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
           TEOZZ=-4.4276+006
           ZHPZZ= 8.7144-001   TMPZZ= 1.9461+000   TEPZZ= 4.9903+006
           TEPZR= 2.3542+004
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             ZRFZZ= 2.6143-001
  OBJ= 2:    FQLOR= 8.3250+003   FQWOR= 2.1909+002   FQPOR=   .0000
  (ID= 2)    ZKOZZ= 5.4530+002   ZMOZZ= 1.0000-002   TMOZZ=   .0000
             TEOZZ=  .0000
VENT= 1:     TEUZZ= 1.4614+006   TMUZZ= 1.9981+000   TMDZZ=-1.8596+000
WALL= 1,1:   FQLWR= 1.5173+004   FQPWR= 4.2465+000   FQLWD= 4.5918+003
             ZKWZZ= 6.3666+002
WALL= 1,2:   FQLWR=  .0000       FQPWR=  .0000       FQLWD=-6.0351+001
             ZKWZZ= 3.1207+002
----------------------------------------------------------------------
----------------------------------------------------------------------
T= 130.000      DT= 2.000     NT=  65     NIT=  617     IT=  5     G.S.
ROOM= 1:     TELZR=-2.7573+006   TELZD=-7.6745+005   ZMLZZ= 8.2478+001
             TMLZZ=-4.8118-002   ZELZZ= 6.0675+007   TELZZ=-2.0053+003
             ZHLZZ= 1.5665+000   ZKLZZ= 7.3273+002   ZYLOZ= 1.2265-001
             ZYLDZ= 6.5753-002   ZYLMZ= 5.7723-004   ZYLSZ= 1.0460-002
             ZYLWZ= 3.0966-002   ZPRZZ=-9.6519-002
  OBJ= 1:    FQLOR= 8.7117+003   FQWOR= 1.0879+002   FQPOR= 3.7428+004
  (ID= 1)    ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
             TEOZZ=-4.4276+006
             ZHPZZ= 8.7186-001   TMPZZ= 1.9471+000   TEPZZ= 4.9906+006
             TEPZR= 2.3542+004
             ZRFZZ= 2.6143-001
  OBJ= 2:    FQLOR= 8.5236+003   FQWOR= 2.1888+002   FQPOR=   .0000
  (ID= 2)    ZKOZZ= 5.5108+002   ZMOZZ= 1.0000-002   TMOZZ=   .0000
             TEOZZ=  .0000
VENT= 1:     TEUZZ= 1.4678+006   TMUZZ= 1.9952+000   TMDZZ=-1.8638+000
WALL= 1,1:   FQLWR= 1.5548+004   FQPWR= 4.1577+000   FQLWD= 4.4081+003
             ZKWZZ= 6.4456+002
WALL= 1,2:   FQLWR=  .0000       FQPWR=  .0000       FQLWD=-7.8885+001
             ZKWZZ= 3.1578+002
----------------------------------------------------------------------
----------------------------------------------------------------------
T= 140.000      DT= 2.000     NT=  70     NIT=  642     IT=  5     G.S.
ROOM= 1:     TELZR=-2.7809+006   TELZD=-7.3868+005   ZMLZZ= 8.2016+001
             TMLZZ=-4.4305-002   ZELZZ= 6.0653+007   TELZZ=-2.3489+003
             ZHLZZ= 1.5660+000   ZKLZZ= 7.3658+002   ZYLOZ= 1.2116-001
             ZYLDZ= 6.6642-002   ZYLMZ= 5.8510-004   ZYLSZ= 1.0602-002
             ZYLWZ= 3.1388-002   ZPRZZ=-9.6699-002
  OBJ= 1:    FQLOR= 8.9032+003   FQWOR= 1.0872+002   FQPOR= 3.7428+004
  (ID= 1)    ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
             TEOZZ=-4.4276+006
             ZHPZZ= 8.7243-001   TMPZZ= 1.9485+000   TEPZZ= 4.9910+006
             TEPZR= 2.3542+004
             ZRFZZ= 2.6143-001
  OBJ= 2:    FQLOR= 8.7072+003   FQWOR= 2.1876+002   FQPOR=   .0000
  (ID= 2)    ZKOZZ= 5.5631+002   ZMOZZ= 1.0000-002   TMOZZ=   .0000
             TEOZZ=  .0000
VENT= 1:     TEUZZ= 1.4737+006   TMUZZ= 1.9928+000   TMDZZ=-1.8662+000
WALL= 1,1:   FQLWR= 1.5894+004   FQPWR= 4.0908+000   FQLWD= 4.2434+003
             ZKWZZ= 6.5172+002
WALL= 1,2:   FQLWR=  .0000       FQPWR=  .0000       FQLWD=-9.9395+001
             ZKWZZ= 3.1988+002
----------------------------------------------------------------------
----------------------------------------------------------------------
T= 150.000      DT= 2.000     NT=  75     NIT=  670     IT=  8     G.S.
ROOM= 1:     TELZR=-2.8019+006   TELZD=-7.1270+005   ZMLZZ= 8.1591+001
             TMLZZ=-4.0677-002   ZELZZ= 6.0629+007   TELZZ=-2.3621+003
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              ZHLZZ= 1.5654+000    ZKLZZ= 7.4013+002    ZYLOZ= 1.2000-001
              ZYLDZ= 6.7337-002    ZYLMZ= 5.9125-004    ZYLSZ= 1.0714-002
              ZYLWZ= 3.1718-002    ZPRZZ=-9.6786-002
  OBJ= 1:     FQLOR= 9.0802+003    FQWOR= 1.0870+002    FQPOR= 3.7428+004
  (ID= 1)     ZKOZZ= 7.2700+002    ZMOZZ= 6.8520+000    TMOZZ=-9.0000-002
              TEOZZ=-4.4276+006
              ZHPZZ= 8.7304-001    TMPZZ= 1.9499+000    TEPZZ= 4.9914+006
              TEPZR= 2.3542+004
              ZRFZZ= 2.6143-001
  OBJ= 2:     FQLOR= 8.8779+003    FQWOR= 2.1869+002    FQPOR=   .0000
  (ID= 2)     ZKOZZ= 5.6107+002    ZMOZZ= 1.0000-002    TMOZZ=   .0000
              TEOZZ=   .0000
VENT= 1:      TEUZZ= 1.4792+006    TMUZZ= 1.9906+000    TMDZZ=-1.8678+000
WALL= 1,1:    FQLWR= 1.6214+004    FQPWR= 4.0404+000    FQLWD= 4.0948+003
              ZKWZZ= 6.5823+002
WALL= 1,2:    FQLWR=   .0000       FQPWR=   .0000       FQLWD=-1.2161+002
              ZKWZZ= 3.2432+002
----------------------------------------------------------------------
----------------------------------------------------------------------
T= 160.000      DT= 2.000      NT=  80      NIT=  698      IT=  6     G.S.
ROOM= 1:      TELZR=-2.8207+006    TELZD=-6.8910+005    ZMLZZ= 8.1201+001
              TMLZZ=-3.7365-002    ZELZZ= 6.0606+007    TELZZ=-2.2299+003
              ZHLZZ= 1.5648+000    ZKLZZ= 7.4340+002    ZYLOZ= 1.1909-001
              ZYLDZ= 6.7877-002    ZYLMZ= 5.9602-004    ZYLSZ= 1.0800-002
              ZYLWZ= 3.1974-002    ZPRZZ=-9.6822-002
  OBJ= 1:     FQLOR= 9.2448+003    FQWOR= 1.0871+002    FQPOR= 3.7428+004
  (ID= 1)     ZKOZZ= 7.2700+002    ZMOZZ= 6.8520+000    TMOZZ=-9.0000-002
              TEOZZ=-4.4276+006
              ZHPZZ= 8.7363-001    TMPZZ= 1.9513+000    TEPZZ= 4.9918+006
              TEPZR= 2.3542+004
              ZRFZZ= 2.6143-001
  OBJ= 2:     FQLOR= 9.0371+003    FQWOR= 2.1865+002    FQPOR=   .0000
  (ID= 2)     ZKOZZ= 5.6543+002    ZMOZZ= 1.0000-002    TMOZZ=   .0000
              TEOZZ=   .0000
VENT= 1:      TEUZZ= 1.4843+006    TMUZZ= 1.9887+000    TMDZZ=-1.8687+000
WALL= 1,1:    FQLWR= 1.6511+004    FQPWR= 4.0022+000    FQLWD= 3.9597+003
              ZKWZZ= 6.6421+002
WALL= 1,2:    FQLWR=   .0000       FQPWR=   .0000       FQLWD=-1.4527+002
              ZKWZZ= 3.2905+002
----------------------------------------------------------------------
----------------------------------------------------------------------
T= 170.000      OT= 2.000      NT=  85      NIT=  725      IT=  5     G.S.
ROOM= 1:      TELZR=-2.8376+006    TELZD=-6.6753+005    ZMLZZ= 8.0843+001
              TMLZZ=-3.4367-002    ZELZZ= 6.0585+007    TELZZ=-2.0256+003
              ZHLZZ= 1.5642+000    ZKLZZ= 7.4643+002    ZYLOZ= 1.1840-001
              ZYLDZ= 6.8294-002    ZYLMZ= 5.9970-004    ZYLSZ= 1.0867-002
              ZYLWZ= 3.2172-002    ZPRZZ=-9.6835-002
  OBJ= 1:     FQLOR= 9.3985+003    FQWOR= 1.0873+002    FQPOR= 3.7428+004
  (ID= 1)     ZKOZZ= 7.2700+002    ZMOZZ= 6.8520+000    TMOZZ=-9.0000-002
              TEOZZ=-4.4276+006
              ZHPZZ= 8.7418-001    TMPZZ= 1.9526+000    TEPZZ= 4.9922+006
              TEPZR= 2.3542+004
              ZRFZZ= 2.6143-001
  OBJ= 2:     FQLOR= 9.1864+003    FQWOR= 2.1864+002    FQPOR=   .0000
  (ID= 2)     ZKOZZ= 5.6943+002    ZMOZZ= 1.0000-002    TMOZZ=   .0000
              TEOZZ=   .0000
VENT= 1:      TEUZZ= 1.4891+006    TMUZZ= 1.9870+000    TMDZZ=-1.8693+000
WALL= 1,1:    FQLWR= 1.6790+004    FQPWR= 3.9734+000    FQLWD= 3.8363+003
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           ZKWZZ= 6.6971+002
WALL= 1,2: FQLWR=  .0000      FQPWR=  .0000      FQLWD=-1.7013+002
           ZKWZZ= 3.3403+002
-----------------------------------------------------------------------
-----------------------------------------------------------------------
T= 180.000    DT= 2.000     NT=  90     NIT=  752     IT=  6     G.S.
ROOM= 1:   TELZR=-2.8531+006  TELZD=-6.4774+005  ZMLZZ= 8.0513+001
           TMLZZ=-3.1707-002  ZELZZ= 6.0566+007  TELZZ=-1.8050+003
           ZHLZZ= 1.5637+000  ZKLZZ= 7.4926+002  ZYLOZ= 1.1786-001
           ZYLDZ= 6.8613-002  ZYLMZ= 6.0253-004  ZYLSZ= 1.0918-002
           ZYLWZ= 3.2324-002  ZPRZZ=-9.6835-002
  OBJ= 1:  FQLOR= 9.5428+003  FQWOR= 1.0875+002  FQPOR= 3.7428+004
  (ID= 1)  ZKOZZ= 7.2700+002  ZMOZZ= 6.8520+000  TMOZZ=-9.0000-002
           TEOZZ=-4.4276+006
           ZHPZZ= 8.7468-001  TMPZZ= 1.9538+000  TEPZZ= 4.9926+006
           TEPZR= 2.3542+004
           ZRFZZ= 2.6143-001
  OBJ= 2:  FQLOR= 9.3267+003  FQWOR= 2.1865+002  FQPOR=  .0000
  (ID= 2)  ZKOZZ= 5.7310+002  ZMOZZ= 1.0000-002  TMOZZ=  .0000
           TEOZZ=  .0000
VENT= 1:   TEUZZ= 1.4936+006  TMUZZ= 1.9855+000  TMDZZ=-1.8698+000
WALL= 1,1: FQLWR= 1.7050+004  FQPWR= 3.9517+000  FQLWD= 3.7230+003
           ZKWZZ= 6.7480+002
WALL= 1,2: FQLWR=  .0000      FQPWR=  .0000      FQLWD=-1.9598+002
           ZKWZZ= 3.3920+002
-----------------------------------------------------------------------
-----------------------------------------------------------------------
T= 190.000    DT= 2.000     NT=  95     NIT=  779     IT=  6     G.S.
ROOM= 1:   TELZR=-2.8672+006  TELZD=-6.2947+005  ZMLZZ= 8.0208+001
           TMLZZ=-2.9337-002  ZELZZ= 6.0549+007  TELZZ=-1.5871+003
           ZHLZZ= 1.5633+000  ZKLZZ= 7.5190+002  ZYLOZ= 1.1746-001
           ZYLDZ= 6.8856-002  ZYLMZ= 6.0468-004  ZYLSZ= 1.0957-002
           ZYLWZ= 3.2439-002  ZPRZZ=-9.6833-002
  OBJ= 1:  FQLOR= 9.6786+003  FQWOR= 1.0879+002  FQPOR= 3.7428+004
  (ID= 1)  ZKOZZ= 7.2700+002  ZMOZZ= 6.8520+000  TMOZZ=-9.0000-002
           TEOZZ=-4.4276+006
           ZHPZZ= 8.7511-001  TMPZZ= 1.9548+000  TEPZZ= 4.9929+006
           TEPZR= 2.3542+004
           ZRFZZ= 2.6143-001
  OBJ= 2:  FQLOR= 9.4591+003  FQWOR= 2.1867+002  FQPOR=  .0000
  (ID= 2)  ZKOZZ= 5.7650+002  ZMOZZ= 1.0000-002  TMOZZ=  .0000
           TEOZZ=  .0000
VENT= 1:   TEUZZ= 1.4978+006  TMUZZ= 1.9841+000  TMDZZ=-1.8701+000
WALL= 1,1: FQLWR= 1.7296+004  FQPWR= 3.9354+000  FQLWD= 3.6183+003
           ZKWZZ= 6.7953+002
WALL= 1,2: FQLWR=  .0000      FQPWR=  .0000      FQLWD=-2.2260+002
           ZKWZZ= 3.4452+002
-----------------------------------------------------------------------
-----------------------------------------------------------------------
T= 200.000    DT= 2.000     NT= 100     NIT=  805     IT=  6     G.S.
ROOM= 1:   TELZR=-2.8801+006  TELZD=-6.1253+005  ZMLZZ= 7.9925+001
           TMLZZ=-2.7249-002  ZELZZ= 6.0534+007  TELZZ=-1.3880+003
           ZHLZZ= 1.5629+000  ZKLZZ= 7.5437+002  ZYLOZ= 1.1715-001
           ZYLDZ= 6.9040-002  ZYLMZ= 6.0631-004  ZYLSZ= 1.0986-002
           ZYLWZ= 3.2526-002  ZPRZZ=-9.6829-002
  OBJ= 1:  FQLOR= 9.8071+003  FQWOR= 1.0883+002  FQPOR= 3.7428+004
  (ID= 1)  ZKOZZ= 7.2700+002  ZMOZZ= 6.8520+000  TMOZZ=-9.0000-002
           TEOZZ=-4.4276+006
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               ZHPZZ= 8.7550-001    TMPZZ= 1.9557+000    TEPZZ= 4.9932+006
               TEPZR= 2.3542+004
               ZRFZZ= 2.6143-001
  OBJ= 2:      FQLOR= 9.5844+003    FQWOR= 2.1869+002    FQPOR=  .0000
  (ID= 2)      ZKOZZ= 5.7965+002    ZMOZZ= 1.0000-002    TMOZZ=  .0000
               TEOZZ=  .0000
VENT= 1:       TEUZZ= 1.5019+006    TMUZZ= 1.9830+000    TMDZZ=-1.8703+000
WALL= 1,1:     FQLWR= 1.7528+004    FQPWR= 3.9232+000    FQLWD= 3.5213+003
               ZKWZZ= 6.8395+002
WALL= 1,2:     FQLWR=  .0000        FQPWR=  .0000        FQLWD=-2.4982+002
               ZKWZZ= 3.4996+002
----------------------------------------------------------------------
----------------------------------------------------------------------
T= 210.000      DT= 2.000     NT= 105      NIT=  833      IT=  7     G.S.
ROOM= 1:       TELZR=-2.8921+006    TELZD=-5.9676+005    ZMLZZ= 7.9662+001
               TMLZZ=-2.5391-002    ZELZZ= 6.0521+007    TELZZ=-1.2078+003
               ZHLZZ= 1.5626+000    ZKLZZ= 7.5670+002    ZYLOZ= 1.1692-001
               ZYLDZ= 6.9178-002    ZYLMZ= 6.0753-004    ZYLSZ= 1.1009-002
               ZYLWZ= 3.2592-002    ZPRZZ=-9.6827-002
  OBJ= 1:      FQLOR= 9.9288+003    FQWOR= 1.0887+002    FQPOR= 3.7428+004
  (ID= 1)      ZKOZZ= 7.2700+002    ZMOZZ= 6.8520+000    TMOZZ=-9.0000-002
               TEOZZ=-4.4276+006
               ZHPZZ= 8.7583-001    TMPZZ= 1.9565+000    TEPZZ= 4.9934+006
               TEPZR= 2.3542+004
               ZRFZZ= 2.6143-001
  OBJ= 2:      FQLOR= 9.7034+003    FQWOR= 2.1872+002    FQPOR=  .0000
  (ID= 2)      ZKOZZ= 5.8258+002    ZMOZZ= 1.0000-002    TMOZZ=  .0000
               TEOZZ=  .0000
VENT= 1:       TEUZZ= 1.5057+006    TMUZZ= 1.9819+000    TMDZZ=-1.8705+000
WALL= 1,1:     FQLWR= 1.7747+004    FQPWR= 3.9141+000    FQLWD= 3.4309+003
               ZKWZZ= 6.8808+002
WALL= 1,2:     FQLWR=  .0000        FQPWR=  .0000        FQLWD=-2.7749+002
               ZKWZZ= 3.5550+002
----------------------------------------------------------------------
----------------------------------------------------------------------
T= 220.000      DT= 2.000     NT= 110      NIT=  860      IT=  7     G.S.
ROOM= 1:       TELZR=-2.9033+006    TELZD=-5.8201+005    ZMLZZ= 7.9416+001
               TMLZZ=-2.3755-002    ZELZZ= 6.0510+007    TELZZ=-1.0551+003
               ZHLZZ= 1.5623+000    ZKLZZ= 7.5890+002    ZYLOZ= 1.1674-001
               ZYLDZ= 6.9281-002    ZYLMZ= 6.0843-004    ZYLSZ= 1.1025-002
               ZYLWZ= 3.2640-002    ZPRZZ=-9.6827-002
  OBJ= 1:      FQLOR= 1.0045+004    FQWOR= 1.0891+002    FQPOR= 3.7428+004
  (ID= 1)      ZKOZZ= 7.2700+002    ZMOZZ= 6.8520+000    TMOZZ=-9.0000-002
               TEOZZ=-4.4276+006
               ZHPZZ= 8.7612-001    TMPZZ= 1.9572+000    TEPZZ= 4.9936+006
               TEPZR= 2.3542+004
               ZRFZZ= 2.6143-001
  OBJ= 2:      FQLOR= 9.8167+003    FQWOR= 2.1876+002    FQPOR=  .0000
  (ID= 2)      ZKOZZ= 5.8530+002    ZMOZZ= 1.0000-002    TMOZZ=  .0000
               TEOZZ=  .0000
VENT= 1:       TEUZZ= 1.5094+006    TMUZZ= 1.9809+000    TMDZZ=-1.8707+000
WALL= 1,1:     FQLWR= 1.7956+004    FQPWR= 3.9074+000    FQLWD= 3.3464+003
               ZKWZZ= 6.9197+002
WALL= 1,2:     FQLWR=  .0000        FQPWR=  .0000        FQLWD=-3.0547+002
               ZKWZZ= 3.6109+002
----------------------------------------------------------------------
----------------------------------------------------------------------
T= 230.000      DT= 2.000     NT= 115      NIT=  885      IT=  5     G.S.
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ROOM= 1:     TELZR=-2.9137+006   TELZD=-5.6818+005   ZMLZZ= 7.9186+001
             TMLZZ=-2.2295-002   ZELZZ= 6.0500+007   TELZZ=-9.2222+002
             ZHLZZ= 1.5620+000   ZKLZZ= 7.6098+002   ZYLOZ= 1.1662-001
             ZYLDZ= 6.9356-002   ZYLMZ= 6.0910-004   ZYLSZ= 1.1037-002
             ZYLWZ= 3.2676-002   ZPRZZ=-9.6830-002
  OBJ= 1:    FQLOR= 1.0155+004   FOWOR= 1.0895+002   FQPOR= 3.7428+004
  (ID= 1)    ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
             TEOZZ=-4.4276+006
             ZHPZZ= 8.7638-001   TMPZZ= 1.9578+000   TEPZZ= 4.9938+006
             TEPZR= 2.3542+004
             ZRFZZ= 2.6143-001
  OBJ= 2:    FOLOR= 9.9248+003   FOWOR= 2.1880+002   FQPOR=  .0000
  (ID= 2)    ZKOZZ= 5.8785+002   ZMOZZ= 1.0000-002   TMOZZ=  .0000
             TEOZZ=  .0000
VENT= 1:     TEUZZ= 1.5128+006   TMUZZ= 1.9801+000   TMDZZ=-1.8708+000
WALL= 1,1:   FQLWR= 1.8155+004   FOPWR= 3.9026+000   FQLWD= 3.2670+003
             ZKWZZ= 6.9564+002
WALL= 1,2:   FQLWR=  .0000       FOPWR=  .0000       FQLWD=-3.3364+002
             ZKWZZ= 3.6673+002
-----------------------------------------------------------------------
-----------------------------------------------------------------------
T= 240.000     DT= 2.000     NT= 120     NIT=  913     IT=  6     G.S.
ROOM= 1:     TELZR=-2.9234+006   TELZD=-5.5514+005   ZMLZZ= 7.8970+001
             TMLZZ=-2.0997-002   ZELZZ= 6.0492+007   TELZZ=-7.9821+002
             ZHLZZ= 1.5618+000   ZKLZZ= 7.6296+002   ZYLOZ= 1.1653-001
             ZYLDZ= 6.9411-002   ZYLMZ= 6.0959-004   ZYLSZ= 1.1046-002
             ZYLWZ= 3.2702-002   ZPRZZ=-9.6833-002
  OBJ= 1:    FQLOR= 1.0261+004   FCWOR= 1.0899+002   FQPOR= 3.7428+004
  (ID= 1)    ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
             TEOZZ=-4.4276+006
             ZHPZZ= 8.7660-001   TMPZZ= 1.9583+000   TEPZZ= 4.9939+006
             TEPZR= 2.3542+004
             ZRFZZ= 2.6143-001
  OBJ= 2:    FQLOR= 1.0028+004   FOWOR= 2.1884+002   FQPOR=  .0000
  (ID= 2)    ZKOZZ= 5.9023+002   ZMOZZ= 1.0000-002   TMOZZ=  .0000
             TEOZZ=  .0000
VENT= 1:     TEUZZ= 1.5162+006   TMUZZ= 1.9793+000   TMDZZ=-1.8710+000
WALL= 1,1:   FQLWR= 1.8346+004   FQPWR= 3.8991+000   FQLWD= 3.1922+003
             ZKWZZ= 6.9911+002
WALL= 1,2:   FQLWR=  .0000       FQPWR=  .0000       FQLWD=-3.6189+002
             ZKWZZ= 3.7238+002
-----------------------------------------------------------------------
-----------------------------------------------------------------------
T= 250.000     DT= 2.000     NT= 125     NIT=  940     IT=  6     G.S.
ROOM= 1:     TELZR=-2.9326+006   TELZD=-5.4283+005   ZMLZZ= 7.8766+001
             TMLZZ=-1.9828-002   ZELZZ= 6.0484+007   TELZZ=-6.9277+002
             ZHLZZ= 1.5616+000   ZKLZZ= 7.6484+002   ZYLOZ= 1.1646-001
             ZYLDZ= 6.9450-002   ZYLMZ= 6.0993-004   ZYLSZ= 1.1052-002
             ZYLWZ= 3.2721-002   ZPRZZ=-9.6840-002
  OBJ= 1:    FQLOR= 1.0362+004   FQWOR= 1.0903+002   FQPOR= 3.7428+004
  (ID= 1)    ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
             TEOZZ=-4.4276+006
             ZHPZZ= 8.7679-001   TMPZZ= 1.9588+000   TEPZZ= 4.9941+006
             TEPZR= 2.3542+004
             ZRFZZ= 2.6143-001
  OBJ= 2:    FQLOR= 1.0127+004   FQWOR= 2.1888+002   FQPOR=  .0000
  (ID= 2)    ZKOZZ= 5.9248+002   ZMOZZ= 1.0000-002   TMOZZ=  .0000
             TEOZZ=  .0000
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VENT= 1:     TEUZZ= 1.5194+006    TMUZZ= 1.9786+000    TMDZZ=-1.8711+000
WALL= 1,1:   FQLWR= 1.8528+004    FQPWR= 3.8966+000    FQLWD= 3.1216+003
             ZKWZZ= 7.0241+002
WALL= 1,2:   FQLWR=  .0000        FQPWR=  .0000        FQLWD=-3.9014+002
             ZKWZZ= 3.7803+002
-----------------------------------------------------------------------
-----------------------------------------------------------------------
T= 260.000      DT= 2.000     NT= 130      NIT=  967      IT=  5     G.S.
ROOM= 1:     TELZR=-2.9412+006    TELZD=-5.3116+005    ZMLZZ= 7.6573+001
             TMLZZ=-1.8792-002    ZELZZ= 6.0478+007    TELZZ=-6.0608+002
             ZHLZZ= 1.5614+000    ZKLZZ= 7.6664+002    ZYLOZ= 1.1642-001
             ZYLDZ= 6.9477-002    ZYLMZ= 6.1018-004    ZYLSZ= 1.1057-002
             ZYLWZ= 3.2734-002    ZPRZZ=-9.6847-002
  OBJ= 1:    FQLOR= 1.0459+004    FQWOR= 1.0906+002    FQPOR= 3.7428+004
  (ID= 1)    ZKOZZ= 7.2700+002    ZMOZZ= 6.8520+000    TMOZZ=-9.0000-002
             TEOZZ=-4.4276+006
             ZHPZZ= 8.7696-001    TMPZZ= 1.9592+000    TEPZZ= 4.9942+006
             TEPZR= 2.3542+004
             ZRFZZ= 2.6143-001
  OBJ= 2:    FQLOR= 1.0223+004    FQWOR= 2.1892+002    FQPOR=  .0000
  (ID= 2)    ZKOZZ= 5.9459+002    ZMOZZ= 1.0000-002    TMOZZ=  .0000
             TEOZZ=  .0000
VENT= 1:     TEUZZ= 1.5224+006    TMUZZ= 1.9780+000    TMDZZ=-1.8712+000
WALL= 1,1:   FQLWR= 1.8703+004    FQPWR= 3.8949+000    FQLWD= 3.0546+003
             ZKWZZ= 7.0554+002
WALL= 1,2:   FQLWR=  .0000        FQPWR=  .0000        FQLWD=-4.1832+002
             ZKWZZ= 3.8366+002
-----------------------------------------------------------------------
-----------------------------------------------------------------------
T= 270.000      DT= 2.000     NT= 135      NIT=  993      IT=  6     G.S.
ROOM= 1:     TELZR=-2.9494+006    TELZD=-5.2007+005    ZMLZZ= 7.8390+001
             TMLZZ=-1.7845-002    ZELZZ= 6.0472+007    TELZZ=-5.2652+002
             ZHLZZ= 1.5613+000    ZKLZZ= 7.6835+002    ZYLOZ= 1.1638-001
             ZYLDZ= 6.9496-002    ZYLMZ= 6.1034-004    ZYLSZ= 1.1060-002
             ZYLWZ= 3.2743-002    ZPRZZ=-9.6857-002
  OBJ= 1:    FQLOR= 1.0553+004    FQWOR= 1.0910+002    FQPOR= 3.7428+004
  (ID= 1)    ZKOZZ= 7.2700+002    ZMOZZ= 6.8520+000    TMOZZ=-9.0000-002
             TEOZZ=-4.4276+006
             ZHPZZ= 8.7711-001    TMPZZ= 1.9595+000    TEPZZ= 4.9943+006
             TEPZR= 2.3542+004
             ZRFZZ= 2.6143-001
  OBJ= 2:    FQLOR= 1.0315+004    FQWOR= 2.1897+002    FQPOR=  .0000
  (ID= 2)    ZKOZZ= 5.9658+002    ZMOZZ= 1.0000-002    TMOZZ=  .0000
             TEOZZ=  .0000
VENT= 1:     TEUZZ= 1.5254+006    TMUZZ= 1.9774+000    TMDZZ=-1.8713+000
WALL= 1,1:   FQLWR= 1.8872+004    FQPWR= 3.8938+000    FQLWD= 2.9909+003
             ZKWZZ= 7.0854+002
WALL= 1,2:   FQLWR=  .0000        FQPWR=  .0000        FQLWD=-4.4635+002
             ZKWZZ= 3.8927+002
-----------------------------------------------------------------------
-----------------------------------------------------------------------
T= 280.000      DT= 2.000     NT= 140      NIT= 1021      IT=  5     G.S.
ROOM= 1:     TELZR=-2.9571+006    TELZD=-5.0951+005    ZMLZZ= 7.8215+001
             TMLZZ=-1.7004-002    ZELZZ= 6.0467+007    TELZZ=-4.6622+002
             ZHLZZ= 1.5612+000    ZKLZZ= 7.7000+002    ZYLOZ= 1.1636-001
             ZYLDZ= 6.9508-002    ZYLMZ= 6.1044-004    ZYLSZ= 1.1061-002
             ZYLWZ= 3.2748-002    ZPRZZ=-9.6866-002
  OBJ= 1:    FQLOR= 1.0644+004    FQWOR= 1.0913+002    FQPOR= 3.7428+004
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  (ID= 1)    ZKOZZ= 7.2700+002    ZMOZZ= 6.8520+000    TMOZZ=-9.0000-002
             TEOZZ=-4.4276+006
             ZHPZZ= 8.7723-001    TMPZZ= 1.9598+000    TEPZZ= 4.9944+006
             TEPZR= 2.3542+004
             ZRFZZ= 2.6143-001
  OBJ= 2:    FQLOR= 1.0403+004    FQWOR= 2.1901+002    FQPOR=  .0000
  (ID= 2)    ZKOZZ= 5.9847+002    ZMOZZ= 1.0000-002    TMOZZ=  .0000
             TEOZZ=  .0000
VENT= 1:     TEUZZ= 1.5282+006    TMUZZ= 1.9768+000    TMDZZ=-1.8714+000
WALL= 1.1:   FQLWR= 1.9034+004    FQPWR= 3.8931+000    FQLWD= 2.9302+003
             ZKWZZ= 7.1140+002
WALL= 1.2:   FQLWR=  .0000        FQPWR=  .0000        FQLWD=-4.7418+002
             ZKWZZ= 3.9484+002
-----------------------------------------------------------------------
-----------------------------------------------------------------------
T= 290.000     DT= 2.000     NT= 145     NIT= 1047     IT=  5     G.S.
ROOM= 1:     TELZR=-2.9645+006    TELZD=-4.9942+005    ZMLZZ= 7.8049+001
             TMLZZ=-1.6223-002    ZELZZ= 6.0463+007    TELZZ=-3.8922+002
             ZHLZZ= 1.5611+000    ZKLZZ= 7.7158+002    ZYLOZ= 1.1635-001
             ZYLDZ= 6.9515-002    ZYLMZ= 6.1051-004    ZYLSZ= 1.1063-002
             ZYLWZ= 3.2752-002    ZPRZZ=-9.6876-002
  OBJ= 1:    FQLOR= 1.0731+004    FQWOR= 1.0917+002    FQPOR= 3.7428+004
  (ID= 1)    ZKOZZ= 7.2700+002    ZMOZZ= 6.8520+000    TMOZZ=-9.0000-002
             TEOZZ=-4.4276+006
             ZHPZZ= 8.7735-001    TMPZZ= 1.9601+000    TEPZZ= 4.9945+006
             TEPZR= 2.3542+004
             ZRFZZ= 2.6143-001
  OBJ= 2:    FQLOR= 1.0489+004    FQWOR= 2.1905+002    FQPOR=  .0000
  (ID= 2)    ZKOZZ= 6.0026+002    ZMOZZ= 1.0000-002    TMOZZ=  .0000
             TEOZZ=  .0000
VENT= 1:     TEUZZ= 1.5310+006    TMUZZ= 1.9763+000    TMDZZ=-1.8714+000
WALL= 1,1:   FQLWR= 1.9191+004    FQPWR= 3.8928+000    FQLWD= 2.8723+003
             ZKWZZ= 7.1414+002
WALL= 1.2:   FQLWR=  .0000        FQPWR=  .0000        FQLWD=-5.0177+002
             ZKWZZ= 4.0035+002
-----------------------------------------------------------------------
-----------------------------------------------------------------------
T= 300.000     DT= 2.000     NT= 150     NIT= 1086     IT= 14     G.S.
ROOM= 1:     TELZR=-2.9715+006    TELZD=-4.8976+005    ZMLZZ= 7.7891+001
             TMLZZ=-1.5523-002    ZELZZ= 6.0459+007    TELZZ=-3.3278+002
             ZHLZZ= 1.5610+000    ZKLZZ= 7.7311+002    ZYLOZ= 1.1635-001
             ZYLDZ= 6.9519-002    ZYLMZ= 6.1054-004    ZYLSZ= 1.1063-002
             ZYLWZ= 3.2753-002    ZPRZZ=-9.6884-002
  OBJ= 1:    FQLOR= 1.0816+004    FQWOR= 1.0920+002    FQPOR= 3.7428+004
  (ID= 1)    ZKOZZ= 7.2700+002    ZMOZZ= 6.8520+000    TMOZZ=-9.0000-002
             TEOZZ=-4.4276+006
             ZHPZZ= 8.7745-001    TMPZZ= 1.9603+000    TEPZZ= 4.9945+006
             TEPZR= 2.3542+004
             ZRFZZ= 2.6143-001
  OBJ= 2:    FQLOR= 1.0572+004    FQWOR= 2.1909+002    FQPOR=  .0000
  (ID= 2)    ZKOZZ= 6.0197+002    ZMOZZ= 1.0000-002    TMOZZ=  .0000
             TEOZZ=  .0000
VENT= 1:     TEUZZ= 1.5337+006    TMUZZ= 1.9759+000    TMDZZ=-1.8715+000
WALL= 1,1:   FQLWR= 1.9343+004    FQPWR= 3.8926+000    FQLWD= 2.8168+003
             ZKWZZ= 7.1677+002
WALL= 1.2:   FQLWR=  .0000        FQPWR=  .0000        FQLWD=-5.2908+002
             ZKWZZ= 4.0582+002
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-----------------------------------------------------------------------
T= 310.000     DT= 2.000      NT= 155      NIT= 1122      IT=  5      G.S.
ROOM= 1:     TELZR=-2.9782+006   TELZD=-4.8051+005   ZMLZZ= 7.7739+001
             TMLZZ=-1.4884-002   ZELZZ= 6.0455+007   TELZZ=-3.1195+002
             ZHLZZ= 1.5609+000   ZKLZZ= 7.7458+002   ZYLOZ= 1.1635-001
             ZYLDZ= 6.9520-002   ZYLMZ= 6.1055-004   ZYLSZ= 1.1063-002
             ZYLWZ= 3.2754-002   ZPRZZ=-9.6899-002
  OBJ= 1:    FQLOR= 1.0898+004   FQWOR= 1.0923+002   FQPOR= 3.7428+004
  (ID= 1)    ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
             TEOZZ=-4.4276+006
             ZHPZZ= 8.7753-001   TMPZZ= 1.9605+000   TEPZZ= 4.9946+006
             TEPZR= 2.3542+004
             ZRFZZ= 2.6143-001
  OBJ= 2:    FQLOR= 1.0652+004   FQWOR= 2.1913+002   FQPOR=   .0000
  (ID= 2)    ZKOZZ= 6.0359+002   ZMOZZ= 1.0000-002   TMOZZ=   .0000
             TEOZZ=   .0000
VENT= 1:     TEUZZ= 1.5362+006   TMUZZ= 1.9754+000   TMDZZ=-1.8716+000
WALL= 1,1:   FQLWR= 1.9491+004   FQPWR= 3.8926+000   FQLWD= 2.7637+003
             ZKWZZ= 7.1930+002
WALL= 1,2:   FQLWR=   .0000      FQPWR=   .0000      FQLWD=-5.5607+002
             ZKWZZ= 4.1122+002
-----------------------------------------------------------------------
-----------------------------------------------------------------------
T= 320.000     DT= 2.000      NT= 160      NIT= 1156      IT= 10      G.S.
ROOM= 1:     TELZR=-2.9846+006   TELZD=-4.7162+005   ZMLZZ= 7.7593+001
             TMLZZ=-1.4285-002   ZELZZ= 6.0452+007   TELZZ=-2.7071+002
             ZHLZZ= 1.5608+000   ZKLZZ= 7.7599+002   ZYLOZ= 1.1635-001
             ZYLDZ= 6.9519-002   ZYLMZ= 6.1054-004   ZYLSZ= 1.1063-002
             ZYLWZ= 3.2754-002   ZPRZZ=-9.6912-002
  OBJ= 1:    FQLOR= 1.0978+004   FQWOR= 1.0926+002   FQPOR= 3.7428+004
  (ID= 1)    ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
             TEOZZ=-4.4276+006
             ZHPZZ= 8.7761-001   TMPZZ= 1.9607+000   TEPZZ= 4.9947+006
             TEPZR= 2.3542+004
             ZRFZZ= 2.6143-001
  OBJ= 2:    FQLOR= 1.0730+004   FQWOR= 2.1916+002   FQPOR=   .0000
  (ID= 2)    ZKOZZ= 6.0514+002   ZMOZZ= 1.0000-002   TMOZZ=   .0000
             TEOZZ=   .0000
VENT= 1:     TEUZZ= 1.5387+006   TMUZZ= 1.9750+000   TMDZZ=-1.8716+000
WALL= 1,1:   FQLWR= 1.9634+004   FQPWR= 3.8927+000   FQLWD= 2.7126+003
             ZKWZZ= 7.2174+002
WALL= 1,2:   FQLWR=   .0000      FQPWR=   .0000      FQLWD=-5.8273+002
             ZKWZZ= 4.1655+002
-----------------------------------------------------------------------
-----------------------------------------------------------------------
T= 330.000     DT= 2.000      NT= 165      NIT= 1182      IT=  5      G.S.
ROOM= 1:     TELZR=-2.9907+006   TELZD=-4.6307+005   ZMLZZ= 7.7453+001
             TMLZZ=-1.3746-002   ZELZZ= 6.0450+007   TELZZ=-2.4734+002
             ZHLZZ= 1.5607+000   ZKLZZ= 7.7736+002   ZYLOZ= 1.1635-001
             ZYLDZ= 6.9517-002   ZYLMZ= 6.1053-004   ZYLSZ= 1.1063-002
             ZYLWZ= 3.2753-002   ZPRZZ=-9.6925-002
  OBJ= 1:    FQLOR= 1.1055+004   FQWOR= 1.0929+002   FQPOR= 3.7428+004
  (ID= 1)    ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
             TEOZZ=-4.4276+006
             ZHPZZ= 8.7768-001   TMPZZ= 1.9609+000   TEPZZ= 4.9947+006
             TEPZR= 2.3542+004
             ZRFZZ= 2.6143-001
  OBJ= 2:    FQLOR= 1.0806+004   FQWOR= 2.1920+002   FQPOR=   .0000
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  (ID= 2)    ZKOZZ= 6.0662+002   ZMOZZ= 1.0000-002   TMOZZ=   .0000
             TEOZZ=  .0000
VENT= 1:     TEUZZ= 1.5411+006   TMUZZ= 1.9746+000   TMDZZ=-1.8717+000
WALL= 1.1:   FQLWR= 1.9773+004   FQPWR= 3.8929+000   FQLWD= 2.6635+003
             ZKWZZ= 7.2410+002
WALL= 1.2:   FQLWR=  .0000       FQPWR=  .0000       FQLWD=-6.0902+002
             ZKWZZ= 4.2180+002
--------------------------------------------------------------------------
--------------------------------------------------------------------------
T= 340.000     DT= 2.000     NT= 170     NIT= 1208      IT=  5     G.S.
ROOM= 1:     TELZR=-2.9966+006   TELZD=-4.5484+005   ZMLZZ= 7.7318+001
             TMLZZ=-1.3230-002   ZELZZ= 6.0447+007   TELZZ=-1.9797+002
             ZHLZZ= 1.5607+000   ZKLZZ= 7.7869+002   ZYLOZ= 1.1635-001
             ZYLDZ= 6.9514-002   ZYLMZ= 6.1050-004   ZYLSZ= 1.1062-002
             ZYLWZ= 3.2751-002   ZPRZZ=-9.6937-002
  OBJ= 1:    FQLOR= 1.1131+004   FQWOR= 1.0932+002   FQPOR= 3.7428+004
  (ID= 1)    ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
             TEOZZ=-4.4276+006
             ZHPZZ= 8.7774-001   TMPZZ= 1.9610+000   TEPZZ= 4.9948+006
             TEPZR= 2.3542+004
             ZRFZZ= 2.6143-001
  OBJ= 2:    FQLOR= 1.0880+004   FQWOR= 2.1924+002   FQPOR=   .0000
  (ID= 2)    ZKOZZ= 6.0803+002   ZMOZZ= 1.0000-002   TMOZZ=   .0000
             TEOZZ=  .0000
VENT= 1:     TEUZZ= 1.5435+006   TMUZZ= 1.9742+000   TMDZZ=-1.8717+000
WALL= 1.1:   FQLWR= 1.9908+004   FQPWR= 3.8931+000   FQLWD= 2.6162+003
             ZKWZZ= 7.2637+002
WALL= 1.2:   FQLWR=  .0000       FQPWR=  .0000       FQLWD=-6.3493+002
             ZKWZZ= 4.2699+002
--------------------------------------------------------------------------
--------------------------------------------------------------------------
T= 350.000     DT= 2.000     NT= 175     NIT= 1238      IT=  5     G.S.
ROOM= 1:     TELZR=-3.0023+006   TELZD=-4.4690+005   ZMLZZ= 7.7188+001
             TMLZZ=-1.2773-002   ZELZZ= 6.0445+007   TELZZ=-1.9856+002
             ZHLZZ= 1.5606+000   ZKLZZ= 7.7998+002   ZYLOZ= 1.1636-001
             ZYLDZ= 6.9511-002   ZYLMZ= 6.1047-004   ZYLSZ= 1.1062-002
             ZYLWZ= 3.2750-002   ZPRZZ=-9.6951-002
  OBJ= 1:    FQLOR= 1.1204+004   FQWOR= 1.0935+002   FQPOR= 3.7428+004
  (ID= 1)    ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
             TEOZZ=-4.4276+006
             ZHPZZ= 8.7779-001   TMPZZ= 1.9611+000   TEPZZ= 4.9948+006
             TEPZR= 2.3542+004
             ZRFZZ= 2.6143-001
  OBJ= 2:    FQLOR= 1.0952+004   FQWOR= 2.1927+002   FQPOR=   .0000
  (ID= 2)    ZKOZZ= 6.0941+002   ZMOZZ= 1.0000-002   TMOZZ=   .0000
             TEOZZ=  .0000
VENT= 1:     TEUZZ= 1.5458+006   TMUZZ= 1.9739+000   TMDZZ=-1.8718+000
WALL= 1.1:   FQLWR= 2.0039+004   FQPWR= 3.8934+000   FQLWD= 2.5705+003
             ZKWZZ= 7.2857+002
WALL= 1.2:   FQLWR=  .0000       FQPWR=  .0000       FQLWD=-6.6045+002
             ZKWZZ= 4.3209+002
--------------------------------------------------------------------------
--------------------------------------------------------------------------
T= 360.000     DT= 2.000     NT= 180     NIT= 1265      IT=  5     G.S.
ROOM= 1:     TELZR=-3.0078+006   TELZD=-4.3924+005   ZMLZZ= 7.7062+001
             TMLZZ=-1.2330-002   ZELZZ= 6.0444+007   TELZZ=-1.7039+002
             ZHLZZ= 1.5606+000   ZKLZZ= 7.8122+002   ZYLOZ= 1.1636-001
             ZYLDZ= 6.9508-002   ZYLMZ= 6.1045-004   ZYLSZ= 1.1061-002
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             ZYLWZ= 3.2748-002   ZPRZZ=-9.6963-002
  OBJ= 1:    FQLOR= 1.1276+004   FQWOR= 1.0937+002   FQPOR= 3.7428+004
  (ID= 1)    ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
             TEOZZ=-4.4276+006
             ZHPZZ= 8.7784-001   TMPZZ= 1.9612+000   TEPZZ= 4.9948+006
             TEPZR= 2.3542+004
             ZRFZZ= 2.6143-001
  OBJ= 2:    FQLOR= 1.1022+004   FQWOR= 2.1931+002   FQPOR=   .0000
  (ID= 2)    ZKOZZ= 6.1070+002   ZMOZZ= 1.0000-002   TMOZZ=   .0000
             TEOZZ=   .0000
VENT= 1:     TEUZZ= 1.5480+006   TMUZZ= 1.9736+000   TMDZZ=-1.8718+000
WALL= 1.1:   FQLWR= 2.0168+004   FQPWR= 3.8936+000   FQLWD= 2.5265+003
             ZKWZZ= 7.3069+002
WALL= 1.2:   FQLWR=   .0000      FQPWR=   .0000      FQLWD=-6.8556+002
             ZKWZZ= 4.3711+002
-----------------------------------------------------------------------
-----------------------------------------------------------------------
T= 370.000     DT= 2.000      NT= 185      NIT= 1292      IT=  5     G.S.
ROOM= 1:     TELZR=-3.0131+006   TELZD=-4.3183+005   ZMLZZ= 7.6941+001
             TMLZZ=-1.1917-002   ZELZZ= 6.0442+007   TELZZ=-1.5377+002
             ZHLZZ= 1.5605+000   ZKLZZ= 7.8243+002   ZYLOZ= 1.1637-001
             ZYLDZ= 6.9504-002   ZYLMZ= 6.1041-004   ZYLSZ= 1.1061-002
             ZYLWZ= 3.2747-002   ZPRZZ=-9.6976-002
  OBJ= 1:    FQLOR= 1.1345+004   FQWOR= 1.0940+002   FQPOR= 3.7428+004
  (ID= 1)    ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
             TEOZZ=-4.4276+006
             ZHPZZ= 8.7788-001   TMPZZ= 1.9613+000   TEPZZ= 4.9949+006
             TEPZR= 2.3542+004
             ZRFZZ= 2.6143-001
  OBJ= 2:    FQLOR= 1.1091+004   FQWOR= 2.1934+002   FQPOR=   .0000
  (ID= 2)    ZKOZZ= 6.1200+002   ZMOZZ= 1.0000-002   TMOZZ=   .0000
             TEOZZ=   .0000
VENT= 1:     TEUZZ= 1.5501+006   TMUZZ= 1.9733+000   TMDZZ=-1.8719+000
WALL= 1.1:   FQLWR= 2.0293+004   FQPWR= 3.8939+000   FQLWD= 2.4839+003
             ZKWZZ= 7.3275+002
WALL= 1.2:   FQLWR=   .0000      FQPWR=   .0000      FQLWD=-7.1026+002
             ZKWZZ= 4.4205+002
-----------------------------------------------------------------------
-----------------------------------------------------------------------
T= 380.000     DT= 2.000      NT= 190      NIT= 1320      IT=  6     G.S.
ROOM= 1:     TELZR=-3.0181+006   TELZD=-4.2467+005   ZMLZZ= 7.6824+001
             TMLZZ=-1.1533-002   ZELZZ= 6.0441+007   TELZZ=-1.3810+002
             ZHLZZ= 1.5605+000   ZKLZZ= 7.8361+002   ZYLOZ= 1.1638-001
             ZYLDZ= 6.9501-002   ZYLMZ= 6.1038-004   ZYLSZ= 1.1060-002
             ZYLWZ= 3.2745-002   ZPRZZ=-9.6989-002
  OBJ= 1:    FQLOR= 1.1414+004   FQWOR= 1.0942+002   FQPOR= 3.7428+004
  (ID= 1)    ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
             TEOZZ=-4.4276+006
             ZHPZZ= 8.7791-001   TMPZZ= 1.9614+000   TEPZZ= 4.9949+006
             TEPZR= 2.3542+004
             ZRFZZ= 2.6143-001
  OBJ= 2:    FQLOR= 1.1157+004   FQWOR= 2.1937+002   FQPOR=   .0000
  (ID= 2)    ZKOZZ= 6.1317+002   ZMOZZ= 1.0000-002   TMOZZ=   .0000
             TEOZZ=   .0000
VENT= 1:     TEUZZ= 1.5522+006   TMUZZ= 1.9730+000   TMDZZ=-1.8719+000
WALL= 1.1:   FQLWR= 2.0415+004   FQPWR= 3.8942+000   FQLWD= 2.4427+003
             ZKWZZ= 7.3475+002
WALL= 1.2:   FQLWR=   .0000      FQPWR=   .0000      FQLWD=-7.3454+002
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             ZKWZZ= 4.4691+002
-----------------------------------------------------------------------
-----------------------------------------------------------------------
T= 390.000      DT= 2.000      NT= 195      NIT= 1345      IT=  5     G.S.
ROOM= 1:     TELZR=-3.0230+006   TELZD=-4.1773+005   ZMLZZ= 7.6710+001
             TMLZZ=-1.1166-002   ZELZZ= 6.0439+007   TELZZ=-1.2187+002
             ZHLZZ= 1.5605+000   ZKLZZ= 7.8475+002   ZYLOZ= 1.1638-001
             ZYLDZ= 6.9498-002   ZYLMZ= 6.1036-004   ZYLSZ= 1.1060-002
             ZYLWZ= 3.2744-002   ZPRZZ=-9.7002-002
  OBJ= 1:    FQLOR= 1.1480+004   FOWOR= 1.0945+002   FQPOR= 3.7428+004
  (ID= 1)    ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
             TEOZZ=-4.4276+006
             ZHPZZ= 8.7795-001   TMPZZ= 1.9615+000   TEPZZ= 4.9949+006
             TEPZR= 2.3542+004
             ZRFZZ= 2.6143-001
  OBJ= 2:    FQLOR= 1.1222+004   FQWOR= 2.1941+002   FQPOR=  .0000
  (ID= 2)    ZKOZZ= 6.1434+002   ZMOZZ= 1.0000-002   TMOZZ=  .0000
             TEOZZ=  .0000
VENT= 1:     TEUZZ= 1.5543+006   TMUZZ= 1.9727+000   TMDZZ=-1.8719+000
WALL= 1,1:   FQLWR= 2.0534+004   FQPWR= 3.8944+000   FQLWD= 2.4028+003
             ZKWZZ= 7.3669+002
WALL= 1,2:   FQLWR=  .0000       FQPWR=  .0000       FQLWD=-7.5840+002
             ZKWZZ= 4.5168+002
-----------------------------------------------------------------------
-----------------------------------------------------------------------
T= 400.000      DT= 2.000      NT= 200      NIT= 1372      IT=  5     G.S.
ROOM= 1:     TELZR=-3.0278+006   TELZD=-4.1101+005   ZMLZZ= 7.6600+001
             TMLZZ=-1.0823-002   ZELZZ= 6.0438+007   TELZZ=-1.1595+002
             ZHLZZ= 1.5604+000   ZKLZZ= 7.8586+002   ZYLOZ= 1.1639-001
             ZYLDZ= 6.9495-002   ZYLMZ= 6.1033-004   ZYLSZ= 1.1059-002
             ZYLWZ= 3.2742-002   ZPRZZ=-9.7014-002
  OBJ= 1:    FQLOR= 1.1545+004   FQWOR= 1.0947+002   FQPOR= 3.7428+004
  (ID= 1)    ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
             TEOZZ=-4.4276+006
             ZHPZZ= 8.7798-001   TMPZZ= 1.9616+000   TEPZZ= 4.9949+006
             TEPZR= 2.3542+004
             ZRFZZ= 2.6143-001
  OBJ= 2:    FQLOR= 1.1286+004   FQWOR= 2.1944+002   FQPOR=  .0000
  (ID= 2)    ZKOZZ= 6.1549+002   ZMOZZ= 1.0000-002   TMOZZ=  .0000
             TEOZZ=  .0000
VENT= 1:     TEUZZ= 1.5562+006   TMUZZ= 1.9724+000   TMDZZ=-1.8720+000
WALL= 1,1:   FQLWR= 2.0651+004   FQPWR= 3.8946+000   FQLWD= 2.3642+003
             ZKWZZ= 7.3858+002
WALL= 1,2:   FQLWR=  .0000       FQPWR=  .0000       FQLWD=-7.8183+002
             ZKWZZ= 4.5637+002
-----------------------------------------------------------------------
-----------------------------------------------------------------------
T= 410.000      DT= 2.000      NT= 205      NIT= 1398      IT=  5     G.S.
ROOM= 1:     TELZR=-3.0324+006   TELZD=-4.0450+005   ZMLZZ= 7.6494+001
             TMLZZ=-1.0497-002   ZELZZ= 6.0437+007   TELZZ=-1.0072+002
             ZHLZZ= 1.5604+000   ZKLZZ= 7.8694+002   ZYLOZ= 1.1639-001
             ZYLDZ= 6.9492-002   ZYLMZ= 6.1030-004   ZYLSZ= 1.1059-002
             ZYLWZ= 3.2741-002   ZPRZZ=-9.7026-002
  OBJ= 1:    FQLOR= 1.1609+004   FQWOR= 1.0949+002   FQPOR= 3.7428+004
  (ID= 1)    ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
             TEOZZ=-4.4276+006
             ZHPZZ= 8.7801-001   TMPZZ= 1.9616+000   TEPZZ= 4.9949+006
             TEPZR= 2.3542+004
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             ZRFZZ= 2.6143-001
  OBJ= 2:    FQLOR= 1.1348+004   FQWOR= 2.1947+002   FQPOR=   .0000
  (ID= 2)    ZKOZZ= 6.1655+002   ZMOZZ= 1.0000-002   TMOZZ=   .0000
             TEOZZ=  .0000
VENT= 1:     TEUZZ= 1.5582+006   TMUZZ= 1.9721+000   TMDZZ=-1.8720+000
WALL= 1,1:   FQLWR= 2.0764+004   FQPWR= 3.8949+000   FQLWD= 2.3267+003
             ZKWZZ= 7.4041+002
WALL= 1,2:   FQLWR=  .0000       FQPWR=  .0000       FQLWD=-8.0484+002
             ZKWZZ= 4.6097+002
------------------------------------------------------------------------
------------------------------------------------------------------------
T= 420.000     DT= 2.000      NT= 210      NIT= 1426      IT=  6     G.S.
ROOM= 1:     TELZR=-3.0368+006   TELZD=-3.9818+005   ZMLZZ= 7.6390+001
             TMLZZ=-1.0185-002   ZELZZ= 6.0436+007   TELZZ=-8.7020+001
             ZHLZZ= 1.5604+000   ZKLZZ= 7.8800+002   ZYLOZ= 1.1640-001
             ZYLDZ= 6.9489-002   ZYLMZ= 6,1028-004   ZYLSZ= 1.1058-002
             ZYLWZ= 3.2739-002   ZPRZZ=-9,7038-002
  OBJ= 1:    FQLOR= 1.1671+004   FQWOR= 1.0951+002   FQPOR= 3.7428+004
  (ID= 1)    ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
             TEOZZ=-4.4276+006
             ZHPZZ= 8.7803-001   TMPZZ= 1.9617+000   TEPZZ= 4.9950+006
             TEPZR= 2.3542+004
             ZRFZZ= 2.6143-001
  OBJ= 2:    FQLOR= 1.1409+004   FQWOR= 2.1950+002   FQPOR=   .0000
  (ID= 2)    ZKOZZ= 6.1761+002   ZMOZZ= 1.0000-002   TMOZZ=   .0000
             TEOZZ=  .0000
VENT= 1:     TEUZZ= 1.5601+006   TMUZZ= 1.9719+000   TMDZZ=-1.8720+000
WALL= 1,1:   FQLWR= 2.0876+004   FQPWR= 3.8951+000   FQLWD= 2.2904+003
             ZKWZZ= 7.4219+002
WALL= 1,2:   FQLWR=  .0000       FQPWR=  .0000       FQLWD=-8.2742+002
             ZKWZZ= 4.6548+002
------------------------------------------------------------------------
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T= 430.000     DT= 2.000      NT= 215      NIT= 1453      IT=  5     G.S.
ROOM= 1:     TELZR=-3.0411+006   TELZD=-3.9205+005   ZMLZZ= 7.6290+001
             TMLZZ=-9.8903-003   ZELZZ= 6.0435+007   TELZZ=-8.0195+001
             ZHLZZ= 1.5603+000   ZKLZZ= 7.8902+002   ZYLOZ= 1.1640-001
             ZYLDZ= 6.9486-002   ZYLMZ= 6.1025-004   ZYLSZ= 1.1058-002
             ZYLWZ= 3.2738-002   ZPRZZ=-9.7050-002
  OBJ= 1:    FQLOR= 1.1732+004   FQWOR= 1.0953+002   FQPOR= 3.7428+004
  (ID= 1)    ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
             TEOZZ=-4.4276+006
             ZHPZZ= 8.7805-001   TMPZZ= 1.9618+000   TEPZZ= 4.9950+006
             TEPZR= 2.3542+004
             ZRFZZ= 2.6143-001
  OBJ= 2:    FQLOR= 1.1469+004   FQWOR= 2.1952+002   FQPOR=   .0000
  (ID= 2)    ZKOZZ= 6.1867+002   ZMOZZ= 1.0000-002   TMOZZ=   .0000
             TEOZZ=  .0000
VENT= 1:     TEUZZ= 1.5619+006   TMUZZ= 1.9716+000   TMDZZ=-1.8720+000
WALL= 1,1:   FQLWR= 2.0985+004   FQPWR= 3.8953+000   FQLWD= 2.2552+003
             ZKWZZ= 7.4392+002
WALL= 1,2:   FQLWR=  .0000       FQPWR=  .0000       FQLWD=-8.4958+002
             ZKWZZ= 4.6992+002
------------------------------------------------------------------------
------------------------------------------------------------------------
T= 440.000     DT= 2.000      NT= 220      NIT= 1480      IT=  5     G.S.
ROOM= 1:     TELZR=-3.0453+006   TELZD=-3.8610+005   ZMLZZ= 7.6193+001
             TMLZZ=-9.6117-003   ZELZZ= 6.0435+007   TELZZ=-7.3719+001
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            ZHLZZ= 1.5603+000   ZKLZZ= 7.9002+002   ZYLOZ= 1.1640-001
            ZYLDZ= 6.9484-002   ZYLMZ= 6.1023-004   ZYLSZ= 1.1058-002
            ZYLWZ= 3.2737-002   ZPRZZ=-9.7062-002
  OBJ= 1:   FQLOR= 1.1791+004   FQWOR= 1.0955+002   FQPOR= 3.7428+004
  (ID= 1)   ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
            TEOZZ=-4.4276+006
            ZHPZZ= 8.7807-001   TMPZZ= 1.9618+000   TEPZZ= 4.9950+006
            TEPZR= 2.3542+004
            ZRFZZ= 2.6143-001
  OBJ= 2:   FQLOR= 1.1527+004   FQWOR= 2.1955+002   FQPOR=  .0000
  (ID= 2)   ZKOZZ= 6.1962+002   ZMOZZ= 1.0000-002   TMOZZ=  .0000
            TEOZZ=  .0000
VENT= 1:    TEUZZ= 1.5637+006   TMUZZ= 1.9714+000   TMDZZ=-1.8720+000
WALL= 1,1:  FQLWR= 2.1091+004   FQPWR= 3.8954+000   FQLWD= 2.2209+003
            ZKWZZ= 7.4560+002
WALL= 1,2:  FQLWR=  .0000       FQPWR=  .0000       FQLWD=-8.7132+002
            ZKWZZ= 4.7426+002
----------------------------------------------------------------------
----------------------------------------------------------------------
T= 450.000     DT= 2.000     NT= 225     NIT= 1508     IT=  5     G.S.
ROOM= 1:    TELZR=-3.0493+006   TELZD=-3.8032+005   ZMLZZ= 7.6098+001
            TMLZZ=-9.3374-003   ZELZZ= 6.0434+007   TELZZ=-6.3195+001
            ZHLZZ= 1.5603+000   ZKLZZ= 7.9100+002   ZYLOZ= 1.1641-001
            ZYLDZ= 6.9482-002   ZYLMZ= 6.1021-004   ZYLSZ= 1.1057-002
            ZYLWZ= 3.2736-002   ZPRZZ=-9.7073-002
  OBJ= 1:   FQLOR= 1.1849+004   FQWOR= 1.0957+002   FQPOR= 3.7428+004
  (ID= 1)   ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
            TEOZZ=-4.4276+006
            ZHPZZ= 8.7809-001   TMPZZ= 1.9618+000   TEPZZ= 4.9950+006
            TEPZR= 2.3542+004
            ZRFZZ= 2.6143-001
  OBJ= 2:   FQLOR= 1.1584+004   FQWOR= 2.1958+002   FQPOR=  .0000
  (ID= 2)   ZKOZZ= 6.2061+002   ZMOZZ= 1.0000-002   TMOZZ=  .0000
            TEOZZ=  .0000
VENT= 1:    TEUZZ= 1.5654+006   TMUZZ= 1.9712+000   TMDZZ=-1.8721+000
WALL= 1,1:  FQLWR= 2.1195+004   FQPWR= 3.8956+000   FQLWD= 2.1877+003
            ZKWZZ= 7.4724+002
WALL= 1,2:  FQLWR=  .0000       FQPWR=  .0000       FQLWD=-8.9265+002
            ZKWZZ= 4.7853+002
----------------------------------------------------------------------
----------------------------------------------------------------------
T= 460.000     DT= 2.000     NT= 230     NIT= 1535     IT=  6     G.S.
ROOM= 1:    TELZR=-3.0532+006   TELZD=-3.7470+005   ZMLZZ= 7.6006+001
            TMLZZ=-9.0789-003   ZELZZ= 6.0433+007   TELZZ=-5.8172+001
            ZHLZZ= 1.5603+000   ZKLZZ= 7.9195+002   ZYLOZ= 1.1641-001
            ZYLDZ= 6.9480-002   ZYLMZ= 6.1020-004   ZYLSZ= 1.1057-002
            ZYLWZ= 3.2735-002   ZPRZZ=-9.7085-002
  OBJ= 1:   FQLOR= 1.1906+004   FQWOR= 1.0959+002   FQPOR= 3.7428+004
  (ID= 1)   ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
            TEOZZ=-4.4276+006
            ZHPZZ= 8.7810-001   TMPZZ= 1.9619+000   TEPZZ= 4.9950+006
            TEPZR= 2.3542+004
            ZRFZZ= 2.6143-001
  OBJ= 2:   FQLOR= 1.1639+004   FQWOR= 2.1961+002   FQPOR=  .0000
  (ID= 2)   ZKOZZ= 6.2156+002   ZMOZZ= 1.0000-002   TMOZZ=  .0000
            TEOZZ=  .0000
VENT= 1:    TEUZZ= 1.5671+006   TMUZZ= 1.9710+000   TMDZZ=-1.8721+000
WALL= 1,1:  FQLWR= 2.1297+004   FQPWR= 3.8957+000   FQLWD= 2.1554+003
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               ZKWZZ= 7.4884+002
WALL= 1,2:     FQLWR=  .0000        FQPWR=  .0000        FQLWD=-9.1356+002
               ZKWZZ= 4.8271+002
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--------------------------------------------------------------------------
T= 470.000       DT= 2.000      NT= 235     NIT= 1562      IT=  5      G.S.
ROOM= 1:       TELZR=-3.0570+006    TELZD=-3.6924+005    ZMLZZ= 7.5916+001
               TMLZZ=-8.8299-003    ZELZZ= 6.0433+007    TELZZ=-5.1148+001
               ZHLZZ= 1.5603+000    ZKLZZ= 7.9287+002    ZYLOZ= 1.1642-001
               ZYLDZ= 6.9478-002    ZYLMZ= 6.1018-004    ZYLSZ= 1.1057-002
               ZYLWZ= 3.2734-002    ZPRZZ=-9.7095-002
  OBJ= 1:      FQLOR= 1.1962+004    FQWOR= 1.0961+002    FQPOR= 3.7428+004
  (ID= 1)      ZKOZZ= 7.2700+002    ZMOZZ= 6.8520+000    TMOZZ=-9.0000-002
               TEOZZ=-4.4276+006
               ZHPZZ= 8.7812-001    TMPZZ= 1.9619+000    TEPZZ= 4.9950+006
               TEPZR= 2.3542+004
               ZRFZZ= 2.6143-001
  OBJ= 2:      FQLOR= 1.1694+004    FQWOR= 2.1963+002    FQPOR=  .0000
  (ID= 2)      ZKOZZ= 6.2249+002    ZMOZZ= 1.0000-002    TMOZZ=  .0000
               TEOZZ=  .0000
VENT= 1:       TEUZZ= 1.5688+006    TMUZZ= 1.9707+000    TMDZZ=-1.8721+000
WALL= 1,1:     FQLWR= 2.1397+004    FQPWR= 3.8959+000    FQLWD= 2.1240+003
               ZKWZZ= 7.5039+002
WALL= 1,2:     FQLWR=  .0000        FQPWR=  .0000        FQLWD=-9.3405+002
               ZKWZZ= 4.8681+002
--------------------------------------------------------------------------
--------------------------------------------------------------------------
T= 480.000       DT= 2.000      NT= 240     NIT= 1593      IT=  9      G.S.
ROOM= 1:       TELZR=-3.0607+006    TELZD=-3.6393+005    ZMLZZ= 7.5829+001
               TMLZZ=-8.5943-003    ZELZZ= 6.0432+007    TELZZ=-5.4864+001
               ZHLZZ= 1.5603+000    ZKLZZ= 7.9378+002    ZYLOZ= 1.1642-001
               ZYLDZ= 6.9476-002    ZYLMZ= 6.1016-004    ZYLSZ= 1.1056-002
               ZYLWZ= 3.2733-002    ZPRZZ=-9.7107-002
  OBJ= 1:      FQLOR= 1.2017+004    FQWOR= 1.0963+002    FQPOR= 3.7428+004
  (ID= 1)      ZKOZZ= 7.2700+002    ZMOZZ= 6.8520+000    TMOZZ=-9.0000-002
               TEOZZ=-4.4276+006
               ZHPZZ= 8.7813-001    TMPZZ= 1.9619+000    TEPZZ= 4.9950+006
               TEPZR= 2.3542+004
               ZRFZZ= 2.6143-001
  OBJ= 2:      FQLOR= 1.1747+004    FQWOR= 2.1966+002    FQPOR=  .0000
  (ID= 2)      ZKOZZ= 6.2338+002    ZMOZZ= 1.0000-002    TMOZZ=  .0000
               TEOZZ=  .0000
VENT= 1:       TEUZZ= 1.5704+006    TMUZZ= 1.9705+000    TMDZZ=-1.8721+000
WALL= 1,1:     FQLWR= 2.1495+004    FQPWR= 3.8960+000    FQLWD= 2.0934+003
               ZKWZZ= 7.5191+002
WALL= 1,2:     FQLWR=  .0000        FQPWR=  .0000        FQLWD=-9.5415+002
               ZKWZZ= 4.9083+002
--------------------------------------------------------------------------
--------------------------------------------------------------------------
T= 490.000       DT= 2.000      NT= 245     NIT= 1622      IT=  5      G.S.
ROOM= 1:       TELZR=-3.0643+006    TELZD=-3.5876+005    ZMLZZ= 7.5744+001
               TMLZZ=-8.3591-003    ZELZZ= 6.0432+007    TELZZ=-3.7828+001
               ZHLZZ= 1.5603+000    ZKLZZ= 7.9466+002    ZYLOZ= 1.1642-001
               ZYLDZ= 6.9475-002    ZYLMZ= 6.1015-004    ZYLSZ= 1.1056-002
               ZYLWZ= 3.2733-002    ZPRZZ=-9.7117-002
  OBJ= 1:      FQLOR= 1.2070+004    FQWOR= 1.0965+002    FQPOR= 3.7428+004
  (ID= 1)      ZKOZZ= 7.2700+002    ZMOZZ= 6.8520+000    TMOZZ=-9.0000-002
               TEOZZ=-4.4276+006
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            ZHPZZ= 8.7814-001   TMPZZ= 1.9620+000   TEPZZ= 4.9950+006
            TEPZR= 2.3542+004
            ZRFZZ= 2.6143-001
  OBJ= 2:   FQLOR= 1.1800+004   FQWOR= 2.1968+002   FQPOR=  .0000
  (ID= 2)   ZKOZZ= 6.2426+002   ZMOZZ= 1.0000-002   TMOZZ=  .0000
            TEOZZ=  .0000
VENT= 1:    TEUZZ= 1.5720+006   TMUZZ= 1.9703+000   TMDZZ=-1.8721+000
WALL= 1,1:  FQLWR= 2.1591+004   FQPWR= 3.8961+000   FQLWD= 2.0637+003
            ZKWZZ= 7.5338+002
WALL= 1,2:  FQLWR=  .0000       FQPWR=  .0000       FQLWD=-9.7384+002
            ZKWZZ= 4.9477+002
-----------------------------------------------------------------------
-----------------------------------------------------------------------
T= 500.000     DT= 2.000     NT= 250     NIT= 1649     IT=  5     G.S.
ROOM= 1:    TELZR=-3.0678+006   TELZD=-3.5374+005   ZMLZZ= 7.5662+001
            TMLZZ=-8.1393-003   ZELZZ= 6.0431+007   TELZZ=-3.8711+001
            ZHLZZ= 1.5602+000   ZKLZZ= 7.9552+002   ZYLOZ= 1.1642-001
            ZYLDZ= 6.9473-002   ZYLMZ= 6.1014-004   ZYLSZ= 1.1056-002
            ZYLWZ= 3.2732-002   ZPRZZ=-9.7127-002
  OBJ= 1:   FQLOR= 1.2122+004   FQWOR= 1.0967+002   FQPOR= 3.7428+004
  (ID= 1)   ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
            TEOZZ=-4.4276+006
            ZHPZZ= 8.7815-001   TMPZZ= 1.9620+000   TEPZZ= 4.9950+006
            TEPZR= 2.3542+004
            ZRFZZ= 2.6143-001
  OBJ= 2:   FQLOR= 1.1851+004   FQWOR= 2.1971+002   FQPOR=  .0000
  (ID= 2)   ZKOZZ= 6.2508+002   ZMOZZ= 1.0000-002   TMOZZ=  .0000
            TEOZZ=  .0000
VENT= 1:    TEUZZ= 1.5735+006   TMUZZ= 1.9701+000   TMDZZ=-1.8721+000
WALL= 1,1:  FQLWR= 2.1684+004   FQPWR= 3.8962+000   FQLWD= 2.0348+003
            ZKWZZ= 7.5482+002
WALL= 1.2:  FQLWR=  .0000       FQPWR=  .0000       FQLWD=-9.9315+002
            ZKWZZ= 4.9863+002
-----------------------------------------------------------------------
-----------------------------------------------------------------------
T= 510.000     DT= 2.000     NT= 255     NIT= 1676     IT=  5     G.S.
ROOM= 1:    TELZR=-3.0712+006   TELZD=-3.4885+005   ZMLZZ= 7.5582+001
            TMLZZ=-7.9259-003   ZELZZ= 6.0431+007   TELZZ=-3.7195+001
            ZHLZZ= 1.5602+000   ZKLZZ= 7.9636+002   ZYLOZ= 1.1642-001
            ZYLDZ= 6.9472-002   ZYLMZ= 6.1013-004   ZYLSZ= 1.1056-002
            ZYLWZ= 3.2731-002   ZPRZZ=-9.7138-002
  OBJ= 1:   FQLOR= 1.2174+004   FQWOR= 1.0968+002   FQPOR= 3.7428+004
  (ID= 1)   ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
            TEOZZ=-4.4276+006
            ZHPZZ= 8.7816-001   TMPZZ= 1.9620+000   TEPZZ= 4.9951+006
            TEPZR= 2.3542+004
            ZRFZZ= 2.6143-001
  OBJ= 2:   FQLOR= 1.1901+004   FQWOR= 2.1973+002   FQPOR=  .0000
  (ID= 2)   ZKOZZ= 6.2585+002   ZMOZZ= 1.0000-002   TMOZZ=  .0000
            TEOZZ=  .0000
VENT= 1:    TEUZZ= 1.5751+006   TMUZZ= 1.9699+000   TMDZZ=-1.8721+000
WALL= 1,1:  FQLWR= 2.1776+004   FQPWR= 3.8963+000   FQLWD= 2.0067+003
            ZKWZZ= 7.5623+002
WALL= 1,2:  FQLWR=  .0000       FQPWR=  .0000       FQLWD=-1.0121+003
            ZKWZZ= 5.0241+002
-----------------------------------------------------------------------
-----------------------------------------------------------------------
T= 520.000     DT= 2.000     NT= 260     NIT= 1704     IT=  6     G.S.
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ROOM= 1:     TELZR=-3.0745+006   TELZD=-3.4409+005   ZMLZZ= 7.5503+001
             TMLZZ=-7.7181-003   ZELZZ= 6.0431+007   TELZZ=-2.9867+001
             ZHLZZ= 1.5602+000   ZKLZZ= 7.9718+002   ZYLOZ= 1.1643-001
             ZYLDZ= 6.9471-002   ZYLMZ= 6.1012-004   ZYLSZ= 1.1056-002
             ZYLWZ= 3.2731-002   ZPRZZ=-9.7147-002
  OBJ= 1:    FQLOR= 1.2224+004   FQWOR= 1.0970+002   FQPOR= 3.7428+004
  (ID= 1)    ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
             TEOZZ=-4.4276+006
             ZHPZZ= 8.7817-001   TMPZZ= 1.9620+000   TEPZZ= 4.9951+006
             TEPZR= 2.3542+004
             ZRFZZ= 2.6143-001
  OBJ= 2:    FQLOR= 1.1950+004   FQWOR= 2.1975+002   FQPOR=  .0000
  (ID= 2)    ZKOZZ= 6.2664+002   ZMOZZ= 1.0000-002   TMOZZ=  .0000
             TEOZZ=  .0000
VENT= 1:     TEUZZ= 1.5765+006   TMUZZ= 1.9698+000   TMDZZ=-1.8721+000
WALL= 1,1:   FQLWR= 2.1866+004   FQPWR= 3.8964+000   FQLWD= 1.9793+003
             ZKWZZ= 7.5759+002
WALL= 1,2:   FQLWR=  .0000       FQPWR=  .0000       FQLWD=-1.0306+003
             ZKWZZ= 5.0612+002
-----------------------------------------------------------------------
-----------------------------------------------------------------------
T= 530.000     DT= 2.000     NT= 265     NIT= 1731      IT=  5     G.S.
ROOM= 1:     TELZR=-3.0777+006   TELZD=-3.3946+005   ZMLZZ= 7.5427+001
             TMLZZ=-7.5190-003   ZELZZ= 6.0430+007   TELZZ=-2.9391+001
             ZHLZZ= 1.5602+000   ZKLZZ= 7.9798+002   ZYLOZ= 1.1643-001
             ZYLDZ= 6.9470-002   ZYLMZ= 6.1011-004   ZYLSZ= 1.1055-002
             ZYLWZ= 3.2730-002   ZPRZZ=-9.7157-002
  OBJ= 1:    FQLOR= 1.2273+004   FQWOR= 1.0971+002   FQPOR= 3.7428+004
  (ID= 1)    ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
             TEOZZ=-4.4276+006
             ZHPZZ= 8.7818-001   TMPZZ= 1.9621+000   TEPZZ= 4.9951+006
             TEPZR= 2.3542+004
             ZRFZZ= 2.6143-001
  OBJ= 2:    FQLOR= 1.1998+004   FQWOR= 2.1978+002   FQPOR=  .0000
  (ID= 2)    ZKOZZ= 6.2740+002   ZMOZZ= 1.0000-002   TMOZZ=  .0000
             TEOZZ=  .0000
VENT= 1:     TEUZZ= 1.5780+006   TMUZZ= 1.9696+000   TMDZZ=-1.8721+000
WALL= 1,1:   FQLWR= 2.1954+004   FQPWR= 3.8965+000   FQLWD= 1.9527+003
             ZKWZZ= 7.5893+002
WALL= 1,2:   FQLWR=  .0000       FQPWR=  .0000       FQLWD=-1.0487+003
             ZKWZZ= 5.0975+002
-----------------------------------------------------------------------
-----------------------------------------------------------------------
T= 540.000     DT= 2.000     NT= 270     NIT= 1758      IT=  5     G.S.
ROOM= 1:     TELZR=-3.0808+006   TELZD=-3.3495+005   ZMLZZ= 7.5353+001
             TMLZZ=-7.3246-003   ZELZZ= 6.0430+007   TELZZ=-2.3953+001
             ZHLZZ= 1.5602+000   ZKLZZ= 7.9877+002   ZYLOZ= 1.1643-001
             ZYLDZ= 6.9469-002   ZYLMZ= 6.1010-004   ZYLSZ= 1.1055-002
             ZYLWZ= 3.2730-002   ZPRZZ=-9.7166-002
  OBJ= 1:    FQLOR= 1.2321+004   FQWOR= 1.0973+002   FQPOR= 3.7428+004
  (ID= 1)    ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
             TEOZZ=-4.4276+006
             ZHPZZ= 8.7818-001   TMPZZ= 1.9621+000   TEPZZ= 4.9951+006
             TEPZR= 2.3542+004
             ZRFZZ= 2.6143-001
  OBJ= 2:    FQLOR= 1.2045+004   FQWOR= 2.1980+002   FQPOR=  .0000
  (ID= 2)    ZKOZZ= 6.2820+002   ZMOZZ= 1.0000-002   TMOZZ=  .0000
             TEOZZ=  .0000
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VENT= 1:     TEUZZ= 1.5794+006   TMUZZ= 1.9694+000   TMDZZ=-1.8722+000
WALL= 1,1:   FQLWR= 2.2040+004   FQPWR= 3.8965+000   FQLWD= 1.9267+003
             ZKWZZ= 7.6023+002
WALL= 1,2:   FQLWR=  .0000       FQPWR=  .0000       FQLWD=-1.0665+003
             ZKWZZ= 5.1330+002
----------------------------------------------------------------------
----------------------------------------------------------------------
T= 550.000      DT= 2.000      NT= 275     NIT= 1788      IT=  6     G.S.
ROOM= 1:     TELZR=-3.0838+006   TELZD=-3.3055+005   ZMLZZ= 7.5281+001
             TMLZZ=-7.1382-003   ZELZZ= 6.0430+007   TELZZ=-2.2082+001
             ZHLZZ= 1.5602+000   ZKLZZ= 7.9953+002   ZYLOZ= 1.1643-001
             ZYLDZ= 6.9468-002   ZYLMZ= 6.1009-004   ZYLSZ= 1.1055-002
             ZYLWZ= 3.2729-002   ZPRZZ=-9.7176-002
  OBJ= 1:    FQLOR= 1.2368+004   FQWOR= 1.0974+002   FQPOR= 3.7428+004
  (ID= 1)    ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
             TEOZZ=-4.4276+006
             ZHPZZ= 8.7819-001   TMPZZ= 1.9621+000   TEPZZ= 4.9951+006
             TEPZR= 2.3542+004
             ZRFZZ= 2.6143-001
  OBJ= 2:    FQLOR= 1.2091+004   FQWOR= 2.1982+002   FQPOR=  .0000
  (ID= 2)    ZKOZZ= 6.2891+002   ZMOZZ= 1.0000-002   TMOZZ=  .0000
             TEOZZ=  .0000
VENT= 1:     TEUZZ= 1.5807+006   TMUZZ= 1.9692+000   TMDZZ=-1.8722+000
WALL= 1,1:   FQLWR= 2.2125+004   FQPWR= 3.8966+000   FQLWD= 1.9015+003
             ZKWZZ= 7.6150+002
WALL= 1,2:   FQLWR=  .0000       FQPWR=  .0000       FQLWD=-1.0839+003
             ZKWZZ= 5.1679+002
----------------------------------------------------------------------
----------------------------------------------------------------------
T= 558.000      DT= 2.000      NT= 279     NIT= 1810      IT=  5     G.S.
ROOM= 1:     TELZR=-3.0862+006   TELZD=-3.2712+005   ZMLZZ= 7.5224+001
             TMLZZ=-6.9936-003   ZELZZ= 6.0430+007   TELZZ=-2.2008+001
             ZHLZZ= 1.5602+000   ZKLZZ= 8.0013+002   ZYLOZ= 1.1643-001
             ZYLDZ= 6.9467-002   ZYLMZ= 6.1009-004   ZYLSZ= 1.1055-002
             ZYLWZ= 3.2729-002   ZPRZZ=-9.7183-002
  OBJ= 1:    FQLOR= 1.2405+004   FQWOR= 1.0976+002   FQPOR= 3.7428+004
  (ID= 1)    ZKOZZ= 7.2700+002   ZMOZZ= 6.8520+000   TMOZZ=-9.0000-002
             TEOZZ=-4.4276+006
             ZHPZZ= 8.7819-001   TMPZZ= 1.9621+000   TEPZZ= 4.9951+006
             TEPZR= 2.3542+004
             ZRFZZ= 2.6143-001
  OBJ= 2:    FQLOR= 1.2128+004   FQWOR= 2.1984+002   FQPOR=  .0000
  (ID= 2)    ZKOZZ= 6.2946+002   ZMOZZ= 1.0000-002   TMOZZ=  .0000
             TEOZZ=  .0000
VENT= 1:     TEUZZ= 1.5818+006   TMUZZ= 1.9691+000   TMDZZ=-1.8722+000
WALL= 1,1:   FQLWR= 2.2191+004   FQPWR= 3.8966+000   FQLWD= 1.8817+003
             ZKWZZ= 7.6249+002
WALL= 1,2:   FQLWR=  .0000       FQPWR=  .0000       FQLWD=-1.0976+003
             ZKWZZ= 5.1952+002
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5. AUTHOR(S)

R.D. Peacock and J.N. Breese

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10. SUPPLEMENTARY NOTES

☐ Document describes a computer program; SF-185, FIPS Software Summary, is attached.

11. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here)

This study presents an initial look at the potential for the use of fire growth models. A technique is presented, based upon numerous fire growth predictions, to estimate the minimum energy required to produce temperature levels capable of promoting flashover in a variety of room configurations. The parameters investigated included room size, room ventilation, ceiling height and room lining material. A comparison is presented of the predictions made with available full-scale fire test data and with other predictions. The technique, although needing refinement, shows promise to estimate flashover potential.

12. KEY WORDS (Six to twelve entries; alphabetical order; capitalize only proper names; and separate key words by semicolons)

Compartment fires; computers; fire growth; flashover; mathematical models.

13. AVAILABILITY

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