EXHIBIT 2

(EXTRACTED FROM REVISION 4 OF THE HI-STORM TSAR
DATED MAY 1998)

(Exhibit 2 contains twelve pages)

11.2.4 Fire Accident

11.2.4.1 Cause of Fire

Although the probability of a fire accident effecting a HI-STORM 100 System during storage operations is low due to the lack of combustible materials at the ISFSI, a conservative fire has been assumed and analyzed. The analysis shows that the HI-STORM 100 System continues to perform its structural, confinement, thermal, and subcriticality functions.

11.2.4.2 Fire Analysis

11.2.4.2.1 Fire Analysis for HI-STORM Overpack

The possibility of a fire accident near an ISFSI is considered to be extremely remote due to an absence of combustible materials within the ISFSI and adjacent to the overpacks. The only credible concern is related to a transport vehicle fuel tank fire, causing the outer layers of the storage overpack to be heated by the incident thermal radiation and convective heat fluxes.

The amount of combustible fuel in the transporter is limited to a volume of 200 gallons based on a Technical Specification in Section 12.3. Based upon results of large pool burning rate experiments [11.2.2], it is conservatively postulated that any transport vehicle fire results in a 1475° F fire environment, and that the fuel burns at a rate of 0.15 inches per minute. Based on IAEA Safety Standards [11.2.3], it is conservatively postulated that a ring of fuel with a width of one meter, a surface area of 21,260 in^2, and a depth of 2.17 in. forms around the storage overpack. Based on these conservative parameters, the maximum duration of the fire is bounded by a time of 15 minutes, during which all outer surfaces of the HI-STORM overpack are exposed to incident radiative and convective heat fluxes.

The inner surface of the overpack is conservatively assumed to be insulated. Because of the severity of the fire condition radiative heat flux, heat flux from incident solar radiation is negligible and is not included. Furthermore, the smoke plume from the fire would block most of the solar radiation. The thermal transient response of the storage overpack is determined using the ANSYS finite element program. Time-histories for points in the storage overpack were monitored for the duration of the fire and the subsequent post-fire equilibrium phase.

Heat input to the HI-STORM overpack while it is subjected to the fire is from a combination of an incident radiation and convective heat fluxes to all external surfaces. This can be expressed by the following equation:

$$q_F = h_{fc}(T_A - T_S) + 0.1714 \times 10^{-8} \epsilon [(T_A + 460)^4 - (T_S + 460)^4]$$

where:

q_F =Surface Heat Input Flux (Btu/ft^2-hr)
h_{fc} = Surface Heat Transfer Coefficient (Btu/ft^2-hr-°F)
T_A = Fire Condition Temperature (1475°F)
T_S = Transient Surface Temperature (°F)
ϵ = Surface Emissivity = 0.85 (flame emissivity = 1.0)

The forced convection heat transfer coefficient is calculated to bound the convective heat flux contribution to the exposed cask surfaces due to fire induced air flow. For the case of air flow past a heated cylinder, Jacob [11.2.4] recommends the following correlation for convective heat transfer obtained from experimental data:

$$Nu_{fc} = 0.028 \ Re^{0.8} \left[1 + 0.4 \left(\frac{L_{st}}{L_{tot}}\right)^{2.75} \right]$$

where:

L_{tot} =	length traversed by flow
L_{st} =	length of unheated section
K_f =	thermal conductivity of air evaluated at the average film temperature
Re =	flow Reynolds Number based on L_{tot}
Nu_{fc} =	Nusselt Number ($h_{fc} L_{tot}/K_f$)

A consideration of the wide range of temperatures to which the exposed surfaces are subjected to during the fire and the temperature dependent trend of air properties requires a careful selection of parameters to determine a conservatively large bounding value of the convective heat transfer coefficient. In Table 11.2.1, a summary of parameter selections with justifications provide an appropriate basis for application of this correlation to determine forced convection heating of the overpack during a short-term fire event.

After the 15 minute fire event, the ambient temperature is restored to 80°F and the storage overpack cools down (post-fire equilibrium). Heat loss from the outer surfaces of the storage overpack is determined by the following equation:

$$q_S = h_S(T_S - T_A) + 0.1714 \times 10^{-8} \epsilon [(T_S + 460)^4 - (T_A + 460)^4]$$

where:

q_S =Surface Heat Loss Flux (Btu/ft^2-hr)
h_S = Surface Heat Transfer Coefficient (Btu/ft^2-hr-°F)
T_S = Transient Surface Temperature (°F)
T_A = Ambient Temperature (°F)
ϵ = Surface Emissivity

In the post-fire equilibrium phase, the surface heat transfer coefficient (h_S) is determined by the following equation:

$$h_S = 0.19 \times |T_A - T_S|^{1/3}$$

where:

h_S = Surface Heat Transfer Coefficient (Btu/ft^2-hr-°F)
T_A = External Air Temperature [Fire or Ambient] (°F)
T_S = Surface Temperature (°F)

A two-dimensional, axisymmetric model was developed for this analysis. Concrete thermal properties used were taken from Section 4.2. The ANSYS model with temperature monitoring locations is shown in Figure 11.2.1. The outer surface and top surface of the overpack are exposed to the ambient conditions (fire and post-fire). The base and the inner surface of the overpack are insulated. The transient study is conducted for a period of 10 hours, which is sufficient to allow all temperatures in the overpack to reach their maximum values and begin to recede.

Based on the results of the analysis, the maximum temperature increases at several points near the overpack mid-height are summarized in Table 11.2.2 along with the corresponding peak temperatures. Temperature profiles through the storage overpack wall thickness near the mid-height of the cask are included in Figures 11.2.2 through 11.2.4. A plot of temperature versus time is shown in Figure 11.2.5 for several points through the overpack wall, near the mid-height of the cask. The temperature profile plots (Figures 11.2.2 through 11.2.4) each contain profiles corresponding to time "snapshots". Profiles are presented at the following times: 15 minutes, 30 minutes, 1 hour, 2 hours, 4 hours, 7 hours, and 10 hours.

The primary shielding material in the storage overpack is concrete, which can suffer a reduction in neutron shielding capability at sustained high temperatures. The results of the analysis show that the intense heat from the fire only partially penetrates the overpack wall, and that the majority of the concrete experiences a relatively minor temperature increase. The concrete that is exposed to extreme temperatures could experience a minor reduction of neutron shielding capability.

Examining Table 11.2.2, it is seen that the overpack inner shell temperature is relatively unaffected by the fire. From this result it can be concluded that a negligible amount of heat for the fire reaches the MPC. Therefore, the temperature of the MPC is increased by the contained decay heat only. Given the large mass of a loaded MPC and the short duration of the fire, the temperature rise of the MPC and stored fuel will be small and a large margin to the short-term cladding temperature limits will exist. Consequently, the impact on the MPC internal helium pressure is expected to be negligibly small. Based on a conservative analysis of the HI-STORM 100 System response to a hypothetical fire event, it is concluded that the fire event does not significantly affect the temperature of the MPC. Furthermore, the ability of the HI-STORM 100 System to cool the spent nuclear fuel within design temperature limits during post-fire equilibrium is not compromised.

Structural

As discussed above, there are no structural consequences as a result of the fire accident condition.

Thermal

As discussed above, the MPC internal pressure increases a negligible amount and is bounded by the 100% fuel rod rupture accident in Section 11.2.9. As shown in Table 11.2.2, the peak fuel cladding and material temperatures are well below short-term accident condition allowable temperatures of Table 2.2.3.

Shielding

There is a limited effect on the shielding performance of the system as a result of this event, since the concrete bulk temperature does not exceed its normal design condition temperature of 300°F.

Criticality

There is no effect on the criticality control features of the system as a result of this event.

Confinement

There is no effect on the confinement function of the MPC as a result of this event.

Radiation Protection

Since there is limited degradation in shielding on the overpack exterior surface and no degradation of confinement capabilities as discussed above, there is a negligible effect on occupational or public exposures as a result of this event.

Based on this evaluation, it is concluded that the overpack fire accident does not affect the safe operation of the HI-STORM 100 System.

11.2.4.2.2 Fire Analysis for HI-TRAC Transfer Cask

To demonstrate the fuel cladding and MPC pressure boundary integrity under an exposure to a hypothetical short duration fire event during on-site handling operations, a fire accident analysis of the loaded 100-ton HI-TRAC is performed. This analysis, because of the lower mass of 100-ton HI-TRAC, bounds the effects for the 125-ton HI-TRAC. In this analysis, the contents of the HI-TRAC are conservatively postulated to undergo a transient heat up as a lumped mass from the decay heat input and heat input from the short duration fire. The rate of temperature rise of the HI-TRAC depends on the thermal inertia of the cask, the cask initial conditions, the spent nuclear fuel decay heat generation, and the fire heat flux. All of these parameters are conservatively bounded by the values in Table 11.2.3 which are used for the fire transient analysis.

Using the values stated in Table 11.2.3, a bounding cask temperature rise of less than 9°F per minute is determined from the combined radiant and convection fire and decay heat inputs to the cask. During the handling of the HI-TRAC transfer cask, the transporter is limited to a maximum of 50 gallons, in accordance with a Technical Specification in Section 12.3. The duration of the 50 gallon fire is less than 5 minutes. Therefore, the fuel cladding will not exceed the short term fuel cladding temperature limit (see Table 11.2.5).

The elevated temperatures as a result of the fire accident will cause the pressure in the water jacket to increase and cause the overpressure relief valve to vent steam to the atmosphere. It is conservatively assumed, for dose calculations, that all the water in the water jacket is lost.

Due to the increased temperatures the MPC experiences as a result of the fire accident in the HI-TRAC transfer cask, the MPC internal pressure increases. Table 11.2.4 provides the MPC maximum internal pressures as a result of the HI-TRAC fire accident. Table 11.2.5 provides a summary of the loaded HI-TRAC bounding maximum temperatures for the hypothetical fire accident condition.

Table 11.2.1

SUMMARY OF TEMPERATURE-DEPENDENT FORCED CONVECTION HEAT TRANSFER CORRELATION PARAMETERS FOR AIR

Parameter	**Trend with Increasing Temperatures**	**Criteria to Maximize h_{fc}**	**Conservative Parameter Value**	**Evaluated At**
Temperature Range	100° F-1475° F	NA	NA	NA
Density	Decreases	Reynolds Number	High	100° F
Viscosity	Increases	Reynolds Number	Low	100° F
Conductivity (K_f)	Increases	h_{fc} Proportional to K_f	High	1475° F

Table 11.2.2

HI-STORM 100 OVERPACK TEMPERATURES AS A RESULT OF THE HYPOTHETICAL FIRE CONDITION

Material/Component	**Initial† Condition (°F)**	**During Fire (°F)**	**Post-Fire†† Cooldown (°F)**
Overpack Inner Shell	200	200	208
Overpack Radial Concrete Inner Surface	200	200	208
Overpack Radial Concrete Mid-Surface	200	200	232
Overpack Outer Shell	200	1155	1155

† Bounding 200°F uniform temperature assumed (maximum normal condition calculated overpack component temperature = 165°F).

†† Maximum temperature during post-fire cooldown.

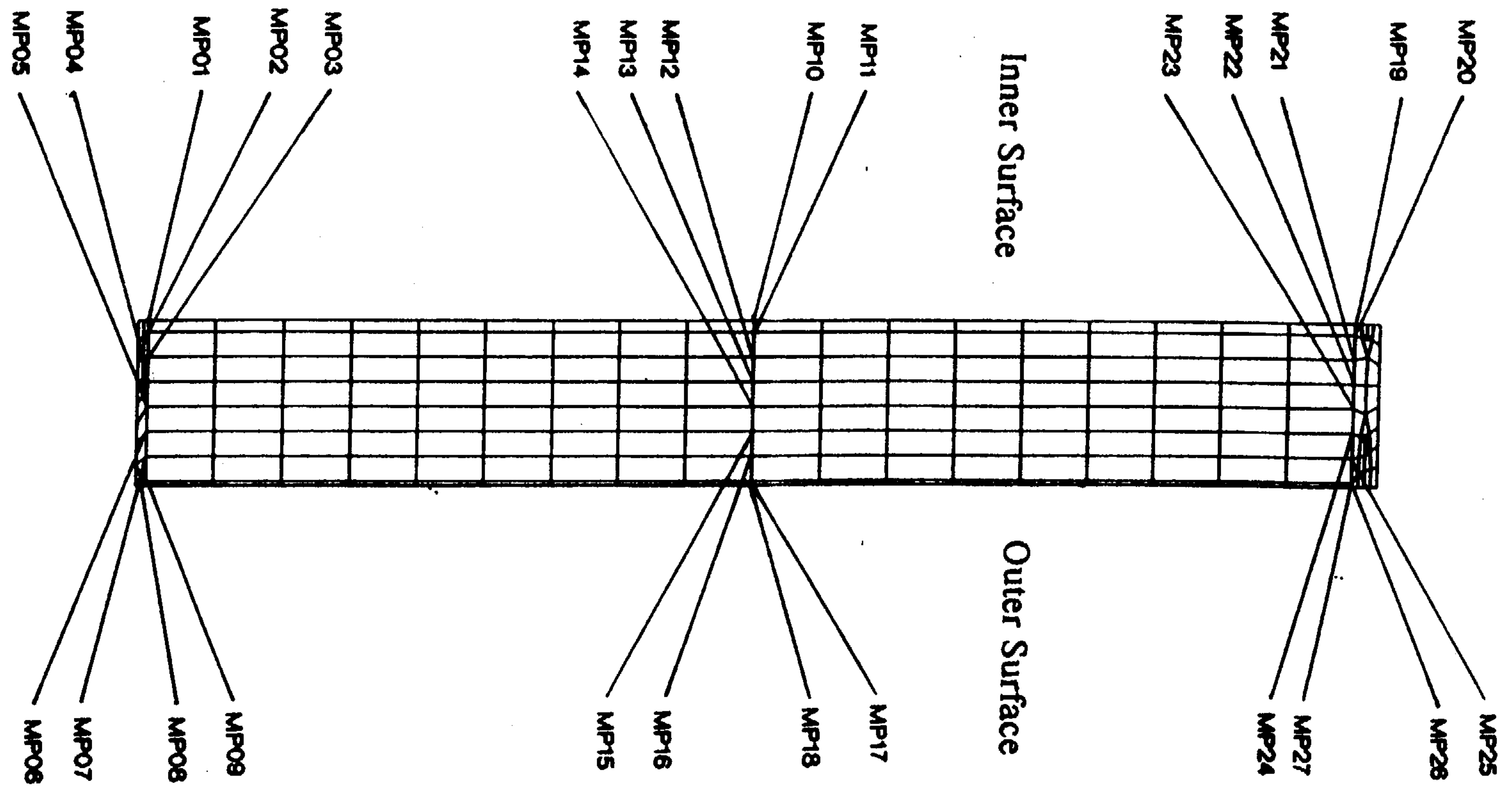


FIGURE 11.2.1; ANSYS MODEL AND TEMPERATURE MONITORING LOCATIONS

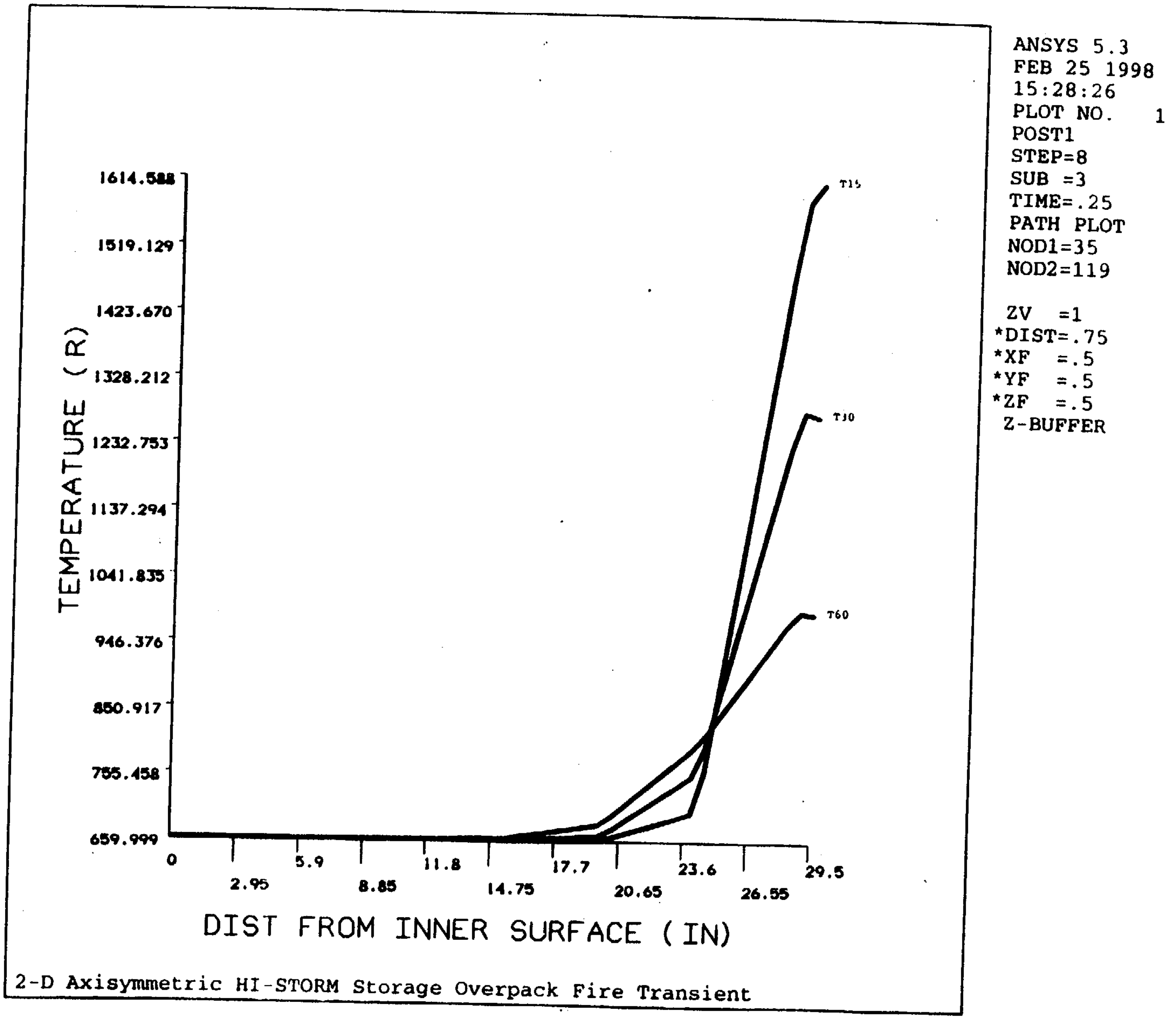


FIGURE 11.2.2; TEMPERATURE PROFILES THROUGH OVERPACK WALL AT 15, 30 AND 60 MINUTES

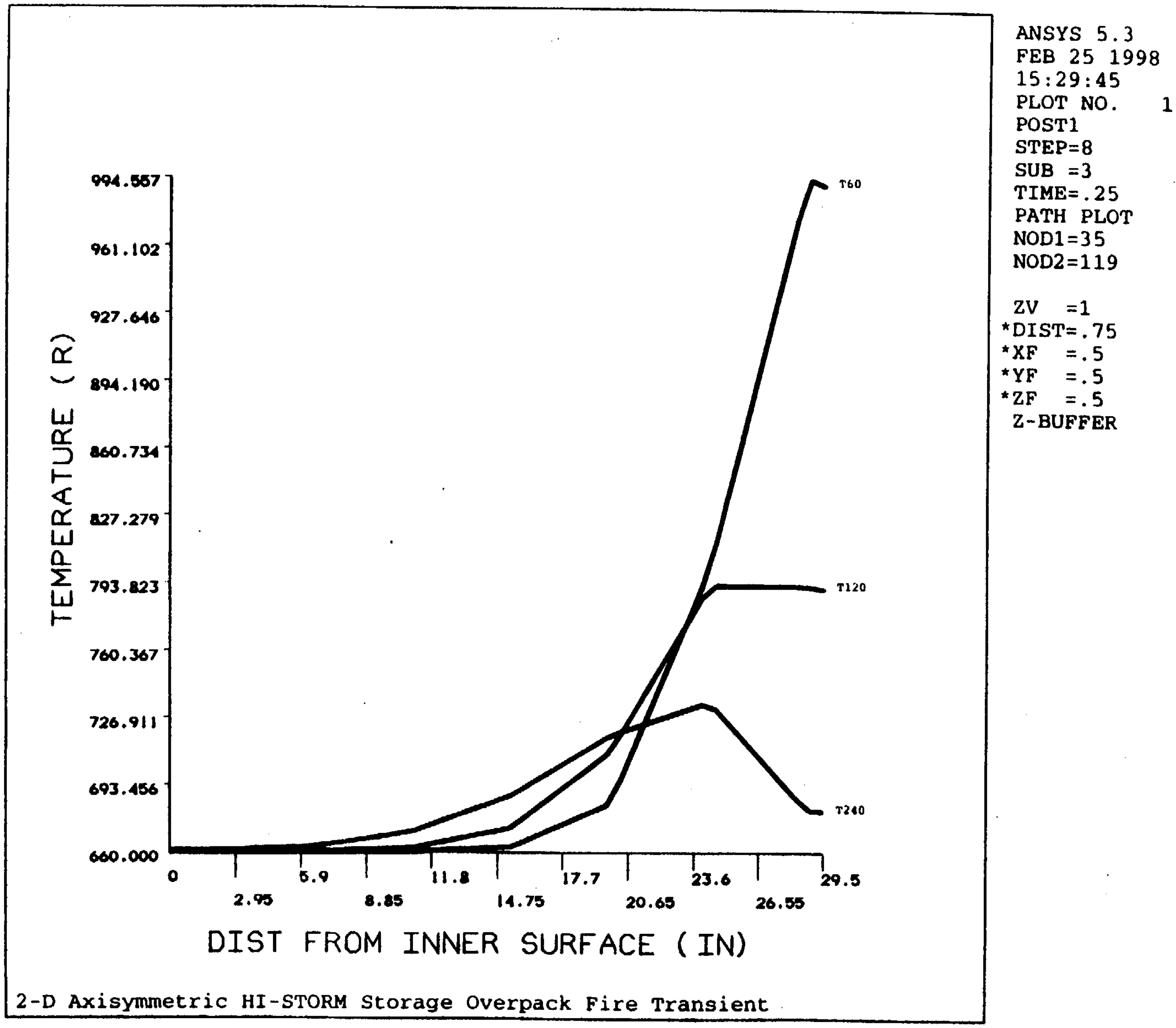


FIGURE 11.2.3; TEMPERATURE PROFILES THROUGH OVERPACK WALL AT 60, 120 AND 240 MINUTES

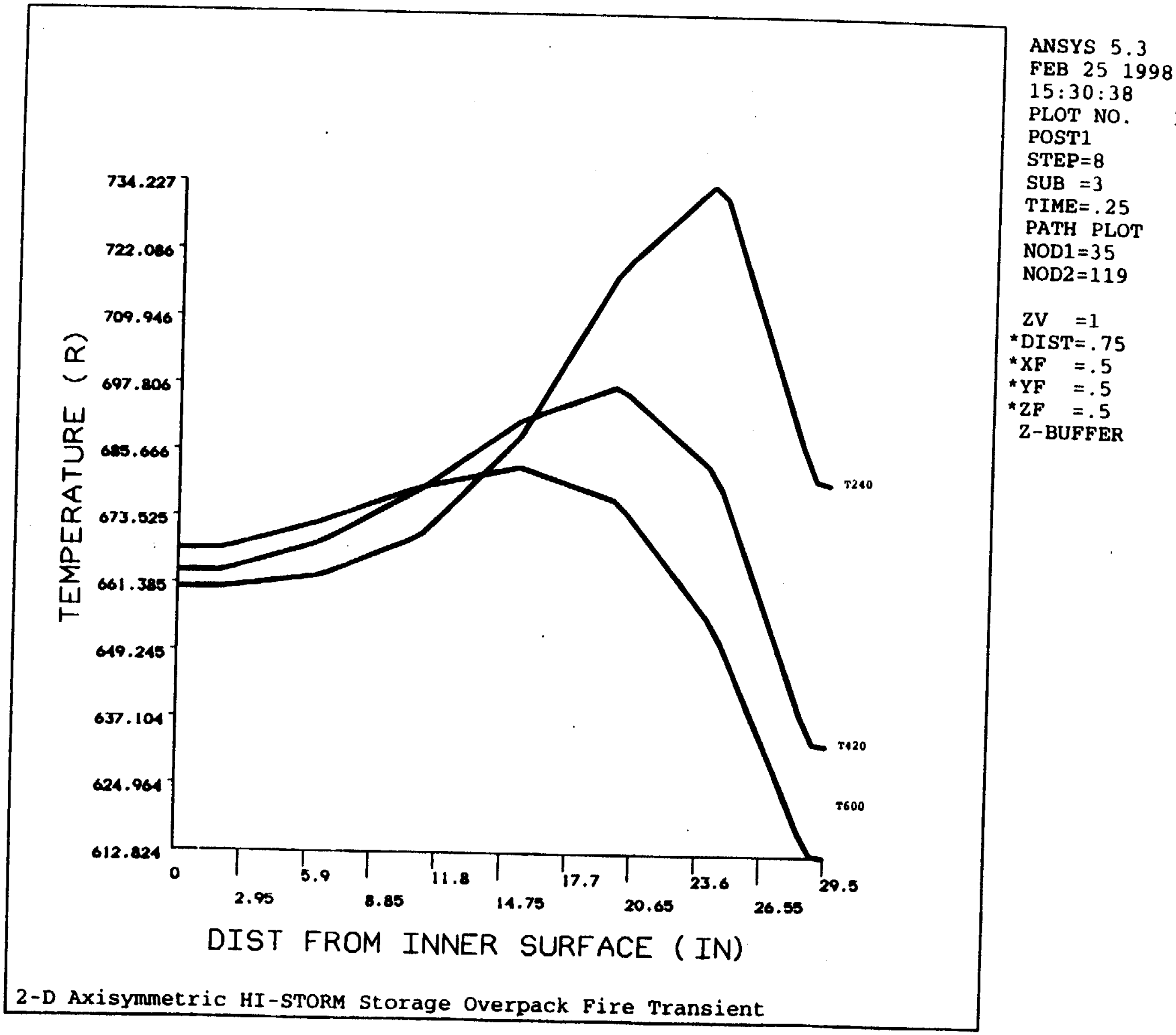
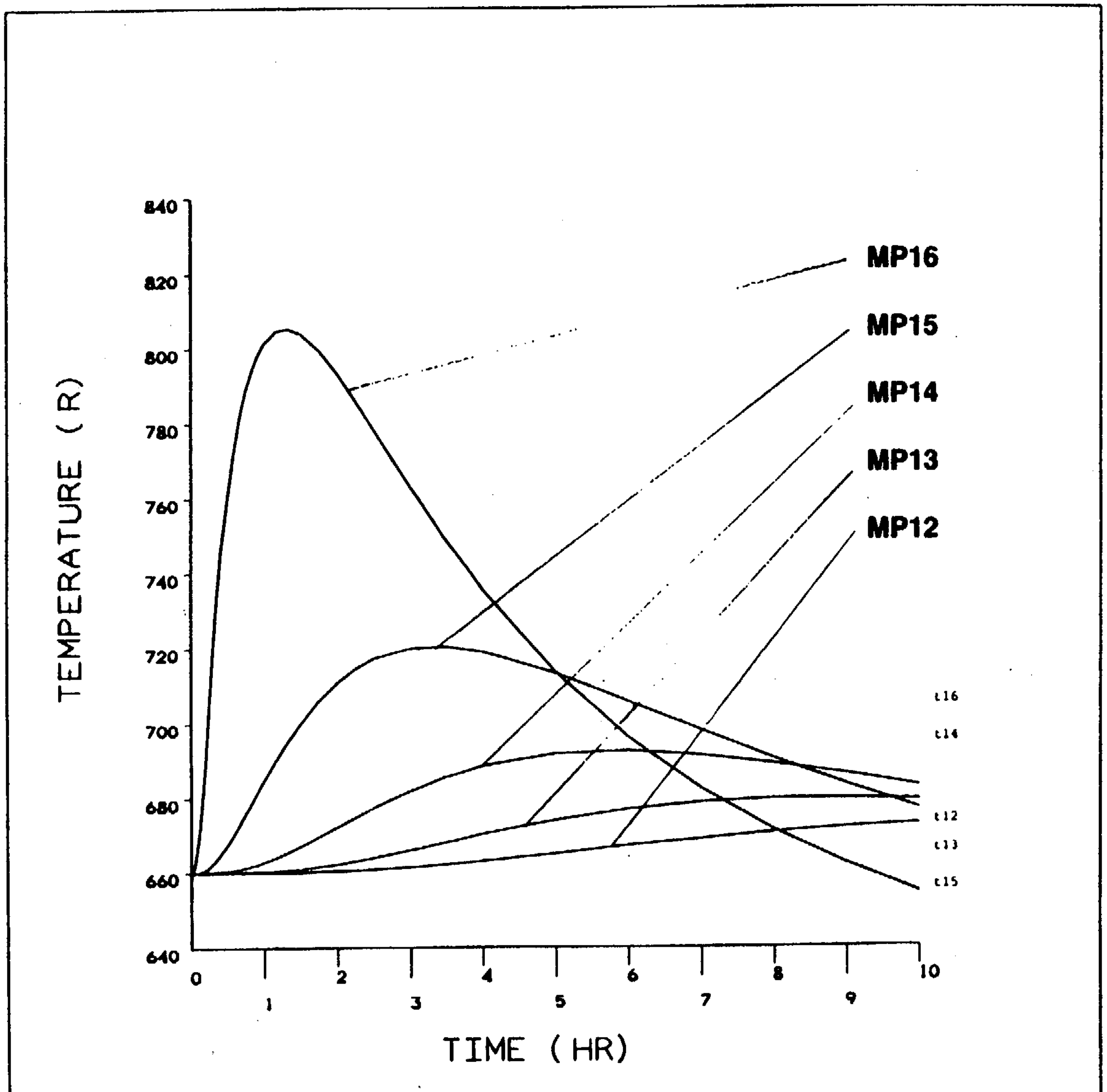


FIGURE 11.2.4; TEMPERATURE PROFILES THROUGH OVERPACK WALL AT 240, 420 AND 600 MINUTES



2-D Axisymmetric HI-STORM Storage Overpack Fire Transient

ANSYS 5.3
FEB 26 1998
09:15:28
PLOT NO. 1
POST26

ZV =1
DIST=.75
XF =.5
YF =.5
ZF =.5
Z-BUFFER

FIGURE 11.2.5; TEMPERATURE VS. TIME NEAR CASK MID-HEIGHT