Private Fuel Storage, L.L.C.

P.O. Box C4010, La Crosse, WI 54602-4010
Phone 303-741-7009 Fax: 303-741-7806
John L. Donnell, P.E., Project Director

April 10, 2000

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555-0001

COMMITMENT RESOLUTION LETTER #29
DOCKET NO. 72-22 / TAC NO. L22462
PRIVATE FUEL STORAGE FACILITY
PRIVATE FUEL STORAGE L.L.C.

In accordance with our April 3, 2000 conference call, Private Fuel Storage (PFS) submits the following resolution to NRC/CNWRA questions and comments regarding Canister Transfer Building (CTB) fire protection issues for the Private Fuel Storage Facility (PFSF). The NRC questions/comments are documented below followed by the PFS response.

NRC Questions and Comments

1. PFS should consider the contributions from the tires on the heavy haul vehicle to the bounding fire in the cask load/unload bay and determine the impact, if any, on the conclusions presented in the SAR regarding Structures, Systems, and Components (SSCs) that are important to safety.

RESPONSE

Canister Transfer Building Assessment

PFS has evaluated four credible fire scenarios for the Canister Transfer Building cask load/unload bay in order to identify a bounding fire scenario for building structural considerations. The fire scenarios evaluated are described below:

- A diesel fuel spill fire consuming 300 gallons in 30 minutes. This scenario assumes that the diesel tractor fuel tanks leak at a rate of 10 gal/min resulting in a prolonged fire in the vicinity of the fuel tanks having a duration of 30 minutes,
- A diesel fuel spill which spreads over an area of 200 sq. ft. and ignites. This is a large enough pool to reach the nearest set of tires on the tractor. The 300 gallons of diesel fuel would burn for 16 minutes, based on the 200 sq. ft. area (2.4 inch fuel depth).
- A double axle of tires on the trailer (16 tires total) which is assumed to burn for 30 minutes, and
- A combined 200 sq. ft. diesel fuel pool fire and 30 minute tire fire.

These scenarios were evaluated in Calculation No. 05996.02-P-006 to determine the fire plume temperatures in the low bay area (at the 30-foot high ceiling), the hot layer temperatures in the

NMSS01Public

high bay area (90-foot high ceiling) and the heat release rate from each fire. PFSF SAR Figure 4.5-4 provides a sketch of the transportation cask heavy haul tractor/trailer considered in this evaluation. For the scenarios involving the 200 sq. ft. diesel pool fire, no credit was taken for the sumps located at each end of the cask load/unload bay nor for the slope of the floor that would direct the fluid into the sumps, and it was conservatively assumed that the 300 gallons of diesel fuel forms a relatively deep pool centered at the tractor's fuel tanks that extends to the nearest set of tires on the tractor. Public domain software, FPEtool, was used for these calculations. FPEtool is a collection of calculation programs developed at the National Institute of Standards and Technology (NIST) with funding from the General Services Administration. The software automates the commonly accepted empirical equations for fire dynamics such as plume temperature, ceiling jet temperatures, and hot layer temperatures. These algorithms are used in NFPA standards such as NFPA #72, NFPA #204 and NFPA #92B. While these programs do not provide the detail or spatial variations of computational fluid dynamics or other field models, they provide conservative bounding information, and are widely accepted for this type of bounding analysis. For the plume calculations, the area of the load/unload bay (10,200 sq. ft.) was used as the area limit, and 30 ft was used as the ceiling height. For the hot layer temperature calculations, the concrete walls and ceiling heat loss area of the high bay area (80,545 sq. ft.) were used. Since the hot layer calculations require a vent, a vent to the low bay area was assumed with a height of 30 feet and a width of 20 feet (the actual door is 22 feet high at the end of the low bay.) No credit was taken for roof level ventilation, which will be provided for normal ventilation. Additionally, no credit was taken for the automatic fire suppression system or for manual actions to extinguish the fire.

The results of these analyses (included in Calculation No. 05996.02-P-006) are summarized in the following table.

FIRE SCENARIO	HEAT RELEASE RATE	PLUME TEMP., LOW BAY	HOT LAYER TEMP., HIGH BAY
30 min diesel fuel pool	21,100 kW	834 F	324 F
16 min diesel fuel pool	38,000 kW	1200 F	408 F
30 min tire	9,000 kW	503 F	214 F
Combined 16 min diesel fuel pool and 30 min tire	47,000/9,000 kW *	1372 F	459 F

* The 47,000 kw heat release rate (combined diesel pool and tire fire) lasts16 minutes, and the 9,000 kw heat release rate (tire fire) continues for an additional 14 minutes.

The bounding fire for building structural considerations is the 300 gallon diesel fuel spill that burns for 16 minutes, combined with the 30 minute tire fire. Ceiling temperatures in the low bay area of the cask load/unload bay were calculated for each of the above fire scenarios, to verify exposures to the reinforced concrete ceiling were acceptable (no structural collapse). The range of plume temperatures at the 30 foot ceiling for the various scenarios did not exceed the exposure conditions of an ASTM E-119 fire resistance test. The furnace temperatures to which a concrete slab is exposed to in a test furnace reaches 1399 F in 15 minutes and continues to climb to 1925 F at 180 minutes. The 12 inch concrete slab is capable of withstanding longer exposures to such temperatures without experiencing failure. The Concrete Reinforcing Steel Institute, "Reinforced Concrete Fire Resistance", dated 1980, reports a slab of only 6 inch thickness exceeds a fire resistance rating of three hours.

As can be seen from the results of the four scenarios evaluated above, these fires will not threaten the structural integrity of the Canister Transfer Building and it will continue to perform its safety functions.

The upper layer temperatures are relatively low (459°F from the bounding fire scenario) and will not have any adverse impact on the Canister Transfer Building structure. In addition, the overhead bridge crane, semi-gantry crane, and HI-TRAC canister downloader structural components would be unaffected by these upper layer temperatures. While components associated with electrical power supplies and the crane and canister downloader motors could possibly fail at these temperatures, causing these lifting devices to discontinue operation and require repair, the cranes and canister downloader are designed to safely retain their loads upon loss of electrical power (PFSF SAR Section 8.1.1). The bounding fire scenario in the load/unload bay will not cause a load drop and will not pose a threat to nuclear safety, even with no credit for the automatic fire suppression system or for manual actions to extinguish the fire.

Transportation Cask Assessment

The tires on the heavy haul vehicle would require a substantial ignition source to create a self-sustaining fire. The analysis considered a diesel fuel spill igniting the rear set of tires on the tractor axles (8 tires). Since the floor is sloped away from the vehicle to a sump, and the sump is sloped away from the transportation cask, it is not considered possible for a spill from the tractor, with a maximum fuel tank capacity of 300 gallons, to spread to the cask located more than 20 m away from the fuel tank. The calculations also demonstrate that it is highly unlikely that a tire fire involving one pair of axles could propagate to an adjacent pair of axles in which the closest edges of the tires are separated by more than 12 feet (3.7 m). The peak radiant heat flux to the adjacent axle was calculated (Calculation No.05996.02-P-007) to be 8.0 kW/m^2 which is less than the minimum flux necessary to ignite vulcanized rubber (values of minimum critical heat flux for ignition are reported by Tewarson in Section 3/Chapter 4 of the SFPE Handbook, 2nd edition for ethylene/propylene rubber power cables as 20-23 kW/m^2, and for chloroprene rubber conveyor belts as 20 kW/m^2). Therefore, a fire involving a set of tires near the fuel tanks on the tractor would not be expected to propagate to the next set of tires.

As a worst case fire for the transportation cask, even though demonstrated to be not practical, the tires on the double axle closest to the transportation cask (16 tires) were assumed to burn (Calculation No.05996.02-P-007). The peak radiant heat flux at mid flame on the cask was calculated to be 10.7 kW/m^2. This is a higher heat flux at the transportation cask than would be produced from the bounding fire for building structural considerations, the 300 gallon diesel fuel spill that burns for 16 minutes combined with the 30 minute tire fire, located near the tractor approximately 20 meters from the cask. Therefore, this postulated fire involving 16 tires nearest the cask is the bounding fire for the transportation cask. However, the 10.7 kW/m^2 generated by the bounding cask fire is well below the radiant heat flux from the fire for which the cask is qualified. The transportation casks are required to be demonstrated capable of safely withstanding the effects of an exposure fire that burns at 1475°F for 30 minutes per 10 CFR 71.73(c)(4). This flame yields a radiant heat flux of 68 kW/m^2.

2. Will canister transfer operations take place in the canister transfer cells when the heavy haul tractor-tailor is positioned in the cask load/unload bay? If so, what are the effects on a loaded transfer cask of a bounding fire in the cask load/unload bay during a canister transfer operation?

RESPONSE

Canister transfer operations can take place while the heavy haul vehicle is in the cask load/unload bay. However, the presence of the vehicle in the cask load/unload bay does not create an unacceptable exposure to the transfer casks. The 30 foot high reinforced concrete barrier walls of the transfer cells prevent radiant heat exposure to equipment in the cells from a fire in the load/unload bay.

Because of the 90 foot high ceiling in the high bay area and the large heat loss surface area of the reinforced concrete walls and ceiling, smoke layer temperatures over the transfer cells from the bounding building fire (the combined fuel spill and tire fire in the cask load/unload bay assessed above) would not create significant exposure to important to safety equipment in the canister transfer cells. The highest calculated upper layer temperature of 459°F for the bounding fire scenario for building structural considerations represents an average temperature of the upper layer for this scenario, with somewhat higher temperatures near the ceiling and lower temperatures near the 30 ft elevation at the bottom of the upper layer. This temperature would pose no threat to the structural integrity of the steel canisters or transfer casks. As shown in PFSF SAR Table 4.7-2, the short term temperature limits are 700°F for the transfer cask outer shell, and 775°F for the canister shell. Section 11.2.1.2.2 of the HI-STORM Storage Cask TSAR analyzes the effects on the HI-TRAC transfer cask of a fire fueled by 50 gallons of diesel fuel surrounding the cask which burns for 4.775 minutes. The analysis determined that the transfer cask and canister would retain their structural integrity and continue to perform their safety functions. For this severe fire, there was some loss of transfer cask shield water due to boiloff, with resultant higher dose rates from the cask. This condition could be addressed by the use of temporary neutron shielding until the shield tubes are refilled with water, and does not pose a threat to worker safety. This HI-TRAC fire analysis is bounding for the Canister Transfer Building fire scenarios, and effects on the transfer cask from the bounding fire in the cask load/unload bay would be less severe than those evaluated in the HI-TRAC fire analysis in the HI-STORM Storage Cask TSAR.

3. Is the maximum temperature reported by PFS for the bounding fire a local temperature or a temperature for the entire building? PFS should describe the boundaries that were used for the bounding fire and determine the average upper hot layer temperature.

RESPONSE

The bounding fire scenarios have been reanalyzed as discussed in Item 1, which considers local effects at the transportation cask as well as in the entire building. Local effects from plume impingement and area building effects from hot layer temperatures are addressed in Item 1.

4. What is the height and fire rating of the southern most canister transfer cell wall that separates the transfer cell #3 from the transfer equipment laydown area?

RESPONSE

The height of all the interior canister transfer cell walls is 30 ft as shown on PFSF SAR Figure 4.7-1, Sheet 3 of 3. The walls are not required to be a fire boundary, however they are 1 foot thick concrete, which, even with the poorest aggregate, provides in excess of a 4 hour fire rating per UBC Table 7-B.

5. SAR Figure 4.3-1 indicates that the CTB smoke detectors will be designed per NFPA 72E. This reference should be to NFPA 72.

RESPONSE

PFSF SAR Figure 4.3-1 will be revised to update the referenced code to NFPA 72. In addition, Section 4.3.8.1, under Design Code Compliance, will be revised to add, "The fire detection system shall be design in accordance with NFPA 72" and the reference section will be revised to include NFPA 72.

PFS will include the information presented above in the next update to the SAR. If you have any questions regarding this response, please contact me at 303-741-7009.

Sincerely,

JH Cooper for

John L. Donnell
Project Director
Private Fuel Storage L.L.C.

Copy to (with enclosure):
Mark Delligatti
John Parkyn
Jay Silberg
Sherwin Turk
Asadul Chowdhury
Murray Wade
Scott Northard
Denise Chancellor
Richard E. Condit
John Paul Kennedy
Joro Walker