4.2.1 Pool size

Three fire accident scenarios are analyzed for each rail cask and one for the truck cask. A hydrocarbon fuel pool that conforms to the HAC fire described in 10 CFR 71.73 is used as the basis for each scenario. This regulation specifies a hydrocarbon fuel pool that extends between one and three meters horizontally beyond the external surface of a cask. To ensure the casks analyzed in this study are fully engulfed by the fire, all hydrocarbon fuel pools were assumed to extend three meters from the sides of the casks (for smaller packages, a pool fire that extends less than three meters from the package surfaces may be sufficient to ensure full engulfment of the package).

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4.2.2 Fire duration

The duration of the fires postulated for the rail cask analyses is based on the capacity of a large rail tank car. Typical large rail tank cars can carry up to 30,000 gallons (113,562 liters) of liquid, such as a flammable hydrocarbon. To estimate the duration of the fires, all the flammable liquid in the tank car is released and assumed to form a pool with the dimensions of a regulatory pool fire for the rail casks that were analyzed. That is, fuel pools that extend horizontally three meters (ten feet) beyond the surfaces of the casks are used in the fire models. Provided that there are relatively small differences between the overall dimensions of the Rail-Steel cask and the Rail-Lead cask, these fuel pools are similar in size and are nominally 14m x 9m (46ft x 29.5ft). A pool of this size would need to be 0.9m (3ft) deep to pool 30,000 gallons (113,562 liters) of liquid fuel, a condition that is extremely unlikely to be met in any accident scenario. If all of the fuel in such a pool were to ignite and burn (i.e., none of the fuel runs off or soaks into the ground), this pool fire would burn for about 3 hours. This fire duration is estimated using a nominal hydrocarbon fuel recession (evaporation) rate of 5mm (0.2in) per minute, typical of large pool fires (SFPE, 2002; Lopez et al., 1998; Quintiere, 1998). Another way this large pool area could burn for up to three hours would be the even less likely case in which liquid fuel flows at exactly the right rate to feed and maintain the pool area for the duration of the fire. Provided that both of these pooling conditions are very difficult to obtain, the fire duration presented here is considered to be conservative. Nevertheless, a 3-hour fire that is not moving over time and is capable of engulfing a rail cask over the duration of the fire is conservatively used for the analysis of the two rail casks considered in this study.

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In the case of the Truck-DU cask, the fire duration is based on the fuel capacity of a typical petroleum tank truck. About 9,000 gallons (34,070 liters) of gasoline can be transported on the road by one of these tank trucks. Provided that the overall dimensions of the Truck-DU cask are 2.3m x 6m (7.5ft x 19.7ft), a regulatory pool that extends horizontally 3 meters (10 feet) beyond the outer surface of the cask would be 8.3m x 12m (27.2ft x 39.4ft). To pool 9,000 gallons (34,070 liters) of gasoline in a pool of this area, the pool would need to be 0.3m (1ft) deep, a configuration that is difficult to obtain in an accident scenario and therefore unlikely to occur. Such a pool fire would burn for a little more than an hour. As discussed for the rail cask pool fire, the other possibility of maintaining a fire that can be engulfing and that can burn for that duration is if, for example, gasoline were to flow at the right rate to maintain the necessary fuel pool conditions. This scenario is also very unlikely. Nevertheless, one hour is used as the duration of a fire that is not moving over time for the conservative analysis of the Truck-DU cask.