Assessing the Hazards and Protection Schemes Related to IBCs in Operations Scenarios – Phase II Testing

EXECUTIVE SUMMARY

The companion Phase I report to these tests concluded that the hazards associated with the use of non-Listed, composite IBCs in operations scenarios were severe and recommended that several different mitigations strategies be explored via full-scale testing. The use of a passive cellular glass insulation material, combined with a containment vessel, was identified as a potentially effective strategy. The first test series in this Phase II effort was intended to characterize the potential liquid discharge (leak) scenarios from various size puncture areas in the side of composite IBCs. The second series of tests was used to evaluate, at a reduced scale, the viability of a passive pool fire suppressant material, a cellular glass insulation, to significantly reduce the thermal threat resulting from an ignited spill or pool fire.

For the leak tests, the predictions from Phase I were validated. Adequate containment against potential IBC leak scenarios would require that the IBC be located in the center of a 12 ft square containment area if a single IBC is being protected.

In the passive material tests, two scenarios were investigated: an unignited spill (ignition occurring after the spill has drained into the containment vessel; and, ignited spill, where an ignition source is intimate with leaking fuel. This second scenario is of particular interest for the IBC operations scenario, where a leak may occur in the container liquid space from a leaking valve or container puncture, as characterized in the leak tests. A Class IB flammable liquid, heptane, was used in the tests. For unignited spills, the cellular glass insulation was very effective in reducing the overall heat threat. The rate of heat release was an order of magnitude less than the free burn. Heat flux to personnel and equipment were within acceptable limits. The cellular glass insulation was less effective for the ignited spill scenario. The qualitative reductions in heat release rate were not achieved; the resulting ignited spill fire had a heat release of at least 50% of the baseline burns. Personnel could not approach safely within 6 feet of the containment area. While nearby combustibles might not ignite, sprinklers in a 20 ft high building are likely to activate.

Potential paths forward include investigation of higher flash point liquid scenarios. Other protection options include those identified in Phase I. Use of Listed/Approved IBCs remains an option.