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CONTROLLING THE INCREASED FIRE RISKS OF IBCs

Gone are the days of the 55-gallon metal drum used everywhere to handle flammable and combustible liquids. The storage industry has developed a variety of new, larger portable containers and tanks, known collectively as intermediate bulk containers (IBCs). Handling fluids in IBCs can yield significant cost savings and operating efficiencies. IBCs also pose a significantly greater fire hazard than the classic 55-gallon drum or smaller containers.

The greater quantity of flammable liquid means that a leak in an IBC can result in a fire too hot for traditional fire sprinkler protection systems. An uncontrolled fire involving IBCs is that much more likely to destroy a manufacturing or warehouse facility, resulting in significant property damage and business interruption. Another risk of IBCs is that the nonmetallic varieties may be more prone to failure.

THE ABCs OF IBCs

The National Fire Protection Association (NFPA) Flammable and Combustible Liquids Code (NFPA 30) defines intermediate bulk container (IBC) as any closed vessel intended for storing and transporting liquids with a liquid capacity not exceeding 793 gallons (3,000 liters). IBCs vary in size but are generally between 46 inches to 52 inches in height (between 700 mm and 2,000 mm). They range in fluid capacity from 119 to 793 gallons (450 to 3,000 liters) with more common volumes in the range of 300 to 400 gallons (U.S.).

IBCs are categorized by NFPA 30 under the headings of metallic or nonmetallic (glass, plastic, fiber – any material other than metal). There are various types of IBC containers currently on the market including:

- Steel
- Stainless steel

Rigid Nonmetallic Intermediate Bulk Containers *(Picture courtesy of Chemical Specialties, Inc.)*

- Rigid nonmetallic/composite
- Foldable (collapsible)

Rigid nonmetallic IBCs feature a plastic vessel that serves as the primary liquid-holding component. This vessel can be encased in a steel cage, a single-wall metal or plastic enclosure, or a double wall of foamed or solid plastic. These are often called composite IBCs (the term used by U.S. Department of Transportation (DOT)). The term rigid nonmetallic IBC also denotes an all-plastic single-wall IBC that may or may not have a separate plastic base and for which the containment vessel also serves as the support structure. IBCs that have a liquid-tight outer metal structure are considered metal IBCs or metal portable tanks by DOT.

One of the main areas of concern regarding IBCs is that composite IBC containers will fail quickly in a fire, releasing a large amount of additional fuel.

LISTED CONTAINERS

NFPA 30 requires that nonmetallic or composite IBC containers be listed and labeled when used in *protected* buildings. The listing and labeling requirements are set by UL 2368 (Standard for Fire Exposure Testing of Intermediate Bulk Containers for Flammable and Combustible Liquids). Storage of liquids in non-listed IBC containers is classified by NFPA 30 as *unprotected* storage.

DOT approves nonmetallic or composite IBC containers as Packing Group II containers UN 31H1 and UN 31H2 (rigid plastics) or UN 31HZ1 (composites). Containers must pass physical tests, e.g., pressure tests, drop tests, etc. It should be noted that *explicit fire testing of containers is not performed* for DOT approval.

LIQUID EVALUATION

Flammable liquids, mixtures, emulsions or semi-solids stored in IBCs must have their flash points and/or fire points measured. Classifications per NFPA 30 are:

- Class I (Flammable Liquid) flashpoint below 100°F (37.8°C)
- Class II (Combustible Liquid) flashpoint at or above 100°F (37.8°C) and below 140°F (60°C)
- Class IIIA (Combustible Liquid) flashpoint at or above 140°F (60°C), but below 200°F (93°C)
- Class IIIB (Combustible Liquid) flashpoint at or above 200°F (93°C)

FIRE TESTS

A fire test project was initiated in 1995 by the National Fire Protection Research Foundation (NFPRP) with the aim of improving fire protection associated with the storage of flammable and combustible liquids in non-metallic IBCs. Phases I and II of the project were conducted to develop protection designs for the palletized storage of flammable and combustible liquids.

The object of Phase I was to identify where and in what time period commercially available IBCs would fail when exposed to a hydrocarbon fire. The fire tests were conducted with a 10-gallon heptane spill fire and a 2-gpm heptane running fuel fire. The tests were conducted with a 30-minute fire exposure. The tests showed that non-listed non-metallic IBC units may fail rapidly (in as little as three minutes) when protected by water sprinklers and subjected to a pan fire.

A follow-up effort (Phase II) was initiated to conduct large-scale fire tests representing real-world storage/use scenarios. The objective was to investigate fire control/suppression capabilities of fixed fire suppression systems on an array of IBCs stacked both one and two containers high. The variables investigated included the design of the fire suppression system, the storage configuration array and the type of IBCs in the array.

The results of the Phase II tests suggested that combining fire resistant IBC design with appropriate water sprinkler protection can control a fire in the tested storage array.

Additional fire testing in a Phase III study examined water sprinkler protection criteria contained in NFPA 30 for large metal containers stored in racks. For additional information please refer to the **NFPA website**.

Factory Mutual (FM) reports on tests comparing a wide variety of plastic and composite IBCs. According to their FM Loss Prevention Data Sheet 7-29 (Flammable Liquid Storage in Portable Containers) Section 3.6.5.1, a series of scoping and intermediate scale fire tests looked at the general performance of IBCs when exposed to pool fires and spill fires with the hope of developing a standard test that could be used to evaluate the fire performance of any IBC.

The test results showed significant differences in the fire performance of the tested units, and highlighted the need for additional performance testing to determine which units should be used for flammable liquid storage. FM concluded that additional research is needed to finalize a method for evaluating the fire performance of IBCs. Copies of FM Data Sheet 7-29 and other FM data sheets are now available for download at no charge upon registration with FM. For further information please refer to the **FM Global website**.

PROTECTION

NFPA 30 addresses the requirements for the protection of metal, rigid nonmetallic and composite IBCs stored either palletized and/or in single and/or double row racks. The standard does not allow the *protected* storage of protected Class I flammable liquids (flashpoint below 100°F (37.8°C)) in rigid nonmetallic or composite containers. NFPA 30 contains protection schemes only for the storage of Class II and III combustible liquid materials in *listed* rigid nonmetallic or composite type IBCs.

Factory Mutual (FM) currently provides protection requirements for *metal containers* holding more than 60 gallons (including metal IBCs) palletized or in solid pile storage. FM may soon provide protection requirements for the storage of low flashpoint liquids in metal IBC containers in racks.

Proven protection schemes are not currently available for flammable and combustible liquids stored in nonmetallic IBCs, according to FM. FM states that the recommended protection for flammable liquids in plastic or glass containers greater than 6.5 gallons (25 liters) in Loss Prevention Data Sheet 7-29 will not prevent the consumption of all of the liquid stored in the cutoff room or building. The large quantity of liquid in a single container greatly increases the potential for a large spill fire that could activate all of the sprinklers in the cutoff room or building.

For *unprotected* storage using rigid nonmetallic or composite IBC containers, NFPA 30 poses storage limitations as to the maximum storage height, maximum gallons per pile and maximum total storage quantity. See Table 12.6.2.2 of NFPA 30 (2008).

For *protected palletized* storage of *listed* rigid nonmetallic IBC containers containing Class II and III combustible liquids, NFPA 30 provides sprinkler protection design criteria for both one and two container high storage in Table 16.5.2.9 NFPA 30 (2008).

For *protected single and/or double rack storage of listed* rigid nonmetallic IBC containers containing Class II and III combustible liquids, NFPA 30 provides sprinkler protection design criteria for maximum 25-foot storage in a building with maximum ceiling height of 30 feet. Please refer to Table 16.5.2.10 NFPA 30 (2008).

PROTECTION ALTERNATIVES

Protection alternatives should always be investigated (i.e., possible use of off-site IBC storage facilities, etc.).

- The indoor storage of flammable or combustible liquids in nonmetallic or composite IBCs in plant production or warehouse storage areas should be prohibited.
- Attempt to store IBCs at a supplier location and receive the materials on a just-in-time basis.
- Consider alternatives such as designing and installing a properly protected bulk storage and piping system.
- Consider the use of steel 55-gallon drums or steel IBCs.
- Determine if nonmetallic or composite IBCs are the only method for receiving and storing flammable and combustible liquids in your plant.

- If the storage of nonmetallic or composite IBCs is necessary, they should be stored off-site or in detached, contained storage areas away from the plant or in commercially available flammable or combustible liquids storage structures designed for handling IBCs.

- If the only option is storage of nonmetallic or composite IBCs in the plant, consider minimizing the storage within the key areas of the plant to one IBC tote in widely separated dispensing or end use areas. Provide adequately sized containment areas or high-sided steel containment designed to prevent the sudden release of liquid. IBC totes should be provided with a double block to provide spill protection from potential damage to the dispensing valve.

- Isolate the storage of nonmetallic or composite IBCs from steel drums containing other combustible or flammable liquids.

- If necessary, the interior storage of IBCs should be limited to rooms with minimum two-hour fire resistance-rated construction and equipped as flammable or combustible liquids rooms as outlined in NFPA 30 and FM Data Sheet 7-29. Such rooms typically include adequate spill containment and/or drainage, automatic sprinkler protection and perhaps the use of AFFF foam protection.

ADDITIONAL INFORMATION

For additional information on the storage and handling of flammable and combustible liquids please refer to the following:

- National Fire Protection Association (NFPA) Flammable and Combustible Liquids Code (NFPA 30)

- Factory Mutual Loss Prevention Data Sheet 7-29 (Flammable Liquid Storage in Portable Containers)

COST VS. SAFETY

As previously noted, the handling of liquids in IBCs can yield significant cost savings and operating efficiency; however, the fire hazard posed by such large volumes of flammable and combustible liquids has been determined by fire tests to be more severe than the hazard posed by the storage and handling of traditional 55-gallon drum and/or smaller capacity containers. We recommend that you discuss any proposed plans or existing storage situations for flammable and combustible liquids with a Property Risk Control consultant before reaching a final decision.

CONTACTS

If you would like additional information on this or other risk control topics, contact your local Willis Property Risk Control representative or:

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