



CAMPUS FIRE SAFETY CODE TALK

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Safe Handling of Flammable and Combustible Liquids

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Back in 2011, I presented articles that discussed two means of safely handling flammable and combustible liquids: safety cans and flammable liquids storage cabinets. In those articles, which mostly reflected the provisions of NFPA 30, *Flammable and Combustible Liquids Code*, I discussed the basic features of each and how they contribute to fire safety. In this article, I'd like to talk about some simple, basic procedures that you should keep in mind when handling and using flammable and combustible liquids. We'll focus on small quantity usage, such as in a laboratory or in a maintenance shop. Please note: most of the following discussion is not based on the requirements of NFPA 30, but, rather, on generally accepted good practice. Also, for laboratories, you should refer to NFPA 45, *Standard on Fire Protection for Laboratories Using Chemicals*, for additional guidance.

Handle liquids safely. Flammable or combustible liquids should be kept in sealed containers until needed, either in safety cans or in their tightly-capped original shipping containers. While it is expected that liquids will be handled in open containers — beakers and flasks in the laboratory and small jars or cans in the maintenance shop — this should be done carefully. Mishandling that can lead to a spill and subsequent fire are to be avoided. Shop personnel and laboratory students and instructors should be trained in proper handling techniques. Liquids should not be used in the vicinity of an open flame or sparking equipment.

Moving liquids safely. When liquids are moved from one place to another, for example, from a central storage room to the location where they'll be used, the containers must be capped or closed. Keeping in mind what was stated in the previous section, NEVER transport liquids in open containers through corridors or other areas where people congregate. If several containers are being moved at one time, consider using a wheeled cart. Special two-wheeled hand carts or "drum buggies", like the one shown in the first photo, are available for moving drums. One other point: don't use damaged containers. Plan for this: if a shipping container is damaged or compromised, have the means ready to transfer its contents to a container that is sound.



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Bung vents, self-closing faucets, and drum pumps. If dispensing is done directly from a drum, as shown in the second photo, the drum should be fitted with a bung vent and a self-closing faucet. The bung vent prevents vapors from escaping and the faucet prevents spills by providing immediate and complete closure on release of the handle. The photo illustrates three other safety accessories: the faucet is fitted with a flexible spout, which is inserted into the safety can that is being filled; the safety can itself sits on a spill collection can (to capture any drips); and a bond wire connects the drum to the spill can. This ensures that any static electric charge can be drained to ground. (You might recall the previous articles mentioned that safety cans frequently are provided with a bare metal contact point for attaching a bonding clamp and storage cabinets often have connection points for a ground conductor and for bonding cables.)



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Bonding and grounding. To be effective, bond wires and connections to ground should be secure and firmly attached. It is best to use braided bare conductor, $\frac{1}{4}$ in. in size, either copper, bronze, or stainless steel for bonding and grounding cables. Don't be tempted to use typical insulated solid copper electrical cable. While it is probably immediately at hand, it won't withstand the rigors of the constant flexing to which it will be subjected. Also, a break in the conductor will not be readily apparent. The clamps at the ends of the bond wires and grounding connectors must be suitable for the purpose. They must have sharp, hardened-steel points that can pierce painted or coated surfaces to the bare metal beneath. Typical alligator clips are not considered adequate. See Annex G of the 2014 edition of NFPA 77, *Recommended Practice on Static Electricity*, for diagrams illustrating the types of clamps that are suitable and for examples of bonding and grounding arrangements. NFPA 77 also provides guidance on testing bonding and grounding connections to ensure continuity and to measure electrical resistance.

Ventilation. In the typical laboratory, ventilation hoods provide effective and reliable capture and control of vapors from flammable and combustible liquids, due to the level of attention they receive to ensure



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protection of the person using the hood. In a maintenance shop, general environmental ventilation will likely be sufficient. If there is a dedicated room or area where liquids are dispensed, ventilation should be checked to confirm that it provides at least 1 cfm of exhaust per sq. ft. of floor area ($0.3 \text{ m}^3/\text{min}/\text{m}^2$), with a minimum of 150 cfm ($4 \text{ m}^3/\text{min}$). This level of ventilation provides six air changes per hour, assuming a 10-foot (3 m) ceiling height and this has historically been considered to be adequate. Exhaust air pick-ups should be positioned within 12 in. (300 mm) of the floor. For liquids that have strong, noxious odors or that present a significant toxicity issue, the assistance of an industrial hygienist is warranted.

Spill Control. Inevitably, a spill will happen. Spill kits that contain an absorbent material (Oil-Dri[®] is one brand), a broom, a small shovel, and a container into which the spilled material is collected should be close by the areas where they are likely to be needed. Personal protective gear, such as gloves and face shields or goggles, should also be available.

Incompatible materials. Flammable and combustible liquids should be stored away from materials with which they might not be compatible. This includes acids, alkaline materials, and, particularly, oxidizers. Depending on the quantities present, separation can be as simple as not intermixing these materials on the same shelf. Flammable liquids storage cabinets are one means of keeping liquids separated. Where large quantities are involved, separate storage rooms might be warranted. In any event, pay close attention to the Safety Data Sheet (formerly called an MSDS). It will provide valuable information on incompatibilities.

Summary. Flammable and combustible liquids are used just about everywhere and we tend to forget how easily mishandling them can cause a spill or release that then leads to a fire. By following these recommendations, you will pay them the respect to which they are entitled and avoid an accident.



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