HAZARDOUS CHEMICAL STORAGE DO'S AND DON'TS

By Guy R. Colonna, P.E.

Earlier this year we discussed the diamond-shaped placard with the bright colors and numbers that might appear on campus buildings, storage rooms, or in your chemistry or science lab. So, what's behind the hazard categories depicted by the colors and special hazard designations?

Throughout building and fire codes, facility managers are instructed to consider, as necessary, how to protect those areas within their facility where hazardous chemicals and materials are stored, handled, or used. The NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response,* alerts emergency responders and those working with or proximate to specific materials of the relative hazards from those materials – specifically health, flammability and instability. For purposes of fire and life safety protection, the building and fire codes require a broader view when establishing that a hazard exists with a specific material. Once the hazard classification has been determined, protection strategies can be developed to manage the presence of the hazardous material and ensure safe storage, handling, or use.

Hazardous materials can be either health hazard materials or physical hazard materials. Health hazard materials include those materials classified as toxic, highly toxic, or corrosive. Toxic materials are those characterized by the potential for causing irreversible or lethal effects on exposure. Corrosive materials cause visible destruction of, or irreversible alterations in, living tissues by chemical action at the site of contact; they should not be confused with those materials that are corrosive to other materials, such as metals.

Physical hazards include a much wider spectrum of properties and materials. Typically, physical hazards include flammable and combustible liquids, explosives, flammable gases, flammable solids, cryogenic materials, organic peroxides, oxidizers, pyrophoric materials, unstable (reactive) materials, and water-reactive materials. With the exception of a research lab or chemistry or science lab, it would not commonly be expected that all these hazard types be present in a campus environment. However, some of these physical hazards are very likely to exist routinely on campus. Let's first describe the hazard categories more completely and then provide some examples of specific materials and locations where such materials could exist.

Fire hazard classification of liquids uses the flash point of the material as the basis for determining whether it is a flammable or combustible liquid. This approach applies consistently throughout the building and fire code applications, but is also found in transportation regulations, as similar criteria exist for establishing the fire hazards of liquids. The flash point is the minimum temperature to which a liquid must be heated before it produces vapors that mix with air to the appropriate concentration for ignition. Flammable liquids have flash points that are less than 100 °F (37.8 °C) while combustible liquids have flash points at or above 100 °F (37.8 °C). Diesel fuel and kerosene both have flash points greater than 100 °F (37.8 °C) so they are classified as combustible liquids, while gasoline is a flammable liquid.

A significant consideration with safe storage and handling of liquids is to be conscious of the ambient conditions in which the material will be stored, handled, or used. For example, extra hazards are extended to materials with higher flash points where their use involves conditions of elevated temperatures such that they are used at or near their flash point. Diesel fuel used below its flash point (134 °F (56.7 °C)) poses little risk as long as no external sources of heat are introduced into the environment; but, if the ambient temperature is increased or direct sources of heat are applied, the hazard from the evaporating diesel liquid surface becomes more pronounced and its relative hazard condition changes markedly. For that reason, liquids are often required to be stored in properly designed cabinets that protect the materials from exposure to temperature increases and contact with incompatible materials.

Flammable gases vary in their type and application within a typical campus environment – some common examples include: flammable liquefied gases such as liquefied propane gas (LPG); compressed natural gas (CNG); natural gas for fuel gas purposes (primarily methane); medical gases within a health care facility; oxygen and cylinders of fuel gas for welding and cutting; acetylene; and other specialty gases associated with research activities. If your campus uses alternative fuels (like CNG or hydrogen) for fleet vehicles on campus (maintenance or other utility vehicles or campus shuttle) there could be a refueling station involving bulk storage, while for welding and cutting or some of the medical gas applications portable cylinders might be utilized. The requirements are different depending on the gas, its characteristics, the nature of the source (bulk, container), and typical use scenarios. At the same time, many of these gases, while flammable, might not be detectable if a leak occurs as they are odorless. Typically LPG and natural gas when used as fuel gas contain an odorant injected into the gas stream to ensure it carries a detectable odor. Unlike the liquids that must reach their flash point in order to form a gas or vapor, flammable gases are already at that stage, so upon release once the required concentration is achieved, ignition becomes more likely once a viable source for ignition appears.

Two other categories of physical hazard material should be highlighted here because of their instability or tendency to self-react or promote other energetic reactions. Oxidizers are those materials, solids or liquids, that readily yield oxygen or other oxidizing gas (like chlorine for example), or that react readily to promote or initiate combustion of other combustible materials. The other materials are those that are either unstable (reactive) or water-reactive. Unstable (reactive) materials undergo violent chemical change when exposed to shock, pressure, or temperature. Ethers are known to form unstable ether peroxides from exposure to air or light; formation is accelerated when containers of ethers are opened and partially used and resealed. Ether peroxides are extremely sensitive to light, heat, or friction, and common practice to protect against this hazard is to inspect the chemical stock and remove materials every six months. Other materials react equally violent when exposed to water or moisture. Such reactions include formation and release of flammable, toxic, or other hazardous gases or evolution of sufficient heat to cause self-ignition of adjacent combustible materials. In addition to combustible metals that are recognized as being water reactive, other materials posing risk from instability or water reactivity include chlorinated materials, as reactions with water or moisture can often produce hydrogen chloride.

One other factor to consider comes from those applications where materials of more than one hazard category are stored, handled, or used as the question of incompatibilities (which contributes to unstable behavior) becomes relevant. One possible incompatibility to protect against would be an oxidizer and any combustible materials. Pool treatment chemical ingredients include oxidizer material and reports have documented reactions with combustible liquids (like oils) to produce spontaneous ignition.

So, what are the best practices to follow when dealing with hazardous materials? First, obtain physical and chemical property information (possibly using multiple sources). Generally, this initial step is accomplished using the Material Safety Data Sheet (MSDS). Preparers of the MSDS will include much of the key information that contributes to your ability to determine whether a particular material is a health hazard material or physical hazard material (keep in mind, some materials can be both). Once, the hazard classification process has been completed, determine whether the material will be stored, handled, or used and in what quantities. Fire and building codes and NFPA 400, *Hazardous Materials Code*, characterize the occupancy (storage, residential, mercantile for example) and establish material quantity thresholds according to occupancy type for each category of hazard. If the quantity involved will be below the established threshold, no additional protective measures are required; however, if the threshold is exceeded, then the protective measures apply.

The process begins with completing an inventory of the materials to be in your facility and determining their physical and chemical characteristics. With MSDS and other property information sources, a thorough evaluation can be conducted to determine the hazard category or classification. Keep in mind that some materials meet the criteria for multiple hazard categories. Also, be alert to recycled or waste storage applications; as the materials might no longer match their pure property condition, hazard characterization and classification becomes more complicated. Waste or recycled materials might be found in labs and shops (machine or wood for example). Establish controls that prohibit mixing wastes of incompatible hazard categories – oxidizers with combustible liquids or chlorinated materials with water-based materials. NFPA 400 describes a hazardous materials management plan (HMMP) which includes an inventory statement. Such a plan ensures that where the storage, handling, and use of such materials occur, it can be done safely.

SIEMENS

SIEMENS INTRODUCES ADVANCED SIGNAL ANALYSIS FIRE DETECTION TECHNOLOGY

Steven Kuehn, SIEMENS. BUFFALO GROVE, Illinois. USA - June 16, 2012

Patented Technology Provides Reliable and False-Alarm Resistant Fire Detection for a Wide Range of Applications

Siemens and its legacy companies have long been pioneers in the development of fire detection technology—a tradition that continues to this day with the introduction of ASAtechnology™. ASA stands for Advanced Signal Analysis, a new, patented technology from Siemens Building Technologies Division that provides reliable and false-alarm resistant fire detection for the wide range of applications.

Siemens' ASAtechnology is a software-based solution that in real time, dynamically compares sensor signal data to sophisticated algorithms to accurately and reliably differentiate between a fire emergency and harmless smoke, steam, or dust.

Current fire detection technology development is focused on "smart" (multi-criteria fire detection) techniques to increase value, simplicity and reliability. Siemens multi-criteria fire detectors integrate 5 sensors (including two optical for forward /backward scattering, two thermal and one CO depending on model) in a single detector. Through ASAtechnology Siemens fire detectors quickly process the sensor array's signals to determine alarm or monitoring status. Siemens fire detectors provide for the earliest detection of smoke, heat, and CO in any environment, and offer a no false-alarm guarantee. Additionally Siemens detectors are certified a life-safety CO gas detector meeting NFPA 720 and UL 2075 code and standard respectively, feature 26 user-friendly, selectable detection profiles, 9 field-selectable temperature settings and their high sensitivity meets NFPA 76 Very Early Warning Fire Detector criteria.

ASAtechnology makes use of the concept of signatures, figures of merit that characterize an ongoing fire (or non-fire) event, derived from the real-time evaluation of signal characteristics—such as instantaneous amplitude, slope, short-term variations, etc., and then dynamically adapts the response time and the sensitivity of the detector to provide an accurate, conditions-based alarm in response to the ambient elements of the fire emergency.

Siemens line of multi-criteria detectors managed by ASAtechnology can sense danger more quickly, avoid nuisance alarms and provide valuable information for emergency responders. Combined with newer panels and control systems, the devices can also improve reliability and reduce maintenance costs.
For more information visit: www.usa.siemens.com/ASA4