TerranearPMC Safety Share

Week of June 6, 2016– Health Effects of Fire Extinguishing Materials

I would imagine that when most of us think of fire extinguishers (F/Es), we automatically picture that red cylinder which we can pick up in our hands, tear off the plastic tie that secures the metal pin, and when removed, allows us to squeeze the handle (gently and firmly), causing the release of the fire extinguishing material. And while we typically view F/E's as tools to mitigate a hazardous situation, there is a component to these items that present a health hazard to the user as well as to those involved in the aftermath cleanup assignments.

That fact is, chemicals used to extinguish fires have been associated with various health problems; especially those persons suffering from pre-existing medical conditions and ailments. Therefore, it is important that should you ever use a fire extinguisher, you should be aware of the potential health effects of the chemicals used in these devices.

One of the most effective fire extinguishing agents is halon. This material is a liquefied, compressed gas that stops the spread of fire by chemically disrupting combustion. It has been in use for several decades and is most commonly found in two forms: 1211 (bromochlorodifluoromethane), a liquid streaming agent found in hand-held extinguishers which gasifies under normal atmospheric conditions, and 1301 (bromotrifluoromethane), a gaseous flooding agent which is found in built-in flood systems. Halon is most effective for flammable liquids and electrical fires (rated B:C) and is electrically non-conductive. While the production of Halon ceased on January 1, 1994 under the Clean Air Act, it is still legal to purchase and use recycled Halon and Halon fire extinguishers. In fact, the FAA requires all commercial aircraft to exclusively use halon.

Due to the health and environmental effects of halon, the U.S. Environmental Protection Agency has made a concerted effort to increase the use of fire extinguishers that use carbon dioxide (CO_2), thereby anticipating a decrease of halon fire extinguishing systems. However, even F/Es that contain CO_2 presents serious health risks. Carbon dioxide at 34 percent concentration is lethal as it is a known simple asphyxiate, displacing air (which contains 20.8% oxygen) from the immediate environment. CO_2 levels of 17% can cause unconsciousness, coma and even death (data from the U.S. EPA). Both OSHA and the American Conference of Governmental Industrial Hygienists have established occupational exposure standards (permissible exposure limits and threshold limit values, respectively) and as an 8-hour time-weighted average of 5,000 parts per million (or ½ %). The National Institute for Occupational Safety and Health (NIOSH) has established an airborne CO_2 concentration as an immediately dangerous to life and health (IDLH) for workers at 40,000 ppm (4%).

The health risks for halon extinguishers include asphyxiation, frostbite burns to the skin, as well as skin and eye irritation. Inhaling halon compounds in high concentrations can cause central nervous system disorders including dizziness, unconsciousness and tingling in the arms and legs. Exposure to halon compounds may also cause cardiac sensitization resulting in irregular heartbeats and even heart attacks (in a severe circumstances). This is because when halon is used on fires, it produces such decomposition byproducts as hydrogen chloride, hydrogen bromide and traces of free halogens.

Other agents used in F/E's are dry chemical and dry powder. Today's most widely used type of fire extinguisher is the multipurpose dry chemical that is effective on Class A, B, and C fires. This agent works by interrupting the reaction between atmospheric oxygen and the burning fuel on Class A fires. Dry powder is similar to dry chemical except that they extinguish a fire by physically separating the fuel from the oxygen element as well as removing the heat element of the fire triangle. However, dry powder extinguishers are for Class D or combustible metal fires, only. They are ineffective on all other classes of fires.

The most common material used dry chemical fire extinguishers is ammonium phosphate (with some ammonium sulfate). These agents can cause health effects associated with inhalation and include upper respiratory irritation with such symptoms as coughing or discomfort in the chest. Those with medical conditions such as asthma may experience respiratory difficulty after exposure to dry compounds in fire extinguishers.

While water and carbon dioxide fire extinguishers may offer a "healthier" alternative to chemical and halon extinguishers, such units are rarely found in production facilities and other work settings. As one might expect, persons with a sensitivity to airborne chemicals, pollens, dust, and molds are quite susceptible to an exposure to dry chemical extinguishing materials. Not only are these materials potential health hazards, but they will likely cause damage to electronics and other metal objects that are in the area of the fire extinguisher discharge as it is corrosive.

The dry chemical, ammonium phosphate, can greatly amplify burn injuries caused by the fire for which it is designed to mitigate. Of course, it is better to have a dry chemical extinguisher than nothing; however, you need to understand that you are spraying a very fine, corrosive powder that will get everywhere. It is designed to stick to everything for the purpose of impeding flames. If you do use a dry chemical fire extinguisher, it is recommended to call in a professional disaster/emergency clean-up service provider after the fire. If you decide to perform clean-up activities yourself, make sure that you are wearing protective clothing and are in a well-ventilated space (i.e. keep windows open or use a mechanical ventilation system). This, of course will require the assistance of an S&H professional so the correct PPE can be selected. Such PPE might include chemical-resistant gloves (nitrile, neoprene, etc., depending on the chemical), eye protection (safety glasses, goggles, face shield, etc.), disposable coveralls (chemical resistant), booties as well as adhering to proper decontamination practices. In addition, respiratory protection with appropriate cartridges or an airline system may be necessary. Disposal of clean-up materials is another important consideration. Vacuum filters, bagged surface contamination or residual debris may require proper disposal practices. This can be as simple as using a municipal waste dumpster or other, more formal techniques.

Because sweeping residual materials with a broom can cause a resuspension of the hazardous materials, it is better to use a HEPA vacuum for indoor clean up, thus mitigating chemical dispersion into the air. In addition, water should not be applied to the discharged chemicals as water can make the powder pasty, more corrosive, and harder to clean. After the surfaces (that were sprayed with the fire extinguisher) have been cleaned, give the surfaces a neutralizing wash of vinegar or alcohol (depending on the chemicals) to ensure all surfaces are clean.

Float like a butterfly, sting like a bee. The hands can't hit what the eyes can't see – Mohammed Ali (The Greatest)