TerranearPMC Safety Share

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Week of April 30, 2018 – Fire Extinguishers, Nanotechnology and Chimney Bombs!

I always appreciate when I get a request to write about specific safety topic. A few weeks ago I received a request to discuss how nanotechnology has effected human health, especially for dry chemical fire extinguishers as many manufacturers are using this technology to create very fine particles which can be very effective in extinguishing fires. This request also included if I could write a little something about chimney bombs. Quite frankly, I never heard of chimney bombs so I had to do a little research. I tried my best to tie them together and find some common thread. Fire extinguishers, nanotechnology and chimney bombs! Who woulda thought!

Without a doubt, fire extinguishers (F/Es) are important safety devices. And while they are useful to minimize an incident, prevention is still the main tool we have to protect workers and the public. Therefore, S&H professionals always stress such proactive preventative measures as housekeeping, proper separation of flammables, combustibles and oxidizers as well as removing sources of potential open flames from these materials. However, once a fire does occur, F/E's, when used properly, can reduce damage while saving lives. Nevertheless, these safety devices have some potential dangers associated with them. For example, the dry chemical extinguishant, monoammonium phosphate (or MAP) does pose a potential health risk. MAP is a typical material used in ABC-type fire extinguishers as it can extinguish fires associated with combustibles, flammables and electrical appliances. The fact is, while fire extinguisher chemicals are generally considered to be non-toxic, MAP (and other chemicals), can be very irritating to mucous membranes and eyes and may cause difficulties with breathing if inhaled in large enough quantities. Therefore, once a fire has been extinguished, the residue left by a fire extinguisher needs to be cleaned up ASAP. This may require appropriate gloves (i.e. nitrile), and a properly fitted dust mask and eye protection.

In addition to the typical use of fire extinguishers, another technique that uses fire extinguishing chemicals (including MAP) are "chimney bombs." These devices are zip-lock bags or other small bags filled with dry chemical. Chimney bombs are used by fire service personnel to help extinguish chimney fires. A substance that is commonly associated with chimneys is creosote. Creosote is produced when coal or wood is burned under variable conditions, producing soot and tarry smoke due to incomplete combustion. Historically, creosote has been used as a treatment for components of seagoing and outdoor wood structures to prevent rot such as bridgework and railroad ties. Since creosote is highly combustible, a thick accumulation creates a fire hazard. When a wood stove or fireplace is burning and the air control is left wide open, hot oxygen can be dispersed into the chimney where it comes in contact with the built-up creosote which then ignites—causing a chimney fire. Chimney fires often spread throughout building because the chimney gets so hot that it ignites any combustible material in direct contact with it. The fire can also spread due to sparks emitting from the chimney and landing on combustible roof surfaces.

Obviously, traditional F/Es do not have the capability to reach into chimney flues to control fires (created from the combustion of creosote). And this is where chimney bombs can be an effective fire-fighting tool. Chimney bombs work by being dropped directly down a chimney, where upon contact with the flue bottom and heat of the fire, they explode, thereby releasing the powder. Then, the natural chimney draft will carry the dry chemical powder up the shaft of the chimney, thereby coating the creosote and eventually neutralizes the fire. Use of multiple chimney bombs may be necessary,

depending on how severe the fire is. In order for chimney bombs to be effective, it may be necessary to first unclog the chimney (typically performed by chimney sweeps).

One method to make a chimney bomb is to take a partially used dry chemical extinguishers and spray them into a 5 gallon bucket. The powder is then transferred into a garbage bag (typically a 2-lb bag). The bag is then cut (i.e. size-reduced) so that it is easy to hold. The end is tied-off with a twist tie, and then placed inside another bag. When at the specific location, the garbage bag is dropped into the chimney. A number of fire fighters have admitted to using this technique while reporting positive results.

Recently, with the advent of nanotechnology, many materials (which include fire extinguishing chemicals such as MAP), the hazard due to inhalation of F/E powders has drastically increased as now dry chemical fire extinguishants are being milled with the aid of this state-of-art technology. Nanotechnology is the science of manipulating materials on an atomic or molecular scale where particles are manufactured to such sizes of 1 to 100 nanometers (a nanometer is 1 billionth of a meter). Having fire extinguishing powders fabricated to nano-particles greatly increases their fire-fighting efficiency as they can more easily penetrate materials and create a more effective blanket which can control the critical oxygen component of the fire tetrahedron.

Nanotechnology, now at the leading edge of rapid development within many industries, has been recognized with some apprehension due to its potential human health risks. With these applications, unprecedented avenues of exposure to nanoparticles (NPs) in humans are likely. Since these particles are very small, problems can arise from the inhalation of these minute particles, much like the problem a person gets from inhaling minute asbestos fibers.

Inhaled NPs may evade phagocytosis, cross cell membranes, and redistribute to other sites of the body, causing systemic health effects. Therefore, the unbridled growth and use of nanotechnology in medical and human health evaluations opens society to the possibility that NPs could become the "asbestos" of the 21st century.

This means that the health effects of NPs needs to be addressed. As it turns out, when it comes to the workplace, proper PPE can protect persons who have been assigned to certain tasks where there is a potential inhalation exposure to NPs. HEPA filters or 100-series filters (whether P-100, R-100 or N-100 material) have been tested to filter particulate with sizes of 0.3 micrometers or less (yes, I said "less") with an efficiency of 99.97%. This means that inhalation hazards associated with nanoparticles can be controlled through proper respiratory protection. But what about the general public where OSHA has no jurisdiction? The fact is, this same protection is available to everyone. Maybe a full face elastomeric respirator with filter cartridges (like we see in movies) may not be the most appropriate (due to cost and maintenance), but definitely filtering face pieces – the kind that can purchased at a hardware store – can be used. These units have an alpha-numeric rating, such as N-100. Other units that have N-95 or P-99 may not provide the protection necessary when dealing with nanoparticles. In addition - and very important - even though these units look like "hobby" use, in order to get the proper protection from airborne particulate, the respirator must be properly fit-tested. Without a fit-test, airborne particulate can easily find the path of least resistance. This would be via leaks or open spaces between the respirator and face and therefore, particles could bypass the filtering facepiece and enter the breathing zone (nose/mouth). Also, it is important to be medically qualified. Due to their filtering ability, they can reduce one's breathing capability, placing a greater burden on the respiratory system. Therefore it is critical to have your doctor evaluate your ability to wear a respirator. It is also

important to consult with an industrial hygienist or other respirator subject-matter expert who can provide the necessary assistance to ensure you are wearing the right respiratory protection for your task.

If you cannot do great things, do small things in a great way.
Napoleon Hill