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Hazardous Safeguards

Few sensible individuals would suspect that there might be something harmful contained within the dry powder fire extinguishers relied upon across the nation to protect people and property. When a fire occurs, no one thinks beyond the immediate issues of personal safety and saving the irreplaceable; family, pets and heirlooms. It is advised to prepare for fires around any heat source by purchasing extinguishers kept specifically in that area in preparation for any out-of-control fire. Fire departments keep them on hand for special situations by the gallon and every branch of government, business and most homes in the United States keep them for emergency use. However, the United Kingdom's British Standards now recommends that "...powder extinguishers should generally not be specified for use indoors..." (5.4.3). There are concerns regarding the extinguisher's effect on human health, synergistic health dangers and damage to property. For these reasons, labeling should be required on these products detailing the risks and their use prohibited in occupied structures.

According to the Safety Data Sheets (SDS) or Material Safety Data Sheets (MSDS) published by the manufacturers, Ansul, Amerex, Kidde, and Badger, ABC dry powder extinguishers are mixtures of different fine powder constituents, including Mono-ammonium Phosphate - Chemical Abstracts Service (CAS) number 7722-76-1, Ammonium Phosphate, Calcium Carbonate and Precipitated Synthetic Zeolite (1)(2-3)(3)(1-2). The Ansul, Kidde and Badger ABC extinguisher SDS list the health rating danger as level 1, low (5)(9)(6). Santa Cruz Biotechnology sells the primary (from 55% to 95%) constituent of the ABC extinguishers, Ammonium Phosphate Monobasic, CAS # 7722-76-1 (1)(2-3)(3)(1-2)(1). The Santa Cruz Biotechnology SDS published in 2014 lists the chemical health concern rating as 2, moderate and advises "Use only outdoors or in a well-ventilated area" and warns of "skin irritation", "serious eye irritation" and "May cause... respiratory irritation" and "May cause... drowsiness or dizziness" (1). These effects are especially undesirable if trying to escape a fire and already impaired by smoke. The manufacturer's MSDS for Ansul ABC extinguisher, Foray, advises "Avoid dust formation." and "Keep formation of airborne dusts to a minimum. Do not breathe dust." (2). How the user is to spray the dry powdered product from its pressurized container, often times into the poorly ventilated and enclosed space of a house, without the user and occupants breathing lots of dust is perplexing. It is also important to consider that all of the regulatory levels are set under the assumption of adult worker safety, relating to an eight-hour workday and not the longer and sometimes twenty-four-hour occupation of a home or the frequent breaths of a child or household pet, both closer to the ground. Of further interest is the specific concentration limits on the Kidde ABC Extinguisher SDS of ingredients of unknown toxicity listed as less than 10 percent. (2) 9.99... percent is a significant unknown risk to be introduced into an occupied home.

When a powder extinguisher is used in an interior environment, either a business or a home, it should fully activate, melting in contact with the heat of the fire and any excess should quickly settle before it

can obscure vision or travel beyond where it is needed. The reality is far from this ideal. Red Point Fire Engineers from the United Kingdom state on their website, "discharge of a powder extinguisher in a confined space can cause a sudden reduction in visibility which can temporarily jeopardize escape, rescue or other emergency action." (n. pag.) Additionally, in his paper from the United Kingdom, Dry Powder Extinguishers - not recommended for Indoor Use, John Webb, Senior Scientific Officer, Fire Research Station (retired) states, "The powder must be cleaned up as... it can trigger asthma attacks when disturbed..." " ...it can adversely affect almost every material it is in contact with..." and "...food will be contaminated and have to be thrown away..." (1). Mr. Webb also describes the £250,000 repairs to a British church required after the prank activation of one dry powder fire extinguisher (1). In a technical clean-up bulletin published by the extinguisher manufacturer Ansul, it is clearly admitted "...chemical makeup and small particle size...help dry chemical find its way in and around nearly everything in the vicinity of the discharge." (1). Dr. Paul Baron of the Centers for Disease Control and Prevention, notes, "Particles setting in turbulent air will have an exponential decay rate..." (14). Air conditioning, ceiling fans, opening and closing doors and human movement are all a part of normal behavior in an occupied house and make the complete removal of these finely milled and irritating particles very difficult. The Ansul technical bulletin's extensive clean up protocol for ABC powder extinguishers is an indicator of this difficulty and recommends, "Sweep or vacuum settled residue...", "...spray the area with 50% isopropyl alcohol and 50% warm water...", "Let stand...", "...rinse with warm water...", "...spray or wash... with... hot water and baking soda..." , "Let stand...", "...rinse with warm water...", "Wash... with a mild soap and water solution...", "...rinse...", "Blow dry...", "If any electrical contacts have been affected...use an approved electrical contact cleaner." (1-2). The performance of this protocol is formidable for an entire modern house with many lights, appliances, electrical outlets, switches, computers and an HVAC system that is often running when the extinguisher is used. These are only the most direct effects.

Anyone who has bought a home has probably had a radon gas test performed before the final purchase. While radon is a problem, the reason for its danger is not clearly laid out to the public. Testing, results and regulatory level nomenclature are unclear and misleading. The most significant danger stems less from the radioactive gas itself, than from its breakdown products. As stated in the toxicological profile of Radon published by the Agency for Toxic Substances and Disease Registry:

As radon and its progeny decay, they cumulatively emit alpha and beta particles as well as gamma- and x-rays. The health hazard from radon does not come primarily from radon itself, but rather from its radioactive progeny (see Chapter 4 for more information on the chemical and physical properties of radon). When an atom of radium transforms to radon, the alpha particle it emits slows down by the attraction of nearby electrons until it captures two electrons and becomes a stable atom of helium (He). The transformed radon and subsequent decay product atoms are charged and tend to attach to aerosol particles. Radon progeny are similarly charged, readily aggregate, form clusters, and attach to dust particles in air. The main health problems arise when primarily those radon progeny that are attached to dust particles (termed the attached fraction) are inhaled, deposit in the airway (particularly the tracheobronchial tree), and irradiate nearby cells repetitively with alpha particles as each atom transforms through the decay chain. These alpha particles can deliver a large localized radiation dose.

The attached fraction is much higher in homes with smokers relative to those with nonsmokers, and in dusty mines relative to those that are well ventilated. (16)

The airborne material from a powder extinguisher can cause problems of its own, but when combined with a house with any radon level, even far below regulatory action levels, the synergism created between the two can create an environment that is a greater health risk than the conditions used to determine safety levels. The SDS provided by Amerex for their ABC extinguisher does not disclose the particular type, but does list synthetic zeolite as a constituent of the extinguisher (2). A study by J.S. Paschalides, G.S. Marinakis and N.P. Petropoulos, shows synthetic zeolite 5A to be so absorptive of radon that the authors propose its use as radon test media (xii). More radiation carried per particle in an environment where extinguisher residue is present potentially creates a greater risk than normal dust carriers.

There are further complications when powder extinguisher residues are not able to be removed completely. In 2012, the large aeronautical company Boeing issued a service letter with the subject, "Avoid Use of Dry Chemical Fire Extinguishers On Airplanes", advising, "Dry chemical extinguishers can cause extensive corrosion damage to airplane structure, electrical systems, and electronic equipment. Dry chemical extinguisher residue is difficult to clean up." (1). Additionally, the report Measuring the Impact of Fire Extinguisher Agents On Cultural Resource Materials, by Hughes Associates, Inc., a fire protection engineering firm, relates how the Smithsonian Institution had a similar issue resulting in a total loss of their exhibit, "The persistence of dry powder was emphasized in loss experience at the Smithsonian Institution.... The... object involved was declared a total loss, reportedly because conservators could not begin to remove all of the powder." (28). J. Andrew Wilson, assistant director of Fire Protection and Safety, Smithsonian Institution, states in his article Fire Protection in Cultural Institutions, "Generally speaking, only gas based or water based automatic fire suppression systems are suitable for protecting cultural properties." (n. pag.). These serious and expensive issues effecting public safety and irreplaceable collections are a problem but consider the effect on a homeowner or other direct user. A bulletin distributed throughout a corporation or institute and easily obtained legal representation helps protect large entities, but the average person has no such messaging system or resources. If not informed by the product manufacturer or the regulatory agencies, average users are at the mercy of their ignorance and faithful assumption that if there were a serious problem, the product would be removed from public access and the market.

A bulletin in the Georgian National Academy of Sciences, by Gurchumelia, et al., promotes dry powder extinguishers as "non-halogen, eco-safe and inexpensive." (69). While Gurchumelia, et al. go into depth regarding the best size and type particle of material used in extinguishers to prevent caking and effectively extinguish fires, human safety is not addressed (65-70). The claim by Gurchumelia, et al. of eco-safety seems to be based solely on the fact that the extinguishing material is not Halon based (65). Likewise, the manufacturers Ansul and Amerex promote on their respective websites the extinguishing capacity, durability and convenience of their ABC dry powder products and Ansul recommends them for use in "...electrical equipment rooms, machining operations, material handling vehicles, banks, offices, schools, hotels..." yet subtly, neither manufacturer makes claims to safety either for humans or possessions in their advertising (n.pag.)(n.pag.). There are some reports that the efficacy of powder

extinguishers on certain types of fires is less than ideal, for instance as stated by Mr. Webb, "...they (powder extinguishers) have a particular limitation in that unlike foam extinguishers they do not form a protective coat over the liquid once the fire is extinguished, so that reignition can easily occur." (1). While the actual effectiveness of powder extinguishers is somewhat debatable, human health concerns and poor visibility in an emergency shadow the rosy picture drawn by their proponents. Water extinguishers are not a health or visibility concern and damage is localized and verifiable. Co2 is very similar to water in that it is localized and not a persistent issue after use. The contents of one's home, from irreplaceable heirlooms, expensive electronics to loved ones are the very things we are trying to protect with a fire extinguisher. To have them all endangered to one extent or another by the very product hoped to save them is unacceptable and nonsensical.

While at first, the characteristics of powder extinguishers seem to make them a valuable part of a fire fighting protocol, the drawbacks regarding health, cleanup and damage make them an unlikely choice for anyone informed of these attributes. Further, there is no clear public notice of these problems that would inform the user. Even when someone knows of the potential problems and decides to use a powder extinguisher, the likely involvement of other people who may be especially vulnerable to respiratory distress and later health issues, such as children, the aged or those with existing health problems, makes the choice inappropriate and dangerous. Because of damage and health questions regarding powder extinguishers, withdrawal from the market for indoor use and clear labeling on the product if marketed for other uses should be required in the United States.

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