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Metal Fires – Why Water isn't Always the Best Extinguishing Agent

On December 29th, 2009, St. Anna, Wisconsin firefighters responded to a call regarding a **trash bin fire at Bremer Manufacturing Co.** in New Holstein.

The first firefighters that arrived witnessed flames coming from the dumpster. They attacked the fire with water and fire suppressant foam, spraying into the bin. As they continued to apply water and foam, they approached the dumpster, unaware in the moment that the water and foam were about to create a violent chemical reaction with the dumpster contents. The dumpster exploded and 33-year old firefighter, Steven Koeser, was killed. Eight others were wounded.

The dumpster had reportedly been full of metal shavings, an important detail provided by the dispatch operator when the call was made. An official statement was later made that the bin contained aluminum alloy shavings and 55-gallon steel barrels of aluminum dross.

In many fire scenarios, water is appropriate to use to fight a fire. Cheap and often plentiful, fire departments and individuals alike often think to use water first when they witness a fire. However, a metal fire is one example of a situation when the use of water can prove ineffective, and even deadly.

Almost all metals burn, given a suitable environment. Metals typically burn at extremely high temperatures, and alkali metals, such as lithium, sodium, potassium, rubidium, and cesium, are particularly reactive with water. When water is applied to an alkali metal fire, the heated water particles can separate into hydrogen and hydroxide. The hydrogen acts as an accelerant (increasing the rate of combustion) and can cause an explosion.

Unlike alkali metals, larger pieces of metals such as aluminum, magnesium, titanium, zirconium or hafnium, can be very difficult to ignite under ordinary conditions, and if ignited can usually be successfully extinguished with water. Such fires may also self-extinguish if the heat source is removed. These same metals are more easily ignited and burn more readily as the piece size reduces. In fine granular or powder form, such as might be produced as a by-product of certain manufacturing processes, these metals are known to readily ignite, and can cause explosions if dispersed in the air.

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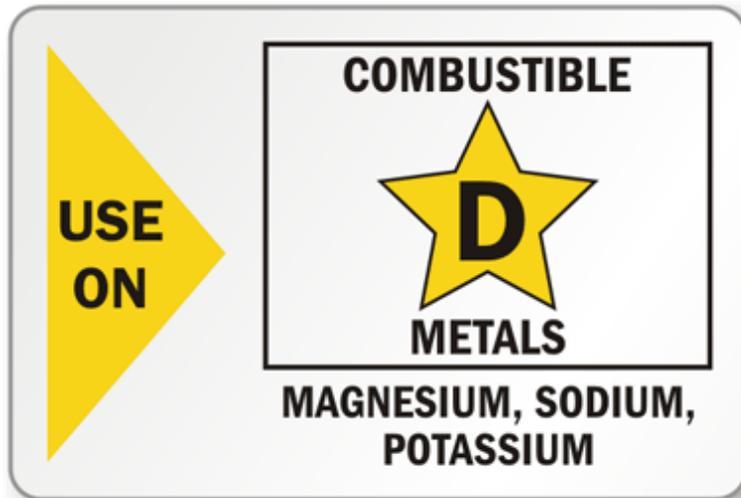
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What are the best strategies for suppressing metal fires? First, let's look at extinguishing agents that should not be used. **NFPA 484 6.3.3.5(1)** specifically states that water shall not be used as an extinguishing agent on combustible-metal fires unless they are compatible with the metal because of adverse reactions and ineffectiveness. Water-based foams are not recommended because they contain water. Carbon dioxide is not recommended because it can act as a catalyst and worsen a fire under certain conditions (see **NFPA's Fire Protection Handbook** 6-158 – 6-161).



Perhaps the best strategy is to provide portable fire extinguishers that listed or approved for use on Class D fire hazards, within easy reach of the hazard. Combustible metals, by definition, are Class D hazards. Care must be

taken to select the Class D extinguisher most suited to the specific combustible metal hazard under consideration. For example, some Class D fire extinguishers utilize a proprietary blend of chemical powders, including sodium chloride, that have been proven to be effective for fires involving magnesium, sodium, and sodium/potassium alloys. Other Class D fire extinguishers utilize a powder blend that contains copper, which has been proven to be effective on for fires involving lithium.

Other points to contemplate include:

- Are conditions present that could give rise to a metal dust explosion?
- Is the local fire department aware of the combustible metal fire or explosion hazards in your facility?
- Are the employees in your facility trained to properly respond in case of a combustible metal fire or explosion incident?

With these questions in mind, you may want to contact a professional who can advise on training to protect your fellow employees, and the best way to protect your assets. The most current edition of **NFPA 484, *Standard for Combustible Metals***, should also be understood and followed.

As an individual, if you are witness to a combustible metal fire, call 9-1-1, or follow your employer's written emergency notification and response procedure.

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