

USE OF WATER ON COMBUSTIBLE METALS

Water

When burning combustible metals are attacked with limited amounts of water, the hot metal extracts oxygen from the water and promotes combustion. At the same time, hydrogen is released in a free state and ignites readily. Since small amounts of water may accelerate combustible metal fires (particularly where chips or other fines are involved), use of water is not recommended except to control fires in adjacent Class A materials.

Water is a good coolant and large amounts can be used on some combustible metals under proper conditions to reduce the temperature of the burning metal below its ignition temperature. The following paragraphs discuss the advantages and limitations of using water on fires involving various combustible metals.

Water on Sodium, Potassium, Lithium, Barium, Calcium, and Strontium Fires: Water applied to sodium, potassium, lithium, sodium-potassium alloys (NaK), barium, and probably calcium and strontium will induce chemical reactions that will lead to fire or explosion even at room temperature. Therefore, water must not be used on fires involving these metals.

Water on Magnesium Fires: Although water in small quantities accelerates magnesium fires, rapid application of large amounts of water is effective in extinguishing magnesium fires because of the cooling effect of water. Automatic sprinklers will extinguish a typical shop fire where the quantity of magnesium is limited. Water should not be used on any fire involving a large number of magnesium chips when it is doubtful that there is sufficient water to handle the large area (a few burning chips can be extinguished by dropping them into a bucket of water). Small streams from portable extinguishers will violently accelerate a magnesium chip fire.

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Burning magnesium parts such as castings and fabricated structures can be cooled and extinguished with coarse streams of water applied with standard fire hoses. A straight stream scatters the fire, but coarse drops (produced by a fixed nozzle operating at a distance or by use of an adjustable nozzle) flow over and cool the unburned metal. Some temporary acceleration normally takes place with this procedure, but rapid extinguishment follows if the technique is pursued. Well advanced fires in several hundred pounds (100 lbs equals 45 kg) of magnesium scrap have been extinguished in less than 1 minute with two, 1 1/2 in. fire hoses. Water fog, on the other hand, tends to accelerate rather than cool such a fire. Application of water to magnesium fires must be avoided where quantities of molten metal are likely to be present; the steam formation and possible metal-water reactions may be explosive.

Water on Zirconium Fires: Powdered zirconium wet with water is more difficult to ignite than the dry powder. However, once ignition takes place, wet powder containing about five to ten percent water is considered to be the most dangerous. Small volumes of water should not be applied to burning zirconium, but large volumes of water can be successfully used to completely cover solid chunks or large chips of burning zirconium (e.g., by drowning the metal in a tank or barrel of water). Hose streams applied directly to burning zirconium chips may yield violent reactions.

Water on Plutonium, Uranium, and Thorium Fires: Limited amounts of water add to the intensity of a fire in natural uranium or thorium, and greatly increase the contamination cleanup required after the fire. A natural uranium scrap fire can be fought with water by personnel (wearing face shields and gloves and using long-handled shovels) shoveling the burning scrap into a drum of water in the open. The hydrogen formed may ignite and burn off above the top of the drum. The radioactivity hazard of natural uranium is extremely low (in reality, uranium is a metal poison, although considerably less toxic than lead). The use of water on enriched uranium or plutonium (fissionable materials) is generally prohibited.

Water on Titanium Fires: Water must not be used on fires in titanium mines and should be used with caution on other titanium fires. Small amounts of burning titanium (other than fines) can be extinguished and considerable salvage accomplished by quickly dumping the burning material into a large volume of water to completely submerge it. Hose streams have been used effectively on fires in outside piles of scrap, but violent reactions have been reported in other cases where water was applied to hot or burning titanium, resulting in serious injury to personnel.