

## Minerals Use in Safety Applications in the Workplace

Many of the applications described below are found in and around the U.S. Geological Survey workplaces.



Aluminum trihydrate is used as a flame retardant filler in carpet backing.

**Aluminum**—Aluminum trihydrate (aluminum hydroxide) is used as a flame retardant filler in products, such as rubber, cable insulation, and carpet backing. When heated by a flame, the aluminum trihydrate decomposes to release water (as steam), which displaces oxygen, slowing the spread of the flame.

**Antimony**—Antimony is used in flame retardants. Flame retardant chemicals are solutions that are applied to a wide variety of items such as seat coverings, to reduce the damage done by an incipient flame.

**Arsenic, gallium, and silicon**—Arsenic, gallium, and silicon compound semiconductors are used in emergency communications equipment, including computers and cell phones, as well as in gallium-based solar cells that power outdoor emergency phones.

Cell phones use semiconductors, one of the important applications for arsenic, gallium, and silicon.



**Bentonite and fuller's earth**—Bentonite and fuller's earth are used as oil and grease absorbents on floors in building maintenance shops to enhance worker safety.

**Beryllium**—Beryllium is used in a beryllium oxide ceramic in high-thermal-conductivity and electrical insulation components in portable defibrillator machines.

**Bismuth, indium, and tin**—Bismuth, indium, and tin or their alloys are used in the plugs in sprinkler systems that are built into ceilings to extinguish fires. These metals have low melting points, and when they are alloyed with each other or with other low-melting-point metals (such as lead), their melting point drops even further. In the event of a fire, the “plug” melts rapidly and releases the fire-quenching liquid inside.



Sprinkler systems use bismuth, indium, and tin to trigger discharge of water to suppress fires.

**Boron**—Borax (the natural form of boron) is used in cleaning compounds in many laboratories.

**Cadmium**—Cadmium is used in nickel-cadmium industrial batteries that provide power to emergency lighting fixtures and backup power to medical equipment.



Cement and construction gravel are used in jersey barriers.

**Cement and construction gravel**—Cement and construction gravel are used in concrete in the jersey walls in the parking lots around the perimeter of buildings.

**Chromium**—Lead chromate (chrome yellow) is the yellow pigment in paint used on road dividing lines. Chromium is also used in stainless steel handrails, doors, bus shelters, security barriers, fences, and equipment.

Chromium provides the brilliant yellow in pigments used in making paints marking road dividing lines.



**Copper**—Copper wiring provides power for emergency lighting systems and power and signal transmission for emergency alarms connected to fire and smoke detectors. Brass valves and electronic controls provide automatic shutoffs to fire sprinkler systems. Copper tubes deliver a safe, potable water supply.

**Diatomite**—Diatomite is used to filter water, particularly in the treatment of drinking water.

**Gold and silver**—Gold and silver are used in emergency electronic equipment as electrical contacts.

**Gypsum**—Gypsum is used as a passive fire-resistance material for drywall. In its natural state, gypsum contains water, in the form of hydrates deposited in the structure of the material during crystallization. When exposed to heat or fire, this water is vaporized, slowing heat transfer. Therefore, a fire in one room that is separated from an adjacent room by fire-resistance-rated drywall will not cause this adjacent room to get any warmer than the boiling point of water (100°C) until the water in the gypsum is gone.

**Iodine**—Iodine is used as an antibacterial agent in soaps and cleaning products in restrooms, in iodized salt to prevent goiter, and in first aid treatment as an antiseptic.



Copper wiring provides a reliable conduit to power emergency lighting systems.

Iodine imparts antibacterial properties to soap used in restrooms.



Iron and steel used in guard posts provides a strong barrier.

**Iron and steel**—Steel is used to make handrails and galvanized vehicle guard rails, guard posts, stairway guard rails, and boom gates that serve as vehicle barriers.

**Kaolin and talc**—These materials, as well as bentonite, are used as a binder, carrier, or dilutant in some medications. Kaolin is also used in the manufacture of fiberglass found in high-temperature aprons, gloves, and suits.

**Lead**—Lead-acid standby batteries provide emergency backup power for computer servers, computer network devices, and telecommunications systems in the event of a power failure.

**Lithium**—Batteries made from lithium metal or lithium carbonate are used in smoke alarms, pacemakers, defibrillators, and many other types of portable medical equipment, and in emergency communications equipment, including computers and cell phones.



Lithium ion rechargeable batteries have been used increasingly in electronic devices.

**Magnesium**—Magnesium chloride salt is used in deicing sidewalks and roads.

**Manganese**—Manganese is used in batteries to power emergency electronic and communications equipment.

**Mercury**—Mercury is used in emergency (and nonemergency) fluorescent lighting.

**Mica**—Mica is used in chemical fire extinguishers because it is fireproof, infusible, incombustible, and nonflammable. Dry ground mica is used in dry chemical fire extinguishers to keep the fire-retarding material free flowing.



Mica is a fireproof, nonflammable mineral used in fire extinguishers.

**Molybdenum**—Molybdenum grease is a high-load-bearing, waterproof grease used in elevator safety brake shoes. Molybdenum is also used in stainless steel handrails, doors, bus shelters, security barriers, and fences.

**Nickel**—Nickel is used in nickel-cadmium industrial batteries that provide power to emergency lighting fixtures and backup power to medical equipment and may be used in stainless steel handrails, doors, bus shelters, security barriers, and fences.



Perlite used in ceiling tiles dampens noise.

**Perlite**—Perlite used in acoustical ceiling tiles improves the work environment by damping noise in the office, which helps protect employee hearing.

**Pumice**—Pumice is often used as a natural material to clean oil spills.

**Salt**—Salt (NaCl) is used in deicing sidewalks and roads. It is also used in saline solution for irrigating wounds.

**Sand, industrial**—The sand in cigarette receptacles or urns is industrial sand. Sand is also used to make glass (which can be tempered for safety), in reflectors, or as glass beads in reflective stripes on roads.

**Soda ash**—Soda ash is used to make sodium bicarbonate (baking soda) used in fire extinguishers. In the event of a chemical spill from one of the laboratories, it could be used to neutralize acid spills or other chemical leakage.



Stone can be used as a functional and aesthetic barrier.

**Stone, crushed**—Large rocks used as security barriers around buildings are a form of riprap used in construction and landscaping.

**Strontium**—Photoluminescent exit signs use a class of newly developed phosphorescent pigments that are based on strontium oxide aluminate chemistry.



Strontium is used in photoluminescent exit signs.



**Tantalum**—Tantalum is used in capacitors to provide backup power in emergency communications equipment.

**Tungsten**—Tungsten filaments and electrodes are used in emergency (and nonemergency) lighting.

Tungsten has extensive use in light bulb filaments.

**Wollastonite**—Wollastonite is used in fire-resistant board found in laboratories, electrical rooms, and anywhere that it can be used in place of asbestos. It is also used in the brakes of cars and trucks.

**Zinc**—Zinc is used in outdoor signage, indoor exit signs (if phosphorescent), and guard rails to prevent corrosion and deterioration. Tritium exit signs are coated with phosphor (ZnS) and filled with tritium ( $^3\text{H}$ ) gas. As the gas decays into helium, it produces low-energy beta particles, which strike the phosphor and cause it to luminesce.



Zinc used in outdoor signs prevents corrosion and deterioration.

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