

Spotlight on Sulfuric Acid

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Several thousand different chemicals are used in chemical laboratories and process operations throughout the DOE complex. One of the most common, especially in DOE laboratories, is sulfuric acid. This article spotlights sulfuric acid as a hazardous chemical whose storage and use must be carefully controlled in order to protect worker safety.

Sulfuric acid is a dense, odorless, oily liquid that is clear to brownish in color. It is a strong irritant to all tissues, such that exposure to the skin or eyes can cause severe burns.

Although it is not combustible, sulfuric acid is a strong dehydrating agent that may ignite finely divided combustible materials. It also reacts with carbides, chlorates, nitrates, and powdered metals. It reacts vigorously with water, to evolve heat. And it can dissolve most metals.

Sulfuric acid is usually shipped in glass bottles or carboys, special drums, tank trucks, railroad tank cars, or tank barges. It should be stored in a cool, dry, well-ventilated location, separate from carbides, chlorates, and nitrates, from combustibles, and from powdered metals and other reactive materials.

At DOE facilities, sulfuric acid is usually purchased, stored, and used in aqueous solution. Because it has a low vapor pressure, spills of sulfuric acid form slowly evaporating pools and present a significant airborne hazard only if a spray or an aerosol is present. However, spills of sulfuric acid should be contained and kept away from water contact. Also, because sulfuric acid is extremely water reactive, small fires involving sulfuric acid should be extinguished with appropriate chemical extinguishers, not water.

Hazard Profile for Sulfuric Acid

Chemical	Description	Hazards	OSHA PSM/ EPA RMP Threshold Quantities	Exposure Limits ACGIH/ NIOSH/OSHA (mg/m ³)	ERPG-1/ ERPG-2/ ERPG-3	Properties	Incompatibilities and Reactivities	NFPA Rating N _h , N _r , N _x
Sulfuric Acid (H ₂ SO ₄) Synonyms: battery acid, electrolyte acid, hydrogen sulfate, oil of vitriol, chamber acid (CAS 7664-93-9)	Dense, oily odorless, liquid, clear to dark brown in color, depending on purity Pure hydrogen sulfate is a solid below 10°C (51°F).	Strong irritant to tissue. Causes severe eye and skin burns. Strongly corrosive. Noncombustible, but capable of igniting finely divided combustible materials. ACGIH: Suspected human carcinogen.	OSHA: none EPA: none	ACGIH: TWA 1 mg/m ³ ACGIH: STEL 3 mg/m ³ NIOSH: TWA 1 mg/m ³ OSHA: TWA 1 mg/m ³	2 mg/m ³ / 10 mg/m ³ / 30 mg/m ³	Boiling point varies 315-338°C (599-640°F), due to evolution of sulfur trioxide. Freezing/melting point = 10°C (51°F). Soluble in water.	Incompatible with organic materials, chlorates, nitrates, carbides, and powdered metals. Very reactive. Reacts violently with water, with evolution of heat. Reacts with metals, with release of hydrogen gas. Reacts with alkalies to release heat.	3, 0, 2

References

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Acronyms and Abbreviations

ACGIH -	American Conference of Governmental Industrial Hygienists
AIHA -	American Industrial Hygiene Association
°C -	degrees centigrade (Celsius)
CAS -	Chemical Abstracts Service (registry number)
CFR -	Code of Federal Regulations
EPA -	Environmental Protection Agency
ERPG -	Emergency Response Planning Guideline (AIHA), chemical concentration in air designed to assist in the development of emergency response strategies
ERPG-1 -	The maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to 1 hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor.
ERPG-2 -	The maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action.
ERPG-3 -	The maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects.
°F -	degrees Fahrenheit
mg/m ³ -	milligrams per cubic meter
NFPA -	National Fire Protection Association
N _h -	NFPA 704, hazard rating for health
N _f -	NFPA 704, hazard rating for fire
N _r -	NFPA 704, hazard rating for reactivity
NIOSH -	National Institute of Occupational Safety and Health
OSHA -	Occupational Safety and Health Administration
PEL -	Permissible exposure limit (OSHA), a time-weighted average (TWA) chemical concentration in air that must not be exceeded during any 8-hour work shift of a 40-hour workweek
PSM -	Process safety management (OSHA), regulation that contains requirements for management of hazards associated with processes using highly hazardous chemicals to prevent or minimize the consequences of chemical accidents, promulgated as 29 CFR 1910.119, "Process Safety Management of Highly Hazardous Chemicals"
REL -	Recommended exposure limit (NIOSH), a time-weighted average (TWA) chemical concentration in air for up to a 10-hour workday during a 40-hour workweek
RMP -	Risk management program, (EPA), regulation to prevent accidental releases of regulated substances and reduce the severity of releases that occur, promulgated as 40 CFR Part 68, "Accidental Release Prevention Requirements: Risk Management Programs Under the Clean Air Act, Section 112(r)(7)"
STEL -	Short-term exposure limit (NIOSH/OSHA), a 15-minute TWA chemical exposure concentration in air that should not be exceeded at any time during a workday
TLV -	Threshold limit value (ACGIH), occupational exposure limit recommended by the ACGIH
TWA -	Time-weighted average, the most frequently used exposure guideline term, representing the average concentration over a workday