

Sulphuric acid

Incident management

Key Points

Fire

- Non flammable under normal conditions
- Highly reactive
- Releases toxic and irritating fumes of oxides of sulphur when heated to decomposition
- Do not use water on fuming acid (anhydrous)
- In the event of a fire involving sulphuric acid, use fine water spray and liquid-tight protective clothing with breathing apparatus
- Gas-tight protective suits with breathing apparatus required for fuming acid

Health


- Exposure may occur following ingestion, inhalation, skin or ocular exposure
- Corrosive
- Inhalation causes irritation of the eyes and nose with sore throat, cough, chest tightness, headache, tachycardia and confusion
- Ingestion causes immediate burning of the mouth and throat, drooling, difficulty swallowing, abdominal pain, vomiting and haematemesis. Haemorrhagic or hypovolaemic shock and airway obstruction from laryngeal and/or epiglottic oedema are features of severe cases.
- Dermal exposure causes coagulation burns
- Ocular exposure causes pain, blepharospasm, lacrimation, conjunctivitis, palpebral oedema and photophobia.


Environment

- Avoid release into the environment
- Inform Environment Agency of substantial release incidents

Hazard Identification

Standard (UK) Dangerous Goods Emergency Action Codes^(a)

UN		1830	Sulphuric acid with more than 51% acid	
EAC		2P	Use fine water spray. Wear liquid-tight chemical protective clothing in combination with breathing apparatus*. Spillages and decontamination run-off may be washed to drains with large quantities of water. Substance can be violently or explosively reactive.	
APP		-		
Hazards	Class	8	Corrosive substance	
	Sub risks	-		
HIN		80	Corrosive or slightly corrosive material	



UN		1832	Sulphuric acid, spent	
EAC		2W	Use fine water spray. Wear liquid-tight chemical protective clothing in combination with breathing apparatus*. Spillages and decontamination run-off should be prevented from entering drains and watercourses. Substance can be violently or explosively reactive.	
APP		-		
Hazards	Class	8	Corrosive substance	
	Sub risks	-		
HIN		80	Corrosive or slightly corrosive material	


UN – United Nations number; EAC – Emergency Action Code; APP – Additional Personal Protection; HIN - Hazard Identification Number

^a Dangerous Goods Emergency Action Code List, HM Fire Service Inspectorate, Publications Section, The Stationery Office, 2009.

SULPHURIC ACID – INCIDENT MANAGEMENT

Standard (UK) Dangerous Goods Emergency Action Codes^(a)

UN		1831	Sulphuric acid, fuming	
EAC		4WE	Use dry agent. Wear liquid-tight chemical protective clothing in combination with breathing apparatus*. Spillages and decontamination run-off should be prevented from entering drains and watercourses. Substance can be violently or explosively reactive. There may be a public safety hazard outside the immediate area of the incident**.	
APP		B	Gas-tight chemical protective suit in combination with breathing apparatus***.	
Hazards	Class	8	Corrosive substance	
	Sub risks	6.1	Toxic substance	
HIN		X886	Highly corrosive substance, toxic which reacts dangerously with water	

UN		2796	Sulphuric acid with not more than 51% acid	
EAC		2R	Use fine water spray. Wear liquid-tight chemical protective clothing in combination with breathing apparatus. Spillages and decontamination run-off may be washed to drains with large quantities of water.	
APP		-		
Hazards	Class	8	Corrosive substance	
	Sub risks	-		
HIN		80	Corrosive or slightly corrosive material	

UN – United Nations number; EAC – Emergency Action Code; APP – Additional Personal Protection; HIN - Hazard Identification Number

* Liquid-tight chemical protective clothing (BS 8428) in combination with self-contained open circuit positive pressure compressed air breathing apparatus (BS EN 137).


^a Dangerous Goods Emergency Action Code List, HM Fire Service Inspectorate, Publications Section, The Stationery Office, 2009.

** People should stay indoors with windows and doors closed, ignition sources should be eliminated and ventilation stopped. Non-essential personnel should move at least 250 m away from the incident.

***Gas-tight chemical protective clothing (BS EN 943 part 2) in combination with self-contained open circuit positive pressure compressed air breathing apparatus (BS EN 137).

Chemical Hazard Information and Packaging for Supply Classification^(a)

Sulphuric acid ...%

Classification	C	Corrosive	
Risk phrases	R35	Causes severe burns	
Safety phrases	S(1/2)	Keep locked up and out of the reach of children	
	S26	In case of contact with eyes rinse immediately with plenty of water and seek medical advice	
	S30	Never add water to this product	
	S45	In case of accident or if you fell unwell, seek medical advice immediately (show label where possible)	

Specific concentration limits


Concentration	Classification
C ≥ 15 %	C; R35
5 % ≤ C < 15 %	Xi; R36/38

^a Annex VI to Regulation (EC) No 1272/2008 on Classification, Labelling and Packaging of Substances and Mixtures- Table 3.2.

<http://esis.jrc.ec.europa.eu/index.php?PGM=cla> (accessed 11/2011)

Globally Harmonised System of Classification and Labelling of Chemicals (GHS)^(a)

Sulphuric acid

Hazard Class and Category	Skin Corr. 1A	Skin corrosion, category 1A	
Hazard Statement	H314	Causes severe skin burns and eye damage	
Signal Words	DANGER		

Implemented in the EU on 20 January 2009.

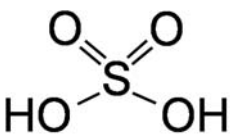
Specific concentration limits

Concentration	Hazard Class and Category	Hazard Statement	
$C \geq 15 \%$	Skin Corr. 1A	H314	Causes severe skin burns and eye damage
$5 \% \leq C < 15 \%$	Skin Irrit. 2;	H315	Causes skin irritation
$5 \% \leq C < 15 \%$	Eye Irrit. 2;	H319	Causes serious eye irritation

^a Annex VI to Regulation (EC) No 1272/2008 on Classification, Labelling and Packaging of Substances and Mixtures- Table 3.1.

<http://esis.jrc.ec.europa.eu/index.php?PGM=cla> (accessed 11/2011)

Physicochemical Properties

CAS number	7664-93-9
Molecular weight	98
Empirical formula	H ₂ SO ₄
Common synonyms	Sulfuric acid
State at room temperature	Liquid
Volatility	Non-volatile at 25 °C
Specific gravity	1.8 at 25 °C (water = 1)
Flammability	Non flammable, but may ignite other flammable materials
Lower explosive limit	Data not available
Upper explosive limit	Data not available
Water solubility	Miscible with water
Reactivity	Highly reactive. Anhydrous sulphuric acid reacts violently with water and organic materials. Concentrated sulphuric acid will oxidize, dehydrate, or sulfonate most organic compounds. It is capable of igniting finely divided combustible materials on contact. Sulphuric acid will corrode many metals by releasing hydrogen
Reaction or degradation products	Releases toxic and irritating fumes of oxides of sulphur when heated to decomposition
Odour	Acrid odour
Structure	

References^(a,b,c)

^a Sulphuric acid (HAZARDTEXT® Hazard Management). In: Klasco RK (Ed): TOMES® System. Thomson Micromedex, Greenwood Village, Colorado (accessed 02/2010).

^b The Merck Index (14th Edition). Entry 8974: Sulfuric Acid, 2006.

^c The Dictionary of Substances and their Effects. Ed. S Gangolli. Second Edition, Volume 6, 1999.

Threshold Toxicity Values

EXPOSURE VIA INHALATION / INGESTION		
ppm	mg m⁻³	SIGNS AND SYMPTOMS
-	-	Data not available

Published Emergency Response Guidelines

Emergency Response Planning Guideline (ERPG) Values^(a)

	Calculated value (ppm)	Listed value (mg m ⁻³)
ERPG-1*	0.5 [^]	2
ERPG-2**	2.5	10
ERPG-3***	30	120

* Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hr without experiencing other than mild transient adverse health effects or perceiving a clearly defined, objectionable odour.

** Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hr without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action.

*** Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hr without experiencing or developing life-threatening health effects.

[^] Odour should be detectable near ERPG-1.

Interim Acute Exposure Guideline Levels (AEGLs)^(b)

	mg m ⁻³				
	10 min	30 min	60 min	4 hr	8 hr
AEGL-1[†]	0.2	0.2	0.2	0.2	0.2
AEGL-2^{††}	8.7	8.7	8.7	8.7	8.7
AEGL-3^{†††}	270	200	160	110	93

[†] The level of the chemical in air at or above which the general population could experience notable discomfort.

^{††} The level of the chemical in air at or above which there may be irreversible or other serious long-lasting effects or impaired ability to escape.

^{†††} The level of the chemical in air at or above which the general population could experience life-threatening health effects or death.

^a American Industrial Hygiene Association (AIHA). 2010 Emergency Response Planning Guideline Values and Workplace Environmental Exposure Level Guides Handbook, Fairfax, VA

^b U.S. Environmental Protection Agency. Acute Exposure Guideline Levels, <http://www.epa.gov/oppt/aegl/pubs/chemlist.htm> (accessed 02/2010).

Exposure Standards, Guidelines or Regulations

Occupational standards

WEL	LTEL (8 hour reference period): No guideline value specified
	STEL (15 min reference period): No guideline value specified

Public health guidelines

DRINKING WATER QUALITY GUIDELINE^(a)	250 µg L ⁻¹ for sulphate anion
AIR QUALITY GUIDELINE	No guideline value specified
SOIL GUIDELINE VALUE AND HEALTH CRITERIA VALUES	No guideline values specified

WEL – Workplace exposure limit; LTEL - Long-term exposure limit; STEL – Short-term exposure limit

^a Interim Guidance on the Water Supply (Water Quality) Regulations 2000 (England) and the Water Supply (Water Quality) Regulations 2001 (Wales) (accessed 01/2011).

Health Effects

Major route of exposure^(a)

- Toxic via inhalation, ingestion, dermal and ocular exposure..

Immediate signs or symptoms of acute exposure^(b-e)

- Inhalation causes eyes and nose with sore throat, cough, chest tightness, headache, fever, wheeze, tachycardia and confusion. Chemical pneumonitis, tachypnoea, dyspnoea and stridor due to laryngeal oedema may follow. Pulmonary oedema with increasing breathlessness, wheeze, hypoxia and cyanosis may take up to 36h to develop. Optic neuropathy has been reported following acute inhalation.
- Ingestion causes immediate pain with burning in the mouth, throat and stomach. This may be followed by abdominal pain, vomiting, haematemesis and dyspnoea. Pain and oedema may make swallowing difficult, causing drooling. Haemorrhagic or hypovolaemic shock and airway obstruction from laryngeal and/or epiglottic oedema are features of severe cases. Stridor and respiratory complications (including pneumonitis, pulmonary oedema, ARDS and pulmonary necrosis) can develop following aspiration of corrosive materials. Acids tend to damage the stomach with ulceration, gangrene, haemorrhage and perforation. However, in severe cases extensive areas of the gastrointestinal tract may be involved.
- Systemic features may include circulatory collapse, metabolic acidosis, hypoxia, respiratory failure, acute renal failure, haemolysis and disseminated intravascular coagulation (DIC).
- Dermal exposure causes pain, blistering, ulceration and penetrating necrosis. Coagulation burns may develop which may be self-limiting and superficial with the destruction of the surface epithelium and submucosa.
- Ocular exposure causes pain, blepharospasm, lacrimation, conjunctivitis, palpebral oedema and photophobia.

TOXBASE - <http://www.toxbase.org> (accessed 01/2011)

^a TOXBASE: Sulphuric acid, 01/2005.

^b TOXBASE: Corrosives - inhalation, 06/2010.

^c TOXBASE: Corrosives - ingestion, 07/2010.

^d TOXBASE: Skin decontamination - corrosives, 06/2010.

^e TOXBASE: Chemicals splashed or sprayed into the eyes, 07/2007.

Decontamination and First Aid

Important Notes

- Secondary contamination may occur.
- Ambulance staff, paramedics and emergency department staff treating chemically-contaminated casualties should be equipped with the Department of Health approved, gas-tight (Respirex) decontamination suits based on EN466:1995, EN12941:1998 and prEN943-1:2001, where appropriate.
- Decontamination should be performed using local protocols in designated areas such as a decontamination cubicle with adequate ventilation.

Dermal exposure^(a,b)

- Remove patient from exposure.
- The patient should remove all clothing and personal effects.
- Double-bag soiled clothing and place in a sealed container clearly labelled as a chemical hazard.
- Gently blot away any adherent liquid from the patient.
- Wash hair and all contaminated skin with copious amounts of water (preferably warm) and soap for at least 10-15 minutes. Decontaminate open wounds first and avoid contamination of unexposed skin.
- Pay special attention to skin folds, axillae, ears, fingernails, genital areas and feet.
- Burns totally more than 15% of body surface in adults (> 10 % in children) will require standard fluid resuscitation as for thermal burns.
- Cover affected area with a clean non-adherent dressing.

Ocular exposure^(c)

- Remove patient from exposure.
- Remove contact lenses if necessary and immediately irrigate the affected eye thoroughly with water or 0.9% saline for at least 10-15 minutes.
- Patients with corneal damage or those whose symptoms do not resolve rapidly should be referred for urgent ophthalmological assessment.
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Inhalation^(d)

- Remove patient from exposure.
- Ensure a clear airway and adequate ventilation.
- Give oxygen to symptomatic patients.
- All patients with abnormal vital signs, chest pain, respiratory symptoms or hypoxia should have a 12 lead ECG performed.
- If the patient has clinical features of bronchospasm treat conventionally with nebulised bronchodilators and steroids.

TOXBASE – <http://www.toxbase.org> (accessed 01/2011)

^a TOXBASE: Sulphuric Acid, 01/2005.

^b TOXBASE: Skin decontamination – corrosives, 06/2010.

^c TOXBASE: Chemicals splashed or sprayed into the eyes, 07/2007.

^d TOXBASE: Corrosives – inhalation, 06/2010.

- Endotracheal intubation, or rarely, tracheostomy may be required for life threatening laryngeal oedema.
- Apply other supportive measures as indicated by the patient's clinical condition. .

Ingestion^(a)

- MAINTAIN AIRWAY AND ESTABLISH HAEMODYNAMIC STABILITY
- In severely affected patients critical care input is essential. Urgent assessment of the airway is required. A supraglottic-epiglottic burn with erythema and oedema is usually a sign that further oedema will occur that may lead to airway obstruction. It is an indication for consideration of early intubation or tracheotomy.
- Do **NOT** attempt gastric lavage.
- Do **NOT** give neutralising chemicals as heat produced during neutralization reactions may increase injury.
- Monitor BP, pulse and oxygen saturation.
- Treat haemorrhagic or hypovolaemic shock by replacing lost fluids and blood intravenously.
- Apply other supportive measures as indicated by the patient's condition.

This document will be reviewed not later than 3 years or sooner if substantive evidence becomes available.

TOXBASE - <http://www.toxbase.org> (accessed 01/2001)

^a TOXBASE: Corrosives – ingestion, 07/2010.