



SIGMA-ALDRICH

Material Safety Data Sheet

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Version 1.130

Section 1 - Product and Company Information

Product Name: 1,4-Dioxane, 99+%, A.C.S. reagent
Product Number: 360481
Brand: Sigma-Aldrich
Company Address: 3050 Spruce Street, SAINT LOUIS, MO 63103 US
Emergency Phone: 314-776-6555

Section 2 - Composition/Information on Ingredient

Table with 5 columns: Substance Name, CAS #, SARA 313, EC no, Annex I Index Number. Row 1: 1,4-DIOXANE, 123-91-1, Yes, 204-661-8, 603-024-00-5

Section 3 - Hazards Identification

Emergency Overview: Flammable (USA) Highly Flammable (EU). Harmful. Highly flammable. May form explosive peroxides. Harmful by inhalation. Irritating to eyes, respiratory system and skin.

HMIS Rating: Health: 2*, Flammability: 3, Reactivity: 1
NFPA Rating: Health: 2, Flammability: 3, Reactivity: 1

Section 4 - First Aid Measures

Oral Exposure: If swallowed, wash out mouth with water provided person is conscious. Call a physician.
Inhalation Exposure: If inhaled, remove to fresh air. If not breathing give artificial respiration.

Dermal Exposure: In case of contact, immediately wash skin with soap and copious amounts of water.
Eye Exposure: In case of contact, immediately flush eyes with copious amounts of water for at least 15 minutes.

Section 5 - Fire Fighting Measures

Flammable Hazards: Yes
Explosion Hazards: Vapor may travel considerable distance to source of ignition and flash back.
Flash Point: 54 °F, 12 °C
Explosion Limits: Lower: 2 %, Upper: 22 %
Autoignition Temp: 180 °C, Flammability: Yes

Extinguishing Media: Suitable
For small (incipient) fires, use media such as "alcohol" foam, dry chemical, or carbon dioxide. For large fires, apply water from as far as possible.

Firefighting: Protective Equipment: Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes.
Specific Hazard(s): Flammable liquid. Emits toxic fumes under fire conditions.
Specific Method(s) of Fire Fighting: For small (incipient) fire extinguishing, use a portable fire extinguisher rated for flammable liquid fires.

Section 6 - Accidental Release Measures

Procedure to be Followed in Case of Leak or Spill: Evacuate area. Shut off all sources of ignition. Use nonsparking tools.
Procedure(s) of Personal Precaution(s): Wear self-contained breathing apparatus, rubber boots, and heavy rubber gloves.

Methods for Cleaning Up: Cover with dry-lime, sand, or soda ash. Place in covered containers using nonsparking tools and transport outdoors. Ventilate area and wash spill site after material pickup is complete.

Section 7 - Handling and Storage

Handling: User Exposure: Do not breathe vapor. Do not get in eyes, on skin, on clothing. Avoid prolonged or repeated exposure.

Storage**Suitable**

Keep tightly closed, Keep away from heat, sparks, and open flame.

Special Requirements

Moisture sensitive, Heat sensitive.

Section 8 - Exposure Controls / PPE**Engineering Controls**

Safety shower and eye bath, Use nonsparking tools, Mechanical exhaust required.

Personal Protective Equipment**Respiratory**

Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Where risk assessment shows air-purifying respirators are appropriate, use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator.

Hand

Compatible chemical-resistant gloves.

Eye

Chemical safety goggles.

General Hygiene Measures

Remove and wash contaminated clothing promptly. Wash thoroughly after handling.

Exposure Limits

Country	Type	Value
Poland	NDS	10 MG/M3
Poland	NDSch	80 MG/M3
Poland	NDSP	-

Exposure Limits, RTECS

Country	Source	Type	Value
USA	ACGIH	TWA	20 PPM
USA	MSHA Standard-air	TWA	100 PPM (360 MG/M3) (SKIN)
USA	OSHA	PEL	8H TWA 100 PPM (360 MG/M3) (SK)
New Zealand	OEL		
USA	NIOSH	Ceiling concentration	1 PPM/30M

Section 9 - Physical/Chemical Properties**Appearance**

Physical State	Color
Liquid	Colorless

Molecular Weight 88.11 AMU

Property	Value	At Temperature or Pressure	Other
pH	6.0 - 8.0	20 °C	Concentration: 500 g/l
BP/BP Range	100 - 102 °C	760 mmHg	
MP/MP Range	11.8 °C		
Freezing Point	N/A		
Vapor Pressure	27 mmHg	20 °C	
Vapor Density	3 g/l		
Saturated Vapor Conc.	N/A		

Sigma-Aldrich - 360481

Page 3

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SG/Density	1.034 g/cm3
Bulk Density	N/A
Odor Threshold	0.278 ppm
Volatile%	N/A
VOC Content	N/A
Water Content	N/A
Solvent Content	N/A
Evaporation Rate	N/A
Viscosity	0.012 Pas 25 °C
Surface Tension	36.9 mN/m 25 °C
Partition Coefficient	Log Kow: -0.27
Decomposition Temp.	N/A
Flash Point °F	54 °F
Flash Point °C	12 °C

Method: closed cup
Method: closed cup

Explosion Limits Lower: 2 %
Upper: 22 %

Flammability

Autoignition Temp 180 °C

Refractive Index 1.422

Solubility

Solubility in Water: Miscible.

Other Solvents: MISCIBLE WITH MOST ORGANIC, SOLVENTS, WITH AROMATIC, HYDROCARBONS AND OILS

N/A = not available

Section 10 - Stability and Reactivity**Stability****Stable**

Stable.

Conditions to Avoid

Moisture, Heat. Potentially explosive peroxides can form on long time storage in contact with air, Light and heat accelerate peroxide formation.

Materials to Avoid

Oxygen, Oxidizing agents, Halogens, Reducing agents

Hazardous Decomposition Products**Hazardous Decomposition Products**

Carbon monoxide, Carbon dioxide

Hazardous Polymerization**Hazardous Polymerization**

Will not occur.

Section 11 - Toxicological Information**Route of Exposure****Skin Contact**

Causes skin irritation.

Skin Absorption

May be harmful if absorbed through the skin.

Eye Contact

Causes eye irritation.

Inhalation

Harmful if inhaled. Vapor or mist is irritating to the mucous membranes and upper respiratory tract.

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Page 4

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Ingestion

May be harmful if swallowed.

Target Organ(s) or System(s)

Liver, Kidneys, Central nervous system,

Signs and Symptoms of Exposure

Prolonged or repeated exposure to skin causes defatting and dermatitis. Symptoms include nausea, vomiting, anorexia, weakness, dizziness, vertigo, headache, and sweating. Damage to the kidneys. Damage to the liver.

RTECS Number: JG8225000

Toxicity Data

Inhalation - Human: 470 ppm (LCLO)

Remarks: Brain and Coverings: Other degenerative changes.
Lungs, Thorax, or Respiration: Other changes.
Liver: Other changes.

Oral - Rat: 4200 mg/kg (LD50)

Inhalation - Rat: 46,000 mg/m³ (LC50)

Remarks: Sense Organs and Special Senses (Nose, Eye, Ear, and Taste): Eye: Other.

Intraperitoneal - Rat: 799 MG/KG (LD50)

Oral - Mouse: 5300 mg/kg (LD50)

Inhalation - Mouse: 37,000 mg/m³ (LC50)

Intraperitoneal - Mouse: 790 MG/KG (LD50)

Remarks: Lungs, Thorax, or Respiration: Other changes.
Kidney, Ureter, Bladder: Changes in tubules (including acute renal failure, acute tubular necrosis).

Oral - Cat: 2000 mg/kg (LD50)

Oral - Rabbit: 2000 mg/kg (LD50)

Skin - Rabbit: 7600 U/L/KG (LD50)

Oral - Guinea pig: 3150 mg/kg (LD50)

Remarks: Behavioral: General anesthetic.
Gastrointestinal: Other changes.
Kidney, Ureter, Bladder: Other changes.

Inhalation - Mammal: 20,500 mg/m³ (LC50)

Irritation Data

Skin - Human:

Remarks: Prolonged and repeated skin contact can cause eczema.

Skin - Rabbit:

Remarks: No irritation effect

Eyes - Human: 300 ppm 15M

Skin - Rabbit: 515 mg

Remarks: Open irritation test

Eyes - Rabbit: 100 mg

Remarks: Severe irritation effect

Eyes - Rabbit: 100 mg 24H

Remarks: Moderate irritation effect

Eyes - Guinea pig: 0.01 mg

Remarks: Moderate irritation effect

Chronic Exposure - Carcinogen

Result: This product is or contains a component that has been reported to be possibly carcinogenic based on its IARC, ACGIH, NTP, or EPA classification.

Rat - Oral: 185 GM/KG 2Y C

Result: Tumorigenic: Carcinogenic by RTECS criteria. Sense Organs and Special Senses (Nose, Eye, Ear, and Taste); Olfaction: Tumors. Liver: Tumors.

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Page 5

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Rat - Inhalation: 111 PPM 7H/2Y I

Result: Tumorigenic: Equivocal tumorigenic agent by RTECS criteria. Blood: Tumors, Blood: Lymphomas including Hodgkin's disease.

Mouse - Oral: 239 GM/KG 90W C

Result: Tumorigenic: Carcinogenic by RTECS criteria. Liver: Tumors.

Mouse - Skin: 14 GM/KG 60W I

Result: Tumorigenic: Equivocal tumorigenic agent by RTECS criteria. Skin and Appendages: Other: Tumors.

Mouse - Intraperitoneal: 12 GM/KG 8W I

Result: Tumorigenic: Neoplastic by RTECS criteria. Lungs, Thorax, or Respiration: Tumors.

Rat - Oral: 416 GM/KG 57W C

Result: Tumorigenic: Equivocal tumorigenic agent by RTECS criteria. Sense Organs and Special Senses (Nose, Eye, Ear, and Taste); Olfaction: Tumors, Liver: Tumors.

Rat - Oral: 408 GM/KG 2Y C

Result: Tumorigenic: Carcinogenic by RTECS criteria. Sense Organs and Special Senses (Nose, Eye, Ear, and Taste); Olfaction: Tumors, Liver: Tumors.

Mouse - Oral: 523 GM/KG 90W C

Result: Tumorigenic: Carcinogenic by RTECS criteria. Liver: Tumors.

Rat - Oral: 416 GM/KG 57W C

Result: Tumorigenic: Carcinogenic by RTECS criteria. Sense Organs and Special Senses (Nose, Eye, Ear, and Taste); Olfaction: Tumors, Liver: Tumors.

Rat - Oral: 528 GM/KG 63W I

Result: Tumorigenic: Equivocal tumorigenic agent by RTECS criteria. Liver: Tumors. Kidney, Ureter, Bladder: Kidney tumors.

IARC Carcinogen List

Rating
Group 2B

NTP Carcinogen List

<u>Rating</u>	<u>Species</u>	<u>Route</u>
Clear evidence.	Mouse/rat	Oral
Anticipated to be a carcinogen.		

IRIS/EPA Carcinogen List

<u>Rating</u>	<u>Species</u>	<u>Route</u>
Group B2	Rat	Drinking

Chronic Exposure - Teratogen

<u>Species</u>	<u>Dose</u>	<u>Route of Application</u>	<u>Exposure Time</u>
Rat	10 GM/KG	Oral	(6-15D PREG)
Result: Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Specific Developmental Abnormalities: Musculoskeletal system.			

Chronic Exposure - Mutagen

<u>Species</u>	<u>Dose</u>	<u>Cell Type</u>	<u>Mutation test</u>
Result: Laboratory experiments have shown mutagenic effects.			
Human	400 MMOL/L	HeLa cell	DNA inhibition
Rat	2550 MG/KG	Oral	DNA damage
Rat	300 UMOL/L	liver	DNA damage
Rat	50 MG/KG	Intravenous	Other mutation test systems
Rat	20 MG/KG	Oral	Unscheduled DNA synthesis
Rat	50 MG/KG	Intravenous	Other mutation test systems
Mouse	900 MG/KG	Oral	Micronucleus test
Mouse	3 GM/KG	Oral	Micronucleus test
Mouse	1 GM/L	fibroblast	Morphological transformation.
Hamster	10500 MG/L	ovary	Sister chromatid exchange

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Page 6

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Section 12 - Ecological Information

Accumulation

Bioaccumulation Potential

No indication of bioaccumulation.

Acute Ecotoxicity Tests

Test Type

LC50 Fish

Species

Pimephales promelas (Fathead minnow)

Time: 96.0 h
Value: 985 mg/l

Test Type

EC50 Daphnia

Species

Daphnia magna

Time: 24.0 h
Value: 8,450 mg/l

Test Type

EC50 Algae

Species

Scenedesmus subspicatus

Time: 72.0 h
Value: > 500 mg/l

Elimination

Section 13 - Disposal Considerations

Appropriate Method of Disposal of Substance or Preparation

Contact a licensed professional waste disposal service to dispose of this material.

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable.

Observe all federal, state, and local environmental regulations.

Section 14 - Transport Information

DOT

Proper Shipping Name: Dioxane

UN#: 1165

Class: 3

Packing Group: Packing Group II

Hazard Label: Flammable liquid

PIH: Not PIH

IATA

Proper Shipping Name: Dioxane

IATA UN Number: 1165

Hazard Class: 3

Packing Group: II

Section 15 - Regulatory Information

EU Directives Classification

Symbol of Danger: F Xn

Indication of Danger

Highly Flammable, Harmful

Risk Statements **R:** 11 19 36/37 40 66

Highly flammable. May form explosive peroxides. Irritating to eyes and respiratory system. Limited evidence of a carcinogenic effect. Repeated exposure may cause skin dryness or cracking.

effect. Repeated exposure may cause skin dryness or cracking.

Safety Statements **S:** 9 16 36/37 46

Keep container in a well-ventilated place. Keep away from sources of ignition- no smoking. Wear suitable protective clothing and gloves. If swallowed, seek medical advice immediately and show this container or label.

US Classification and Label Text

Indication of Danger

Flammable (USA) Highly Flammable (EU), Harmful.

Risk Statements

Highly flammable. May form explosive peroxides. Harmful by inhalation. Irritating to eyes, respiratory system and skin. Limited evidence of a carcinogenic effect. Repeated exposure may cause skin dryness or cracking.

Safety Statements

Keep container in a well-ventilated place. Keep away from sources of ignition- no smoking. Wear suitable protective clothing, gloves, and eye/face protection. If swallowed, seek medical advice immediately and show this container or label.

US Statements

Target organ(s): Liver, Kidneys, Possible Carcinogen (US), Calif. Prop. 65 carcinogen.

United States Regulatory Information

SARA Listed: Yes

Deminimis: 0.1 %

Notes: This product is subject to SARA section 313 reporting requirements.

TSCA Inventory Item: Yes

United States - State Regulatory Information

California Prop - 65

This product is or contains chemical(s) known to the state of California to cause cancer.

Canada Regulatory Information

WHMIS Classification

This product has been classified in accordance with the hazard criteria of the CPR, and the MSDS contains all the information required by the CPR.

DSL: Yes

NDSL: No

Section 16 - Other Information

Disclaimer

For R&D use only. Not for drug, household or other uses.

Warranty

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. SigmaAldrich Inc., shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale. Copyright 2009 Sigma-Aldrich Co. License granted to make unlimited paper copies for internal use only.