

SECTION 1: Identification

1.1 GHS Product identifier

Product name Dinitrogen tetraoxide

1.2 Other means of identification

Product number -

Other names dinitrogen dioxide dimer;dinitrogen tertoxide;Nitrogen dioxide,di

1.3 Recommended use of the chemical and restrictions on use

Identified uses Fuels and fuel additives

Uses advised against no data available

SECTION 2: Hazard identification

2.1 Classification of the substance or mixture

Gases under pressure: Liquefied gas

Oxidizing gases, Category 1

Skin corrosion, Sub-category 1B

Acute toxicity - Category 2, Inhalation

2.2 GHS label elements, including precautionary statements

Pictogram(s)



Signal word

Danger

Hazard statement(s)

H270 May cause or intensify fire; oxidizer

H314 Causes severe skin burns and eye damage

H330 Fatal if inhaled

Precautionary statement(s)

Prevention

P220 Keep away from clothing and other combustible materials.

P244 Keep valves and fittings free from oil and grease.

P260 Do not breathe dust/fume/gas/mist/vapours/spray.

P264 Wash ... thoroughly after handling.

P280 Wear protective gloves/protective clothing/eye protection/face protection/hearing protection/...

P271 Use only outdoors or in a well-ventilated area.

P284 [In case of inadequate ventilation] wear respiratory protection.

Response

P370+P376 In case of fire: Stop leak if safe to do so.

P301+P330+P331 IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.

P363 Wash contaminated clothing before reuse.

P304+P340 IF INHALED: Remove person to fresh air and keep comfortable for breathing.

P316 Get emergency medical help immediately.

P321 Specific treatment (see ... on this label).

P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P320 Specific treatment is urgent (see ... on this label).

Storage

P410+P403 Protect from sunlight. Store in a well-ventilated place.

P403 Store in a well-ventilated place.

P405 Store locked up.

P403+P233 Store in a well-ventilated place. Keep container tightly closed.

Disposal

P501 Dispose of contents/container to an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal.

2.3 Other hazards which do not result in classification

no data available

SECTION 3: Composition/information on ingredients

3.1 Substances

Chemical name	Common names and synonyms	CAS number	EC number	Concentration
Dinitrogen tetraoxide	Dinitrogen tetraoxide	10544-72-6	234-126-4	100%

SECTION 4: First-aid measures

4.1 Description of necessary first-aid measures

If inhaled

Fresh air, rest. Half-upright position. Administration of oxygen may be needed. Refer immediately for medical attention.

Following skin contact

First rinse with plenty of water for at least 15 minutes, then remove contaminated clothes and rinse again. Refer immediately for medical attention.

Following eye contact

Rinse with plenty of water for several minutes (remove contact lenses if easily possible). Refer immediately for medical attention.

Following ingestion

Rinse mouth. Do NOT induce vomiting. Refer immediately for medical attention.

4.2 Most important symptoms/effects, acute and delayed

Very concentrated fumes produce coughing, choking, headache, nausea, pain in chest and abdomen; otherwise, few symptoms appear at time of exposure. After symptom-free period of 5-72 hours, pulmonary edema gradually develops, causing fatigue, restlessness, coughing, difficulty in breathing, frothy expectoration, mental confusion, lethargy, bluish skin, and weak, rapid pulse. Since NO_x interferes with gas exchange in lungs, unconsciousness and death by asphyxiation can result, usually within a few hours after onset of pulmonary edema. (USCG, 1999)

4.3 Indication of immediate medical attention and special treatment needed, if necessary

Immediate first aid: Ensure that adequate decontamination has been carried out. If patient is not breathing, start artificial respiration, preferably with a demand-valve resuscitator, bag-valve-mask device, or pocket mask, as trained. Perform CPR as necessary. Immediately flush contaminated eyes with gently flowing water. Do not induce vomiting. If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain an open airway and prevent aspiration. Keep patient quiet and maintain normal body temperature. Obtain medical attention. Nitrogen Oxides (NO_x) and Related Compounds

SECTION 5: Fire-fighting measures

5.1 Suitable extinguishing media

Extinguish surrounding fire using suitable agent. Use water spray to keep fire-exposed containers cool. Approach fire from upwind to avoid hazardous vapors. Nitrogen oxides

5.2 Specific hazards arising from the chemical

Special Hazards of Combustion Products: Produces toxic gas when heated. Behavior in Fire: Does not burn, but supports combustion of combustible materials such as wood. May cause fire or explode on contact with other materials. (USCG, 1999)

5.3 Special protective actions for fire-fighters

Wear self-contained breathing apparatus for firefighting if necessary.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Avoid dust formation. Avoid breathing mist, gas or vapours. Avoid contacting with skin and eye. Use personal protective equipment. Wear chemical impermeable gloves. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak.

6.2 Environmental precautions

Evacuate danger area! Consult an expert! Personal protection: gas-tight chemical protection suit including self-contained breathing apparatus. Ventilation. Do NOT absorb in saw-dust or other combustible absorbents. Remove vapour with fine water spray. Neutralize used water with chalk or soda.

6.3 Methods and materials for containment and cleaning up

Releases may require isolation or evacuation. Stop or control the leak if this can be done without undue risk. Use water spray to disperse vapors and protect personnel. Approach release from upwind. Runoff of less volatile nitrogen oxides may contain highly corrosive nitric acid. Nitrogen oxides

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Handling in a well ventilated place. Wear suitable protective clothing. Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Use non-sparking tools. Prevent fire caused by electrostatic discharge steam.

7.2 Conditions for safe storage, including any incompatibilities

Ventilation along the floor. Separated from combustible substances and reducing agents. Store in tightly closed containers in a cool, well ventilated area away from oxidizable materials. Outside or detached storage is preferred. Do not put on wooden floors. Nitrogen oxides

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Occupational Exposure limit values

no data available

Biological limit values

no data available

8.2 Appropriate engineering controls

Ensure adequate ventilation. Handle in accordance with good industrial hygiene and safety practice. Set up emergency exits and the risk-elimination area.

8.3 Individual protection measures, such as personal protective equipment (PPE)

Eye/face protection

Wear tightly fitting safety goggles with side-shields conforming to EN 166(EU) or NIOSH (US).

Skin protection

Wear fire/flame resistant and impervious clothing. Handle with gloves. Gloves must be inspected prior to use. Wash and dry hands. The selected protective gloves have to satisfy the specifications of EU Directive 89/686/EEC and the standard EN 374 derived from it.

Respiratory protection

If the exposure limits are exceeded, irritation or other symptoms are experienced, use a full-face respirator.

Thermal hazards

no data available

SECTION 9: Physical and chemical properties and safety characteristics

Physical state	Nitrogen tetroxide is a red-brown liquid with a sharp, unpleasant chemical odor. Low-boiling (boiling point 21.15°C) and held as a liquid by compression. Density 1.448 g / cm ³ . Consists of an equilibrium mixture of brown NO ₂ (nitrogen dioxide) and colorless N ₂ O ₄ (dinitrogen tetroxide). Evolves poisonous brown vapors. Cylinders and ton containers may not be equipped with a safety relief device. Prolonged exposure of the containers to fire or heat may result in their violent rupturing and rocketing.
Colour	Colorless gas
Odour	no data available
Melting point/freezing point	-11°C(lit.)
Boiling point or initial boiling point and boiling range	21°C(lit.)
Flammability	Not combustible but enhances combustion of other substances.
Lower and upper explosion limit/flammability limit	no data available
Flash point	no data available
Auto-ignition temperature	Not flammable (USCG, 1999)
Decomposition temperature	no data available
pH	no data available
Kinematic viscosity	no data available
Solubility	Reacts with water
Partition coefficient n-octanol/water	no data available
Vapour pressure	1551 mm Hg (USCG, 1999)
Density and/or relative density	2.62 g/mL at 25°C(lit.)
Relative vapour density	(air = 1): 1.58
Particle characteristics	no data available

SECTION 10: Stability and reactivity

10.1 Reactivity

The substance is a strong oxidant. It reacts violently with combustible and reducing materials. Reacts with water. This produces nitric acid and nitric oxide. Attacks many metals in the presence of water.

10.2 Chemical stability

no data available

10.3 Possibility of hazardous reactions

Non-flammable. Nitrogen tetroxide does not burn but supports the combustion of carbon, phosphorus, and sulfur. The gas is heavier than air. Liquid NITROGEN TETROXIDE is an oxidizing agent consisting of an equilibrium mixture of colorless dinitrogen tetraoxide (N₂O₄) and red-brown nitrogen dioxide (NO₂). The exact composition of the mixture depends on the temperature with higher temperature favoring conversion to NO₂. Vaporizes readily to give NO₂, also an oxidizing agent. Noncombustible but can accelerate the burning of combustible materials. Reacts with reducing agents to generate heat and products that may be gaseous (causing pressurization of closed containers). The products may themselves be capable of further reactions (such as combustion in the air). Reacts with alkalis to form nitrates and nitrites [Merck 11th ed. 1989]. Corrodes steel if wet, but can be stored in steel cylinders if dry [Merck]. Reacts explosively with liquid ammonia even at very low temperatures (below its freezing point) [Mellor, 1940, Vol. 8, 54]. Reacts energetically with boron trichloride [Mellor, 1946, Vol. 5, 132]. Mixtures with metal carbonyls are hypergolic (enflame immediately). Mixtures with halocarbons,

hydrazine derivatives, heterocyclic bases (pyridine), isopropyl nitrite/propyl nitrite, active metals (magnesium, calcium, etc.), nitroaromatics, nitrogen trichloride, phosphorus, triethylamine, unsaturated hydrocarbons may react explosively. Accidental mixing with hot cyclohexane caused an explosion [MCA Case History 128. 1962]. A mixture with acetonitrile and indium showed no evidence of change for a time and then detonated when shaken (ascribed to the catalyzed oxidation of acetonitrile) [Chem. & Ind., 1958, 1004]. Mixture with alcohols produced a violent explosion [Chem. Eng. News, 1955, 33, 2372]. Vapor reacts with barium oxide incandescently [Mellor, 1940, Vol. 8, 545]. A slow reaction between the vapor and formaldehyde became explosive near 180°C [Trans. Faraday Soc. 45:767-770. 1949]. Manganese and potassium both ignite in the vapor [Ann. Chem. et Phys.(2) 2:317]. The vapor and ozone react with the evolution of light and often explode when mixed [J. Chem. Phys. 18:366. 1920].

10.4 Conditions to avoid

no data available

10.5 Incompatible materials

Strong oxidizers that enhance the combustion of easily oxidized materials, reducing agents, combustibles, organics. Nitrogen oxides

10.6 Hazardous decomposition products

When heated to decomposition it emits toxic fumes of /nitroxides/.

SECTION 11: Toxicological information

Acute toxicity

- Oral: no data available
- Inhalation: LC50 Rabbit inhalation 315 ppm/15 min Note: this study refers to the mixture of nitrogen dioxide and nitrogen tetroxide. The exposure measurements are related to ppm nitrogen dioxide and does not set the LC50 for nitrogen tetroxide as such.
- Dermal: no data available

Skin corrosion/irritation

no data available

Serious eye damage/irritation

no data available

Respiratory or skin sensitization

no data available

Germ cell mutagenicity

no data available

Carcinogenicity

no data available

Reproductive toxicity

no data available

STOT-single exposure

no data available

STOT-repeated exposure

no data available

Aspiration hazard

no data available

SECTION 12: Ecological information

12.1 Toxicity

- Toxicity to fish: no data available
- Toxicity to daphnia and other aquatic invertebrates: no data available
- Toxicity to algae: no data available
- Toxicity to microorganisms: no data available

12.2 Persistence and degradability

no data available

12.3 Bioaccumulative potential

no data available

12.4 Mobility in soil

no data available

12.5 Other adverse effects

no data available

SECTION 13: Disposal considerations

13.1 Disposal methods

Product

The material can be disposed of by removal to a licensed chemical destruction plant or by controlled incineration with flue gas scrubbing. Do not contaminate water, foodstuffs, feed or seed by storage or disposal. Do not discharge to sewer systems.

Contaminated packaging

Containers can be triply rinsed (or equivalent) and offered for recycling or reconditioning. Alternatively, the packaging can be punctured to make it unusable for other purposes and then be disposed of in a sanitary landfill. Controlled incineration with flue gas scrubbing is possible for combustible packaging materials.

SECTION 14: Transport information

14.1 UN Number

ADR/RID: no data available

IMDG: no data available

IATA: no data available

14.2 UN Proper Shipping Name

ADR/RID: no data available

IMDG: no data available

IATA: no data available

14.3 Transport hazard class(es)

ADR/RID: 6.1 (For reference only, please check.)

IMDG: 6.1 (For reference only, please check.)

IATA: 6.1 (For reference only, please check.)

14.4 Packing group, if applicable

ADR/RID: II (For reference only, please check.)

IMDG: II (For reference only, please check.)

IATA: II (For reference only, please check.)

14.5 Environmental hazards

ADR/RID: No

IMDG: No

IATA: No

14.6 Special precautions for user

no data available

14.7 Transport in bulk according to IMO instruments

no data available

SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations specific for the product in question

Chemical name	Common names and synonyms	CAS number	EC number
Dinitrogen tetroxide	Dinitrogen tetroxide	10544-72-6	234-126-4
European Inventory of Existing Commercial Chemical Substances (EINECS)			Listed.
EC Inventory			Listed.
United States Toxic Substances Control Act (TSCA) Inventory			Listed.
China Catalog of Hazardous chemicals 2015			Listed.
New Zealand Inventory of Chemicals (NZIoC)			Listed.
Philippines Inventory of Chemicals and Chemical Substances (PICCS)			Listed.
Vietnam National Chemical Inventory			Not Listed.
Chinese Chemical Inventory of Existing Chemical Substances (China IECSC)			Not Listed.
Korea Existing Chemicals List (KECL)			Listed.

SECTION 16: Other information

Information on revision

Creation Date July 15, 2019

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Abbreviations and acronyms

- CAS: Chemical Abstracts Service
- ADR: European Agreement concerning the International Carriage of Dangerous Goods by Road
- RID: Regulation concerning the International Carriage of Dangerous Goods by Rail
- IMDG: International Maritime Dangerous Goods
- IATA: International Air Transportation Association

- TWA: Time Weighted Average
- STEL: Short term exposure limit
- LC50: Lethal Concentration 50%
- LD50: Lethal Dose 50%
- EC50: Effective Concentration 50%

References

- IPCS - The International Chemical Safety Cards (ICSC), website: <http://www.ilo.org/dyn/icsc/showcard.home>
- HSDB - Hazardous Substances Data Bank, website: <https://toxnet.nlm.nih.gov/newtoxnet/hsdb.htm>
- IARC - International Agency for Research on Cancer, website: <http://www.iarc.fr/>
- eChemPortal - The Global Portal to Information on Chemical Substances by OECD, website: http://www.echemportal.org/echemportal/index?pageID=0&request_locale=en
- CAMEO Chemicals, website: <http://cameochemicals.noaa.gov/search/simple>
- ChemIDplus, website: <http://chem.sis.nlm.nih.gov/chemidplus/chemidlite.jsp>
- ERG - Emergency Response Guidebook by U.S. Department of Transportation, website: <http://www.phmsa.dot.gov/hazmat/library/erg>
- Germany GESTIS-database on hazard substance, website: <http://www.dguv.de/ifa/gestis/gestis-stoffdatenbank/index-2.jsp>
- ECHA - European Chemicals Agency, website: <https://echa.europa.eu/>