NITROGEN TETROXIDE

NOX

CAUTIONARY RESPONSE INFORMATION

Common Synonyms
Dinitrogen tetroxide
Nitrogen dioxide
Nitrogen peroxide
Oxides of nitrogen
Red oxide of nitrogen

Liquefied compressed gas | Red-brown | Sharp, unpleasant chemical odor

Sinks and reacts with water. Poisonous brown vapor is produced.

Keep people away. AVOID CONTACT WITH LIQUID AND VAPOR.
Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves).
Evacuate area in case of large discharge.
Notify local health and pollution control agencies.
Protect water intakes.

Fire

Not flammable.
May cause fire and explode on contact with combustibles.
POISONOUS GASES ARE PRODUCED IN FIRE AND WHEN HEATED.
Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves).
Flood discharge area with water.
Stop flow of gas or liquid.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
POISONOUS IF INHALED.
Irritating to eyes.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Will burn skin and eyes.
POISONOUS IF SWALLOWED.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. CORRECTIVE RESPONSE ACTIONS

Dilute and disperse
Stop discharge

2. CHEMICAL DESIGNATIONS

2.1 CG Compatibility Group: Not listed.
2.2 Formula: N_2O_4
2.3 IMO/UN Designation: 2/1067
2.4 DOT ID No.: 1067
2.5 CAS Registry No.: 10102-44-0
2.6 NAERG Guide No.: 124
2.7 Standard Industrial Trade Classification: 52239

3. HEALTH HAZARDS

3.1 Personal Protective Equipment: Rubber gloves; safety goggles and face shield; protective clothing; acid gas canister respirator or self-contained breathing apparatus.

3.2 Symptoms Following Exposure: Very concentrated fumes produce coughing, choking, headache, nausea, pain in chest and abdomen; otherwise, few symtoms 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 NOX interferes with gas exchange in lungs, unconsciousness and death by asphyxiation can result, usually within a few hours after onset of pulmonary edema.

3.3 Treatment of Exposure: INHALATION: remove patient to fresh air and have him breathe as deeply as possible; call a doctor; enforce complete rest for 24-48 hours; keep warm; give oxygen if coughing starts; physician may administer morphine (10 mg.) EYES AND SKIN: flush with water for at least 15 min.

3.4 TLV-TWA: 3 ppm
3.5 TLV-STEL: 5 ppm
3.6 TLV-Ceiling: Not listed.
3.7 Toxicity by Ingestion: Currently not available
3.8 Toxicity by Inhalation: Currently not available.
3.9 Chronic Toxicity: Currently not available

3.10 Vapor (Gas) Irritant Characteristics: Vapors cause severe irritation of eyes and throat and can cause eye and lung injury. They cannot be tolerated even at low concentrations.

3.11 Liquid or Solid Characteristics: Severe skin irritant. Causes second- and third-degree burns on short contact and is very injurious to the eyes.

3.12 Odor Threshold: 5 ppm
3.13 IDLH Value: 20 ppm
3.14 OSHA PEL-TWA: Not listed.
3.15 OSHA PEL-STEL: Not listed.
3.16 OSHA PEL-Ceiling: 5 ppm.
3.17 EPA AEGL: Not listed

4. FIRE HAZARDS

4.1 Flash Point: Not flammable
4.2 Flammable Limits in Air: Not flammable
4.3 Fire Extinguishing Agents: Stop flow of gas
4.4 Fire Extinguishing Agents Not to Be Used: Not pertinent
4.5 Special Hazards of Combustion Products: Produces toxic gas when heated.
4.6 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.
4.7 Auto Ignition Temperature: Not flammable
4.8 Electrical Hazards: Currently not available
4.9 Burning Rate: Not flammable
4.10 Adiabatic Flame Temperature: Currently not available
4.11 Stoichometric Air to Fuel Ratio: Not pertinent.
4.12 Flame Temperature: Currently not available
4.13 Combustion Molar Ratio (Reactant to Product): Not pertinent.
4.14 Minimum Oxygen Concentration for Combustion (MOCC): Not listed

5. CHEMICAL REACTIVITY

5.1 Reactivity with Water: Dissolves to form nitric acid and nitric oxide. Nitric oxide reacts with air to form more nitrogen tetroxide.
5.2 Reactivity with Common Materials: Very corrosive to metals when wet. Reacts vigorously with combustible materials such as wood.
5.3 Stability During Transport: Stable
5.4 Neutralizing Agents for Acids and Caustics: Flush with water, then use soda ash or lime.
5.5 Polymerization: Not pertinent
5.6 Inhibitor of Polymerization: Not pertinent

6. WATER POLLUTION

6.1 Aquatic Toxicity:
72 ppm/96 hr/mosquito fish/TL_m/fresh water
330-1000 ppm/48 hr/cockle/LC_{50}/salt water
6.2 Waterfowl Toxicity: Currently not available
6.3 Biological Oxygen Demand (BOD): None
6.4 Food Chain Concentration Potential: None
6.5 GESAMP Hazard Profile: Not listed

7. SHIPPING INFORMATION

7.1 Grades of Purity: Currently not available
7.2 Storage Temperature: Ambient. Storage and transfer structures shall be equipped with mechanical ventilation systems.
7.3 Inert Atmosphere: No requirement
7.4 Venting: Pressure relief valves on containers
7.5 IMO Pollution Category: Currently not available
7.6 Ship Type: Currently not available
7.7 Barge Hull Type: Currently not available

8. HAZARD CLASSIFICATIONS

8.1 49 CFR Category: Poison gas
8.2 49 CFR Class: 2.3
8.3 49 CFR Package Group: Not pertinent.
8.4 Marine Pollutant: No
8.5 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue).....	3
Flammability (Red).....	0
Instability (Yellow).....	0
Special (White).....	OX

8.6 EPA Reportable Quantity: Not listed.
8.7 EPA Pollution Category: Not listed.
8.8 RCRA Waste Number: Not listed
8.9 EPA FWPCA List: Not listed

9. PHYSICAL & CHEMICAL PROPERTIES

9.1 Physical State at 15° C and 1 atm: Soluble
9.2 Molecular Weight: 92.02
9.3 Boiling Point at 1 atm: 70.1°F = 21.2°C = 294°K
9.4 Freezing Point: 11.8°F = –11.2°C = 262°K
9.5 Critical Temperature: 316.8°F = 158.2°C = 431.4°K
9.6 Critical Pressure: 1470 psia = 100 atm = 10.1 MN/m^2
9.7 Specific Gravity: 1.45 at 20°C (liquid)
9.8 Liquid Surface Tension: Not pertinent
9.9 Liquid Water Interfacial Tension: Not pertinent
9.10 Vapor (Gas) Specific Gravity: 3.2
9.11 Ratio of Specific Heats of Vapor (Gas): (est.) 1.262
9.12 Latent Heat of Vaporization: 178 Btu/lb = 99.1 cal/g = 4.15 X 10^5 J/kg
9.13 Heat of Combustion: Not pertinent
9.14 Heat of Decomposition: Not pertinent
9.15 Heat of Solution: Currently not available
9.16 Heat of Polymerization: Not pertinent
9.17 Heat of Fusion: 60.2 cal/g
9.18 Limiting Value: Currently not available
9.19 Reid Vapor Pressure: 30 psia

NOTES

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9.20 SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot
35	93.370
40	92.940
45	92.509
50	92.070
55	91.639
60	91.209
65	90.770
70	90.339

9.21 LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
28	0.358
30	0.358
32	0.359
34	0.359
36	0.360
38	0.360
40	0.361
42	0.361
44	0.361
46	0.362
48	0.362
50	0.363
52	0.363
54	0.364
56	0.364
58	0.365
60	0.365
62	0.366
64	0.366
66	0.366
68	0.367
70	0.367

9.22 LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit inch per hour-square foot-F
	NOT PERTINENT

9.23 LIQUID VISCOSITY

Temperature (degrees F)	Centipoise
69	0.413

9.24 SOLUBILITY IN WATER

Temperature (degrees F)	Pounds per 100 pounds of water
	REACTS

9.25 SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
-30	0.605
-20	0.888
-10	1.281
0	1.818
10	2.543
20	3.509
30	4.780
40	6.431
50	8.554
60	11.260
70	14.660
80	18.910
90	24.160
100	30.620
110	38.480
120	47.980
130	59.380
140	72.980
150	89.099
160	108.099
170	130.299
180	156.199
190	186.299
200	220.900
210	260.599

9.26 SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
-30	0.00907
-20	0.01300
-10	0.01833
0	0.02545
10	0.03485
20	0.04708
30	0.06282
40	0.08283
50	0.10800
60	0.13940
70	0.17810
80	0.22550
90	0.28290
100	0.35200
110	0.43460
120	0.53260
130	0.64800
140	0.78320
150	0.94050
160	1.12200
170	1.33200
180	1.57200
190	1.84500
200	2.15500
210	2.50400

9.27 IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
90	0.138
100	0.138
110	0.138
120	0.138
130	0.138
140	0.138
150	0.138
160	0.138
170	0.138
180	0.138
190	0.138
200	0.138
210	0.138
220	0.138
230	0.138
240	0.138
250	0.138
260	0.138