



Right to Know Hazardous Substance Fact Sheet

Common Name: **2,4,6-TRINITROTOLUENE**

Synonyms: 1-Methyl-2,4,6-Trinitrobenzene; TNT

Chemical Name: Benzene, 2-Methyl-1,3,5-Trinitro-

Date: May 2000

Revision: September 2010

CAS Number: 118-96-7

RTK Substance Number: 1948

DOT Number: UN 0209

Description and Use

2,4,6-Trinitrotoluene is an odorless, colorless to pale yellow, crystalline (sand-like) solid that is often transported in a slurry. It is used primarily as an explosive and is also used in making dye stuffs and photographic chemicals.

Reasons for Citation

- ▶ **2,4,6-Trinitrotoluene** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH, IARC and IRIS.
- ▶ This chemical is on the Special Health Hazard Substance List.

SEE GLOSSARY ON PAGE 5.

FIRST AID

Eye Contact

- ▶ Immediately flush with large amounts of water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while rinsing.

Skin Contact

- ▶ Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

Inhalation

- ▶ Remove the person from exposure.
- ▶ Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- ▶ Transfer promptly to a medical facility.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222

CHEMTREC: 1-800-424-9300

NJDEP Hotline: 1-877-927-6337

National Response Center: 1-800-424-8802

EMERGENCY RESPONDERS >>>> SEE LAST PAGE

Hazard Summary

Hazard Rating	NJDOH	NFPA
HEALTH	2	-
FLAMMABILITY	4	-
REACTIVITY	4	-
CARCINOGEN EXPLOSIVE - KEEP WET FLAMMABLE AND REACTIVE POISONOUS GASES ARE PRODUCED IN FIRE CONTAINERS MAY EXPLODE IN FIRE		

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

- ▶ **2,4,6-Trinitrotoluene** can affect you when inhaled and may be absorbed through the skin.
- ▶ **2,4,6-Trinitrotoluene** should be handled as a CARCINOGEN--WITH EXTREME CAUTION.
- ▶ **2,4,6-Trinitrotoluene** may cause reproductive damage. HANDLE WITH EXTREME CAUTION.
- ▶ Contact can irritate the skin and eyes and may cause a skin allergy.
- ▶ Inhaling **2,4,6-Trinitrotoluene** can irritate the nose and throat.
- ▶ High levels of this substance can reduce the blood's ability to transport *Oxygen* causing headache, fatigue, dizziness, and a blue color to the skin and lips (*methemoglobinemia*).
- ▶ Exposure to **2,4,6-Trinitrotoluene** can cause nausea and vomiting, weakness, drowsiness, tremors and seizures.
- ▶ **2,4,6-Trinitrotoluene** may damage the liver and the nervous system.
- ▶ Repeated exposure to **2,4,6-Trinitrotoluene** can damage the red blood cells causing anemia.
- ▶ High or repeated exposure can cause clouding of the eye lens (cataracts), which may damage vision.
- ▶ **2,4,6-Trinitrotoluene** is an EXPLOSIVE that can be detonated by SHOCK, FRICTION, IMPACT or HEAT.
- ▶ **2,4,6-Trinitrotoluene** is FLAMMABLE and REACTIVE and a DANGEROUS FIRE and EXPLOSION HAZARD.

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **1.5 mg/m³** averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit (REL) is **0.5 mg/m³** averaged over a 10-hour workshift.

ACGIH: The threshold limit value (TLV) is **0.1 mg/m³** averaged over an 8-hour workshift.

- ▶ **2,4,6-Trinitrotoluene** may be a CARCINOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.

Determining Your Exposure

- ▶ Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- ▶ For each individual hazardous ingredient, read the New Jersey Department of Health Hazardous Substance Fact Sheet, available on the RTK website (www.nj.gov/health/eoh/rtkweb) or in your facility's RTK Central File or Hazard Communication Standard file.
- ▶ You have a right to this information under the New Jersey Worker and Community Right to Know Act and the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- ▶ The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

Health Hazard Information

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **2,4,6-Trinitrotoluene**:

- ▶ Contact can irritate the skin and eyes.
- ▶ Inhaling **2,4,6-Trinitrotoluene** can irritate the nose and throat causing coughing and wheezing.
- ▶ High levels of this substance can reduce the blood's ability to transport *Oxygen*, causing headache, fatigue, dizziness, and a blue color to the skin and lips (*methemoglobinemia*). Exposure to very high levels can cause trouble breathing, collapse and even death.
- ▶ Exposure to **2,4,6-Trinitrotoluene** can cause nausea and vomiting, weakness, drowsiness, tremors and seizures.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **2,4,6-Trinitrotoluene** and can last for months or years:

Cancer Hazard

- ▶ **2,4,6-Trinitrotoluene** may be a CARCINOGEN in humans since it has been shown to cause bladder cancer in animals.
- ▶ Many scientists believe there is no safe level of exposure to a carcinogen.

Reproductive Hazard

- ▶ **2,4,6-Trinitrotoluene** may damage the testes (male reproductive glands).

Other Effects

- ▶ **2,4,6-Trinitrotoluene** may cause a skin allergy. If allergy develops, very low future exposure can cause itching and a skin rash.
- ▶ **2,4,6-Trinitrotoluene** may damage the liver.
- ▶ **2,4,6-Trinitrotoluene** may damage the nervous system causing numbness, "pins and needles," and/or weakness in the hands and feet.
- ▶ Repeated exposure to **2,4,6-Trinitrotoluene** can damage the red blood cells causing anemia.
- ▶ High or repeated exposure can cause clouding of the eye lens (cataracts), which may damage vision.

Medical

Medical Testing

For frequent or potentially high exposure (half the TLV or greater), the following are recommended before beginning work and at regular times after that:

- ▶ Complete blood count
- ▶ Liver function tests

If symptoms develop or overexposure is suspected, the following are recommended:

- ▶ Blood methemoglobin level
- ▶ Evaluation by a qualified allergist can help diagnose skin allergy.
- ▶ Exam of the eyes and vision
- ▶ Exam of the nervous system

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

Mixed Exposures

- ▶ More than light alcohol consumption can cause liver damage. Drinking alcohol can increase the liver damage caused by **2,4,6-Trinitrotoluene**.

Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- ▶ Label process containers.
- ▶ Provide employees with hazard information and training.
- ▶ Monitor airborne chemical concentrations.
- ▶ Use engineering controls if concentrations exceed recommended exposure levels.
- ▶ Provide eye wash fountains and emergency showers.
- ▶ Wash or shower if skin comes in contact with a hazardous material.
- ▶ Always wash at the end of the workshift.
- ▶ Change into clean clothing if clothing becomes contaminated.
- ▶ Do not take contaminated clothing home.
- ▶ Get special training to wash contaminated clothing.
- ▶ Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- ▶ Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- ▶ Before entering a confined space where **2,4,6-Trinitrotoluene** may be present, check to make sure that an explosive concentration does not exist.
- ▶ Use a wet method to reduce dust during clean-up. DO NOT DRY SWEEP as friction may cause detonation.

Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Gloves and Clothing

- ▶ Avoid skin contact with **2,4,6-Trinitrotoluene**. Wear personal protective equipment made from material which can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- ▶ The recommended glove material for **2,4,6-Trinitrotoluene** is Butyl.
- ▶ The recommended protective clothing material for *wetted* **2,4,6-Trinitrotoluene** is Tychem® CSM, or the equivalent.
- ▶ All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- ▶ For impact hazards (such as flying fragments, chips or particles), wear safety glasses with side shields or safety goggles.
- ▶ If additional protection is needed for the entire face, use in combination with a face shield. A face shield should not be used without another type of eye protection.

Respiratory Protection

Improper use of respirators is dangerous. Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- ▶ Where the potential exists for exposure over **0.1 mg/m³**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus or an emergency escape air cylinder.
- ▶ Exposure to **500 mg/m³** is immediately dangerous to life and health. If the possibility of exposure above **500 mg/m³** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- ▶ **2,4,6-Trinitrotoluene** is an EXPLOSIVE that can be detonated by HEAT, LIGHT, FRICTION or SHOCK.
- ▶ **2,4,6-Trinitrotoluene** is a FLAMMABLE and REACTIVE SOLID.
- ▶ Use water or dirt for small fires. DO NOT attempt to extinguish large fires.
- ▶ POISONOUS GASES ARE PRODUCED IN FIRE, including *Nitrogen Oxides*.
- ▶ CONTAINERS MAY EXPLODE IN FIRE.
- ▶ Use water spray to keep fire-exposed containers cool.

Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **2,4,6-Trinitrotoluene** is spilled or leaked, take the following steps:

- ▶ Evacuate personnel and secure and control entrance to the area.
- ▶ Eliminate all ignition sources.
- ▶ DO NOT CLEAN-UP or DISPOSE of unless supervised by a specialist in explosives.
- ▶ KEEP SPILLED **2,4,6-Trinitrotoluene** WET!
- ▶ DO NOT SWEEP UP DRY MATERIAL.
- ▶ Keep **2,4,6-Trinitrotoluene** out of confined spaces, such as sewers, because of the possibility of an explosion.
- ▶ Ventilate and wash area after clean-up is complete.
- ▶ DO NOT wash into sewer.
- ▶ It may be necessary to contain and dispose of **2,4,6-Trinitrotoluene** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

Handling and Storage

Prior to working with **2,4,6-Trinitrotoluene** you should be trained on its proper handling and storage.

- ▶ **2,4,6-Trinitrotoluene**, especially *hot liquid 2,4,6-Trinitrotoluene*, may explosively decompose with SHOCK, FRICTION, IMPACT or HEAT (above 464°F (240°C)).
- ▶ **2,4,6-Trinitrotoluene** reacts violently or explosively with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); AMMONIA; REDUCING AGENTS (such as LITHIUM, SODIUM, ALUMINUM and their HYDRIDES); STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE); NITRIDES; NITRIC ACID; LEAD; IRON; and ORGANIC SOLVENTS.
- ▶ Store in tightly closed containers in a cool, well-ventilated area away from COMBUSTIBLES and protect from PHYSICAL DAMAGE.
- ▶ Sources of ignition, such as smoking and open flames, are prohibited where **2,4,6-Trinitrotoluene** is used, handled, or stored.
- ▶ Metal containers involving the transfer of **2,4,6-Trinitrotoluene** should be grounded and bonded.
- ▶ Use explosion-proof electrical equipment and fittings wherever **2,4,6-Trinitrotoluene** is used, handled, manufactured, or stored.
- ▶ Use only non-sparking tools and equipment, especially when opening and closing containers of **2,4,6-Trinitrotoluene**.

Occupational Health Information Resources

The New Jersey Department of Health offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

For more information, please contact:

New Jersey Department of Health
Right to Know
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.state.nj.us
Web address: <http://www.nj.gov/health/eoh/rtkweb>

The Right to Know Hazardous Substance Fact Sheets are not intended to be copied and sold for commercial purposes.

GLOSSARY

ACGIH is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

Acute Exposure Guideline Levels (AEGLs) are established by the EPA. They describe the risk to humans resulting from once-in-a-lifetime, or rare, exposure to airborne chemicals.

Boiling point is the temperature at which a substance can change its physical state from a liquid to a gas.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

CFR is the Code of Federal Regulations, which are the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

The **critical temperature** is the temperature above which a gas cannot be liquefied, regardless of the pressure applied.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

ERG is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

Emergency Response Planning Guideline (ERPG) values provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

IARC is the International Agency for Research on Cancer, a scientific group.

Ionization Potential is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

IRIS is the Integrated Risk Information System database on human health effects that may result from exposure to various chemicals, maintained by federal EPA.

LEL or Lower Explosive Limit, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

mg/m³ means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

Permeated is the movement of chemicals through protective materials.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

Protective Action Criteria (PAC) are values established by the Department of Energy and are based on AEGLs and ERPGs. They are used for emergency planning of chemical release events.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

STEL is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

UEL or Upper Explosive Limit is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

Vapor Density is the ratio of the weight of a given volume of one gas to the weight of another (usually *Air*), at the same temperature and pressure.

The **vapor pressure** is a force exerted by the vapor in equilibrium with the solid or liquid phase of the same substance. The higher the vapor pressure the higher concentration of the substance in air.

Common Name: **2,4,6-TRINITROTOLUENE**

Synonyms: 1-Methyl-2,4,6-Trinitrobenzene; TNT

CAS No: 118-96-7

 Molecular Formula: C₇H₅N₃O₆

RTK Substance No: 1948

Description: Odorless, colorless to pale yellow, crystalline solid that may be transported in a slurry

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
2 - Health 4 - Fire 4 - Reactivity DOT#: UN 0209 ERG Guide #: 112 Hazard Class: 1 (Explosive)	2,4,6-Trinitrotoluene is an EXPLOSIVE that can be detonated by HEAT, LIGHT, FRICTION or SHOCK. 2,4,6-Trinitrotoluene is a FLAMMABLE and REACTIVE SOLID. Use water or dirt for small fires. DO NOT attempt to extinguish large fires. POISONOUS GASES ARE PRODUCED IN FIRE, including <i>Nitrogen Oxides</i> . CONTAINERS MAY EXPLODE IN FIRE. Use water spray to keep fire-exposed containers cool.	2,4,6-Trinitrotoluene , especially <i>hot liquid 2,4,6-Trinitrotoluene</i> may explosively decompose with SHOCK, FRICTION, IMPACT or HEAT (above 464°F (240°C)). 2,4,6-Trinitrotoluene reacts violently or explosively with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); AMMONIA; REDUCING AGENTS (such as LITHIUM, SODIUM, ALUMINUM and their HYDRIDES); STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE); NITRIDES; NITRIC ACID; LEAD; IRON; and ORGANIC SOLVENTS.

SPILL/LEAKS

Isolation Distance:
Spill: 500 meters (1/2 mile)
Fire: 1,600 meters (1 mile)

DO NOT CLEAN-UP or DISPOSE of unless supervised by a specialist in explosives.

 Keep spilled **2,4,6-Trinitrotoluene** WET!

 Use only non-sparking tools and equipment, especially when opening and closing containers of **2,4,6-Trinitrotoluene**.

 Metal containers involving the transfer of **2,4,6-Trinitrotoluene** should be grounded and bonded.

DO NOT wash into sewer.

DO NOT OPERATE RADIO TRANSMITTERS within 100 meters (330 feet) of ELECTRICAL DETONATORS.

2,4,6-Trinitrotoluene is toxic to aquatic organisms and may cause long-term effects.

PHYSICAL PROPERTIES

Odor Threshold: Odorless

Flash Point: Flammable Solid (Explodes)

Auto Ignition Temp: 887°F (474°C)

Vapor Pressure: 0.0002 mm Hg at 68°F (20°C)

Specific Gravity: 1.65 (water = 1)

Water Solubility: Very slightly soluble

Boiling Point: 464°F (240°C) (Explodes)

Melting Point: 176°F (80°C)

Ionization Potential: 10.59 eV

Molecular Weight: 227.15

EXPOSURE LIMITS

OSHA: 1.5 mg/m³, 8-hr TWA

NIOSH: 0.5 mg/m³, 10-hr TWA

ACGIH: 0.1 mg/m³, 8-hr TWA

IDLH: 500 mg/m³

The Protective Action Criteria values are:

 PAC-1 = 1.25 mg/m³ PAC-2 = 7.5 mg/m³

 PAC-3 = 500 mg/m³

PROTECTIVE EQUIPMENT

Gloves: Butyl (>8-hr breakthrough for *liquid Nitro compounds*)

Coveralls: Tychem® CSM (>2-hr breakthrough for *liquid Nitro compounds*)
 Flash protection or Turn-Out gear

Respirator: SCBA

HEALTH EFFECTS

Eyes: Irritation

Skin: Irritation

Inhalation: Nose and throat irritation with coughing and wheezing

Headache, fatigue and blue color to the skin and lips (methemoglobinemia)

Chronic: Cancer (bladder) in animals

FIRST AID AND DECONTAMINATION

Remove the person from exposure.

Flush eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn.

Quickly remove contaminated clothing and wash contaminated skin with large amounts of soap and water.

Begin artificial respiration if breathing has stopped and CPR if necessary.

Transfer promptly to a medical facility.