



Right to Know Hazardous Substance Fact Sheet

Common Name: **ADIPONITRILE**

Synonyms: 1,4-Dicyanobutane; Tetramethylene Cyanide

Chemical Name: Hexanedinitrile

Date: June 2008 Revision: November 2009

CAS Number: 111-69-3

RTK Substance Number: 0027

DOT Number: UN 2205

Description and Use

Adiponitrile is a colorless, nearly odorless, oily liquid. It is used as an intermediate in making nylon, and as a corrosion inhibitor, solvent and rubber accelerator.

Reasons for Citation

Adiponitrile is on the Right to Know Hazardous Substance List because it is cited by ACGIH, DOT, NIOSH, DEP, IRIS, NFPA and EPA.

[SEE GLOSSARY ON PAGE 5.](#)

FIRST AID

Eye Contact

- ▶ Immediately flush with large amounts of cool water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while flushing. Seek medical attention immediately.

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.

Antidotes and Special Procedures

- ▶ Use *Amyl Nitrite* capsules if symptoms develop. All area employees should be trained regularly in emergency treatment of *Cyanide poisoning* and in CPR. A *Cyanide* antidote kit MUST be rapidly available and ingredients replaced every 1 to 2 years to ensure freshness.

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	-	3
FLAMMABILITY	-	2
REACTIVITY	-	1
COMBUSTIBLE POISONOUS GASES ARE PRODUCED IN FIRE		

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

- ▶ **Adiponitrile** can affect you when inhaled and by passing through the skin.
- ▶ Contact can irritate and burn the skin and eyes.
- ▶ Inhaling **Adiponitrile** can irritate the nose, throat and lungs.
- ▶ High exposure to **Adiponitrile** can cause *Cyanide poisoning* with headache, weakness, confusion, nausea, pounding of the heart, coma, and even death.
- ▶ Repeated exposure may cause personality changes.
- ▶ **Adiponitrile** may affect the nervous system.
- ▶ High exposure may cause enlargement of the thyroid gland.
- ▶ If **Adiponitrile** is involved in a fire it can release *Hydrogen Cyanide*. Consult the *Right to Know Hazardous Substance Fact Sheet on HYDROGEN CYANIDE*.

Workplace Exposure Limits

NIOSH: The recommended airborne exposure limit (REL) is **4 ppm** averaged over a 10-hour workshift.

ACGIH: The threshold limit value (TLV) is **2 ppm** averaged over an 8-hour workshift.

- ▶ The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

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 **Adiponitrile**:

- ▶ Contact can irritate and burn the skin and eyes.
- ▶ Inhaling **Adiponitrile** can irritate the nose, throat and lungs causing coughing, wheezing and/or shortness of breath.
- ▶ High exposure to **Adiponitrile** can cause *Cyanide poisoning* with flushing of the face, chest tightness, headache, weakness, confusion, nausea and vomiting, pounding of the heart, trouble breathing, coma, and even death.

Chronic Health Effects

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

Cancer Hazard

- ▶ According to the information presently available to the New Jersey Department of Health and Senior Services, **Adiponitrile** has not been tested for its ability to cause cancer in animals.

Reproductive Hazard

- ▶ There is limited evidence that **Adiponitrile** may damage the developing fetus.

Other Effects

- ▶ Repeated exposure may cause personality changes such as depression, anxiety or irritability.
- ▶ **Adiponitrile** may affect the nervous system.
- ▶ High exposure may cause enlargement of the thyroid gland and may interfere with thyroid function.

Medical

Medical Testing

Before beginning employment and at regular times thereafter, (at least annually), the following is recommended:

- ▶ Urine Thiocyanate test

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

- ▶ Blood *Cyanide* level
- ▶ Evaluation of thyroid function
- ▶ 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).

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.

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 **Adiponitrile**. 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.
- ▶ Safety equipment manufacturers recommend Butyl Rubber, Silver Shield®/4H® and Barrier® as glove materials for *Nitriles, aliphatic*, and Tychem® F, BR, Responder® and TK; Zytron® 400 and 500; ONESuit®TEC; and Trelchem® HPS and VPS, as clothing materials for *Nitriles, aliphatic*.
- ▶ All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- ▶ Wear indirect-vent, impact and splash resistant goggles when working with liquids.
- ▶ Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.
- ▶ Do not wear contact lenses when working with this substance.

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 **2 ppm**, 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 operated in a pressure-demand or other positive-pressure mode.

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).

- ▶ **Adiponitrile** is a COMBUSTIBLE LIQUID.
- ▶ Use dry chemical, CO₂, water spray, or alcohol-resistant foam as extinguishing agents.
- ▶ POISONOUS GASES ARE PRODUCED IN FIRE, including *Hydrogen Cyanide*.
- ▶ Use water spray to keep fire-exposed containers cool.
- ▶ Vapor is heavier than air and may travel a distance to cause a fire or explosion far from the source.

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 **Adiponitrile** is spilled or leaked, take the following steps:

- ▶ Evacuate personnel and secure and control entrance to the area.
- ▶ Eliminate all ignition sources.
- ▶ Absorb liquids in vermiculite, dry sand, earth, or a similar material and deposit in sealed containers.
- ▶ Ventilate and wash area after clean-up is complete.
- ▶ DO NOT wash into sewer.
- ▶ It may be necessary to contain and dispose of **Adiponitrile** 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 **Adiponitrile** you should be trained on its proper handling and storage.

- ▶ **Adiponitrile** reacts violently with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE).
- ▶ **Adiponitrile** is not compatible with STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC) and STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE).
- ▶ **Adiponitrile** decomposes above 194°F (90°C) to release toxic *Hydrogen Cyanide gas*.
- ▶ Store in tightly closed containers in a cool, well-ventilated area.
- ▶ Sources of ignition, such as smoking and open flames, are prohibited where **Adiponitrile** is used, handled, or stored in a manner that could create a potential fire or explosion hazard.

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: **ADIPONITRILE**

Synonyms: 1,4-Dicyanobutane; Hexanedinitrile Tetramethylene Cyanide

CAS No: 111-69-3

Molecular Formula: C₆H₈N₂

RTK Substance No: 0027

Description: Colorless, nearly odorless, oily liquid

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
3 - Health 2 - Fire 1 - Reactivity DOT#: UN 2205 ERG Guide #: 153 Hazard Class: 6.1 (Poison)	COMBUSTIBLE LIQUID Use dry chemical, CO ₂ , water spray, or alcohol-resistant foam as extinguishing agents. POISONOUS GASES ARE PRODUCED IN FIRE, including <i>Hydrogen Cyanide</i> . Use water spray to keep fire-exposed containers cool. Vapor is heavier than air and may travel a distance to cause a fire or explosion far from the source.	Adiponitrile reacts violently with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE). Adiponitrile is not compatible with STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC) and STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE). Adiponitrile decomposes above 194°F (90°C) to release toxic <i>Hydrogen Cyanide</i> gas.

SPILL/LEAKS

Isolation Distance:

Small Spill: 60 meters (200 feet)

Large Spill: 270 meters (900 feet)

Fire: 800 meters (1/2 mile)

Absorb liquids in vermiculite, dry sand, earth, or a similar material and deposit in sealed containers.

DO NOT wash into sewer.

Animals and aquatic life are endangered by potential *Cyanide* production.

PHYSICAL PROPERTIES

Odor Threshold:	Nearly odorless
Flash Point:	199°F (93°C)
LEL:	1 to 1.7%
UEL:	5%
Auto Ignition Temp:	1,022°F (550°C)
Vapor Density:	3.73 (air = 1)
Vapor Pressure:	0.002 mm Hg at 68°F (20°C)
Specific Gravity:	0.97 (water = 1)
Water Solubility:	Slightly soluble
Boiling Point:	563°F (295°C)
Freezing Point:	34°F (1°C)
Molecular Weight:	108.1

EXPOSURE LIMITS

NIOSH: 4 ppm, 10-hr TWA

ACGIH: 2 ppm, 8-hr TWA

IDLH: None

The Protective Action Criteria values are:

PAC-1 = 3.85 ppm PAC-2 = 3.85 ppm PAC-3 = 150 ppm

PROTECTIVE EQUIPMENT

Gloves:	Butyl Rubber, Silver Shield®/4H® and Barrier® (>8-hr breakthrough for <i>Nitriles, aliphatic</i>)
Coveralls:	Tychem® BR, Responder® and TK; Zytron® 400 and 500; ONESuit®TEC; and Trelchem® HPS and VPS (>8-hr breakthrough for <i>Nitriles, aliphatic</i>)
Respirator:	>2 ppm - Supplied air >150 ppm - SCBA

HEALTH EFFECTS

Eyes: Irritation and burns

Skin: Irritation and burns

Inhalation: Nose, throat and lung irritation with coughing, wheezing and shortness of breath

Headache, weakness, confusion, nausea and vomiting, pounding of the heart and trouble breathing, coma and death

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. Seek medical attention immediately.

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

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

Transfer to a medical facility.