



Right to Know Hazardous Substance Fact Sheet

Common Name: **HYDROGEN CYANIDE**

Synonyms: Formonitrile; Prussic Acid

Chemical Name: Hydrocyanic Acid

Date: June 1998

Revision: January 2011

CAS Number: 74-90-8

RTK Substance Number: 1013

DOT Number: UN 1051 (Anhydrous; Stabilized)

Description and Use

Hydrogen Cyanide is a colorless to pale blue liquid below 78°F (26°C) and a colorless gas at higher temperatures. It has a distinct bitter almond or stinky sneaker odor. **Hydrogen Cyanide** is used to kill insects and rodents, in making other chemicals, synthetic fibers, plastics and dyes, and as a chemical warfare agent.

- ▶ **ODOR THRESHOLD = 2 to 10 ppm**
- ▶ Odor thresholds vary greatly. Do not rely on odor alone to determine potentially hazardous exposures.

Reasons for Citation

- ▶ **Hydrogen Cyanide** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH, DEP, IRIS, NFPA and EPA.
- ▶ 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. Seek medical attention.

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	-	4
FLAMMABILITY	-	4
REACTIVITY	-	1
FLAMMABLE POISONOUS GASES ARE PRODUCED IN FIRE CONTAINERS MAY EXPLODE IN FIRE		

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

- ▶ **Hydrogen Cyanide** can affect you when inhaled and by passing through the skin.
- ▶ Contact can irritate and burn the skin and eyes.
- ▶ Inhaling **Hydrogen Cyanide** can irritate the nose and throat.
- ▶ High exposure can cause *Cyanide poisoning*. Symptoms include headache, weakness, confusion, and pounding of the heart. This can rapidly lead to convulsions and death.
- ▶ **Hydrogen Cyanide** may affect the nervous system.
- ▶ Repeated exposure may interfere with thyroid function and enlarge the thyroid gland (goiter), and cause nosebleeds.
- ▶ **Hydrogen Cyanide** is a **FLAMMABLE LIQUID and GAS** and a **DANGEROUS FIRE HAZARD**.
- ▶ *Anhydrous* and *Unstabilized Hydrogen Cyanide* are severe explosion hazards and can polymerize violently, resulting in fires and explosions.

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **10 ppm** averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit (REL) is **4.7 ppm**, which should not be exceeded at any time.

ACGIH: The threshold limit value (TLV) is **4.7 ppm**, which should not be exceeded at any time.

- ▶ 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 **Hydrogen Cyanide**:

- ▶ Contact can irritate and burn the skin and eyes with skin rash and itching.
- ▶ Inhaling **Hydrogen Cyanide** can irritate the nose and throat causing coughing and wheezing.
- ▶ High exposure can cause *Cyanide poisoning*. Symptoms include flushing of the face, chest tightness, headache, nausea and vomiting, weakness, confusion, pounding of the heart, and trouble breathing. This can rapidly lead to convulsions and death.

Chronic Health Effects

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

Cancer Hazard

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

Reproductive Hazard

- ▶ According to the information presently available to the New Jersey Department of Health, **Hydrogen Cyanide** has not been tested for its ability to affect reproduction.

Other Effects

- ▶ **Hydrogen Cyanide** may affect the nervous system.
- ▶ Repeated exposure may interfere with thyroid function and enlarge the thyroid gland (goiter), and cause nosebleeds.

Medical

Medical Testing

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

- ▶ Urine thiocyanate test (most accurate if done soon after exposure).

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).

Mixed Exposures

- ▶ Since cigarette smoke also contains some **Hydrogen Cyanide**, smokers may have somewhat higher blood **Hydrogen Cyanide** and urine thiocyanate levels

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 **Hydrogen Cyanide** may be present, check to make sure that an explosive concentration does not exist.
- ▶ Where possible, transfer **Hydrogen Cyanide** from cylinders or other containers to process containers in an enclosed system.

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 **Hydrogen Cyanide**. 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 materials for *liquid Hydrogen Cyanide* are Nitrile and Neoprene.
- ▶ The recommended protective clothing material for *gaseous* and *liquid Hydrogen Cyanide* is Tychem® TK, or the equivalent.

- ▶ All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- ▶ Wear non-vented, impact resistant goggles when working with fumes, gases, or vapors.
- ▶ 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).

- ▶ **DO NOT USE CHEMICAL CARTRIDGE OR CANISTER RESPIRATORS.**
- ▶ Where the potential exists for exposure over **4.7 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 or an emergency escape air cylinder.
- ▶ Exposure to **50 ppm** is immediately dangerous to life and health. If the possibility of exposure above **50 ppm** 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).

- ▶ **Hydrogen Cyanide** is a FLAMMABLE LIQUID and GAS.
- ▶ Stop flow of gas or allow to burn. DO NOT attempt to extinguish fire unless flow can be stopped. Shut off supply or let burn.
- ▶ Use dry chemical, CO₂, water spray, alcohol-resistant foam or other foam as extinguishing agents.
- ▶ **POISONOUS GASES ARE PRODUCED IN FIRE**, including *Nitrogen Oxides*.
- ▶ **CONTAINERS MAY EXPLODE IN FIRE.**
- ▶ Use water spray to keep fire-exposed containers cool and to suppress vapors.
- ▶ Vapors may travel to a source of ignition and flash back.
- ▶ **Hydrogen Cyanide** may form an ignitable vapor/air mixture in closed tanks or containers.

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 **Hydrogen Cyanide** *liquid* or *gas* is spilled or leaked, take the following steps:

- ▶ Evacuate personnel and secure and control entrance to the area.
- ▶ Eliminate all ignition sources.
- ▶ Ventilate area of leak to disperse the gas.
- ▶ Stop flow of gas. If source of leak is a cylinder and the leak cannot be stopped in place, remove the leaking cylinder to a safe place in the open air, and repair leak or allow cylinder to empty.
- ▶ Absorb *liquids* in dry sand, earth, or a similar material and place into sealed containers for disposal.
- ▶ Keep **Hydrogen Cyanide** out of confined spaces, such as sewers, because of the possibility of an explosion.
- ▶ Ventilate area of spill or leak and use water spray to dilute and foam to suppress vapors.
- ▶ DO NOT wash into sewer.
- ▶ It may be necessary to contain and dispose of **Hydrogen Cyanide** 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 **Hydrogen Cyanide** you should be trained on its proper handling and storage.

- ▶ *Anhydrous* and *Unstabilized Hydrogen Cyanide* are severe explosion hazards and can polymerize violently, resulting in fires and explosions.
- ▶ **Hydrogen Cyanide** can polymerize explosively when exposed to ELEVATED TEMPERATURES (over 122°F or 50°C) and STRONG BASES (such as SODIUM HYDROXIDE, CALCIUM HYDROXIDE, AMMONIA, AMINES and SODIUM CARBONATE).
- ▶ **Hydrogen Cyanide** reacts violently with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC).
- ▶ **Hydrogen Cyanide** *solutions* containing more than 4 to 5% water are less stable than the anhydrous (dry) form and can self react and/or form explosive mixtures in air.
- ▶ Store in tightly closed containers in a cool, well-ventilated area away from HEAT and store with a stabilizer (such as *Phosphoric Acid*).
- ▶ Sources of ignition, such as smoking and open flames, are prohibited where **Hydrogen Cyanide** is used, handled, or stored.
- ▶ Metal containers involving the transfer of **Hydrogen Cyanide** should be grounded and bonded.

- ▶ Use explosion-proof electrical equipment and fittings wherever **Hydrogen Cyanide** is used, handled, manufactured, or stored.
- ▶ Use only non-sparking tools and equipment, especially when opening and closing containers of **Hydrogen Cyanide**.

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: HYDROGEN CYANIDE

Synonyms: Formonitrile; Hydrocyanic Acid; Prussic Acid

CAS No: 74-90-8

Molecular Formula: HCN

RTK Substance No: 1013

Description: Colorless to pale blue liquid below 78°F (26°C), and a colorless gas at higher temperatures, with a distinct bitter almond or stinky sneaker odor

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
<p>4 - Health</p> <p>4 - Fire</p> <p>1 - Reactivity</p> <p>DOT#: UN 1051 (Anhydrous; Stabilized)</p> <p>ERG Guide #: 117</p> <p>Hazard Class: 6.1 (Poison)</p>	<p>FLAMMABLE LIQUID and GAS.</p> <p>Stop flow of gas or allow to burn. DO NOT attempt to extinguish fire unless flow can be stopped. Shut off supply or let burn.</p> <p>Use dry chemical, CO₂, water spray, alcohol-resistant foam or other foam as extinguishing agents.</p> <p>POISONOUS GASES ARE PRODUCED IN FIRE, including <i>Nitrogen Oxides</i>.</p> <p>CONTAINERS MAY EXPLODE IN FIRE.</p> <p>Use water spray to keep fire-exposed containers cool and to suppress vapors.</p> <p>Vapors may travel to a source of ignition and flash back.</p> <p>Hydrogen Cyanide may form an ignitable vapor/air mixture in closed tanks or containers.</p>	<p><i>Anhydrous and Unstabilized Hydrogen Cyanide</i> are severe explosion hazards and can polymerize violently, resulting in fires and explosions.</p> <p>Hydrogen Cyanide can polymerize explosively when exposed to ELEVATED TEMPERATURES (over 122°F or 50°C) and STRONG BASES (such as SODIUM HYDROXIDE, CALCIUM HYDROXIDE, AMMONIA, AMINES and SODIUM CARBONATE).</p> <p>Hydrogen Cyanide reacts violently with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC).</p> <p>Hydrogen Cyanide solutions containing more than 4 to 5% water are less stable than the anhydrous (dry) form and can self react and/or form explosive mixtures in air.</p>

SPILL/LEAKS

Isolation Distance:

Spill (small): 60 meters (200 feet)

Spill (large): 400 meters (1,250 feet)

Fire: 800 meters (1/2 mile)

Stop flow of gas. If source of leak is a cylinder and the leak cannot be stopped in place, remove the leaking cylinder to a safe place in the open air, and repair leak or allow cylinder to empty.

Absorb liquids in dry sand, earth, or a similar material and place into sealed containers for disposal.

Use foam to suppress vapors.

DO NOT wash into sewer.

Bond and ground all containers when transferring **Hydrogen Cyanide** and use only non-sparking tools and equipment.

Hydrogen Cyanide is very toxic to aquatic organisms.

PHYSICAL PROPERTIES

Odor Threshold:	2 to 10 ppm
Flash Point:	0°F (-18°C)
LEL:	5.6%
UEL:	40%
Auto Ignition Temp:	1,000°F (538°C)
Vapor Density:	0.94 (gas) (air = 1)
Vapor Pressure:	630 mm Hg at 68°F (20°C)
Specific Gravity:	0.7 (water = 1)
Water Solubility:	Soluble
Boiling Point:	78°F (26°C)
Melting Point:	7°F (-13.3°C)
Ionization Potential:	13.6 eV
Molecular Weight:	27

EXPOSURE LIMITS

OSHA: 10 ppm, 8-hr TWA

NIOSH: 4.7 ppm, Ceiling

ACGIH: 4.7 ppm, Ceiling

IDLH: 50 ppm

The Protective Action Criteria values are:

PAC-1 = 2 ppm PAC-2 = 7.1ppm PAC-3 = 15 ppm

PROTECTIVE EQUIPMENT

Gloves:	Nitrile and Neoprene (>8-hr breakthrough for <i>liquid Hydrogen Cyanide</i>)
Coveralls:	Tychem® TK (>8-hr breakthrough for <i>gaseous and liquid Hydrogen Cyanide</i>)
Respirator:	SCBA

HEALTH EFFECTS

Eyes:	Irritation and burns
Skin:	Irritation and burns (skin absorbable)
Inhalation:	Flushing of the face, chest tightness, headache, nausea and vomiting, weakness and shortness of breath

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, while rinsing.

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

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

Transfer to a medical facility.

Use *Amyl Nitrite* capsules if symptoms develop.