Right to Know
Hazardous Substance Fact Sheet

Common Name: **DIBORANE**

Synonyms: Boroethane; Boron Hydride

Chemical Name: Diborane

Date: January 2009 Revision: April 2017

CAS Number: 19287-45-7

RTK Substance Number: 0629

DOT Number: UN 1911

EMERGENCY RESPONDERS >>>> SEE BACK PAGE

Description and Use

Diborane is a colorless gas with a sickly, sweet odor. It is usually shipped in pressurized cylinders diluted with *Hydrogen*, *Argon*, *Nitrogen* or *Helium*. **Diborane** is used as a reducing agent for making other chemicals, as a catalyst, and in electronics and vulcanizing rubber.

- **ODOR THRESHOLD = 1.8 - 3.5 ppm**
- Odor thresholds vary greatly. Do not rely on odor alone to determine potentially hazardous exposures.

Reasons for Citation

- **Diborane** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH, DEP, 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.

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.
- Medical observation is recommended for 24 to 48 hours after overexposure, as pulmonary edema may be delayed.

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

Hazard Summary

Hazard Rating	NJDOH	NFPA
HEALTH	-	4
FLAMMABILITY	-	4
REACTIVITY	-	3 ~~W~~

FLAMMABLE AND REACTIVE
POISONOUS GASES ARE PRODUCED IN FIRE
CYLINDERS MAY EXPLODE IN FIRE
DO NOT USE WATER OR HALOGENATED AGENTS

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

- **Diborane** can affect you when inhaled.
- Contact can irritate the skin and eyes.
- Exposure to **Diborane** can irritate the nose and throat.
- **Diborane** can cause headache, dizziness, nausea and vomiting, tremor and confusion.
- Inhaling **Diborane** can irritate the lungs. Higher exposures may cause a build-up of fluid in the lungs (pulmonary edema), a medical emergency.
- High exposure may damage the liver, kidneys and nervous system.
- **Diborane** is FLAMMABLE and REACTIVE and a DANGEROUS FIRE and EXPLOSION HAZARD.

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **0.1 ppm** averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit (REL) is **0.1 ppm** averaged over a 10-hour workshift.

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

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 and Senior Services Hazardous Substance Fact Sheet, available on the RTK Program website (http://nj.gov/health/workplacehealthandsafety/right-to-know/) 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, 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 and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) 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) requires private 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 **Diborane**:

- Contact can irritate the skin and eyes.
- Exposure to **Diborane** can irritate the nose and throat.
- **Diborane** can cause headache, dizziness, nausea and vomiting, tremor, muscle weakness, convulsions and confusion.
- Inhaling **Diborane** can irritate the lungs causing coughing and/or shortness of breath. Higher exposures may cause a build-up of fluid in the lungs (pulmonary edema), a medical emergency, with severe shortness of breath.

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

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

Other Effects
- **Diborane** can irritate the lungs. Repeated exposure may cause bronchitis to develop with coughing, phlegm, and/or shortness of breath.
- High exposure may damage the liver, kidneys and nervous system.

Medical

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

- Lung function tests

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

- Consider chest x-ray after acute overexposure
- Liver and kidney function tests
- 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
- Smoking can cause heart disease, lung cancer, emphysema, and other respiratory problems. It may worsen respiratory conditions caused by chemical exposure. Even if you have smoked for a long time, stopping now will reduce your risk of developing health problems.
- More than light alcohol consumption can cause liver damage. Drinking alcohol can increase the liver damage caused by **Diborane**.

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:

- Specific actions are required for this chemical by OSHA. Refer to the OSHA *Compressed Gases* Standard (29 CFR 1910.101).
- Before entering a confined space where **Diborane** may be present, check to make sure that an explosive concentration does not exist.

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 **Diborane**. 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.
- Manufacturers of **Diborane** recommend Plastic, Butyl or Rubber gloves for exposures of less than one hour, and Tychem® BR, LV, Responder® and TK, or the equivalent, as protective materials for clothing.
- 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.
- 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 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.
- Exposure to **15 ppm** is immediately dangerous to life and health. If the possibility of exposure above **15 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).

- **Diborane** is a FLAMMABLE AND REACTIVE GAS that can ignite on contact with AIR.
- Stop flow of gas and allow to burn out or use dry chemical or *liquid Nitrogen* as extinguishing agents.
- DO NOT USE WATER OR HALOGENATED AGENTS to extinguish fire as fires and explosions will occur.
- POISONOUS GASES ARE PRODUCED IN FIRE, including *Hydrogen*, *Boric Acid*, and *Boric Oxide*.
- CYLINDERS MAY EXPLODE IN FIRE.
- Use water spray only 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 **Diborane** is leaked, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate 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.
- Use water spray only to keep cylinders cool.
- Keep **Diborane** out of confined spaces, such as sewers, because of the possibility of an explosion.
- It may be necessary to contain and dispose of **Diborane** 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 **Diborane** you should be trained on its proper handling and storage.

- **Diborane** will ignite spontaneously in MOIST AIR at room temperature and will react with WATER, ALCOHOLS, and HALOGENATED COMPOUNDS (such as CARBON TETRACHLORIDE and TRICHLOROETHYLENE) to generate flammable and explosive *Hydrogen gas* and shock-sensitive mixtures.
- **Diborane** reacts explosively with BENZENE VAPOR; NITRIC ACID; TETRAVINYL LEAD; DIMETHYL SULFOXIDE; and OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE).
- **Diborane** will react with AMMONIA; METAL OXIDES; REDUCING AGENTS (such as LITHIUM, SODIUM, ALUMINUM and their HYDRIDES); and other READILY OXIDIZABLE MATERIALS to form *Hydrides* which may ignite spontaneously in air.
- Store in tightly closed containers in a cool, well-ventilated area away from MOISTURE, RUBBER, and ELASTOMERS.
- Sources of ignition, such as smoking and open flames, are prohibited where **Diborane** is used, handled, or stored.
- Metal containers involving the transfer of **Diborane** should be grounded and bonded.
- Use explosion-proof electrical equipment and fittings wherever **Diborane** is used, handled, manufactured, or stored.
- Use only non-sparking tools and equipment, especially when opening and closing containers of **Diborane**.

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 Program
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.nj.gov
Web address:
http://nj.gov/health/workplacehealthandsafety/right-to-know/

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.

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/m^3 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 *Hydrogen*), 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.

Right to Know Hazardous Substance Fact Sheet

Emergency Responders Quick Reference

Common Name: **DIBORANE**

Synonyms: Boroethane; Boron Hydride
CAS No: 19287-45-7
Molecular Formula: B_2H_6
RTK Substance No: 0629
Description: Colorless gas with a sickly, sweet odor which is usually shipped in pressurized cylinders diluted with *Hydrogen*, *Argon*, *Nitrogen* or *Helium*

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
4 - Health **4 - Fire** **3 ~~W~~ - Reactivity** **DOT#:** UN 1911 **ERG Guide #:** 119 **Hazard Class:** 2.3 (Poisonous Gas)	FLAMMABLE AND REACTIVE GAS that can ignite on contact with AIR. Stop flow of gas and allow to burn out or use dry chemical or *liquid Nitrogen* as extinguishing agents. DO NOT USE WATER or HALOGENATED AGENTS to extinguish fire as fires and explosions will occur. POISONOUS GASES ARE PRODUCED IN FIRE, including *Hydrogen*, *Boric Acid*, and *Boric Oxide*. CYLINDERS MAY EXPLODE IN FIRE. Use water spray only to keep fire-exposed containers cool.	**Diborane** will ignite spontaneously in MOIST AIR at room temperature and will react with WATER, ALCOHOLS, and HALOGENATED COMPOUNDS (such as CARBON TETRACHLORIDE and TRICHLOROETHYLENE) to generate flammable and explosive *Hydrogen gas* and shock-sensitive mixtures. **Diborane** reacts explosively with BENZENE VAPOR; NITRIC ACID; TETRAVINYL LEAD; DIMETHYL SULFOXIDE; and OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE). **Diborane** will react with AMMONIA; METAL OXIDES; REDUCING AGENTS (such as LITHIUM, SODIUM, ALUMINUM and their HYDRIDES); and other READILY OXIDIZABLE MATERIALS to form *Hydrides* which may ignite spontaneously in air.

SPILL/LEAKS

Isolation Distance:
Small Spill: 60 meters (200 feet)
Large Spill: 300 meters (1,000 feet)
Fire: 1,600 meters (1 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.

Keep **Diborane** out of confined spaces, such as sewers, because of the possibility of an explosion.

Use only non-sparking tools and equipment, especially when opening and closing containers of **Diborane**.

PHYSICAL PROPERTIES

Odor Threshold:	1.8 to 3.5 ppm
Flash Point:	-130°F (-90°C)
LEL:	0.8%
UEL:	98%
Auto Ignition Temp:	104° to 122°F (40° to 50°C)
Vapor Density:	0.96 (air = 1)
Vapor Pressure:	224 mm Hg at -170°F (-112°C)
Specific Gravity:	0.2 to 0.4 (water = 1)
Water Solubility:	Decomposes
Boiling Point:	-135°F (-93°C)
Melting Point:	-265°F (-165°C)
Ionization Potential:	11.4 eV
Molecular Weight:	27.7

EXPOSURE LIMITS

OSHA:	0.1 ppm, 8-hr TWA
NIOSH:	0.1 ppm, 10-hr TWA
ACGIH:	0.1 ppm, 8-hr TWA
IDLH LEVEL:	15 ppm
PAC LEVELS:	PAC-1 = 0.3 ppm; PAC-2 = 1.0 ppm; PAC-3 = 3.7 ppm

PROTECTIVE EQUIPMENT

Gloves:	Plastic, Butyl or Rubber (<1-hr breakthrough)
Coveralls:	Tychem® BR, LV, Responder® and TK (>8-hr breakthrough)
Respirator:	>0.1 ppm – Pressure demand supplied air
	>15 ppm – Pressure demand SCBA

HEALTH EFFECTS

Eyes:	Irritation
Skin:	Irritation
Inhalation:	Nose, throat and lung irritation with coughing and severe shortness of breath (pulmonary edema)
	Headache, dizziness, nausea, vomiting, tremor, convulsions and confusion

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.
Medical observation is recommended as symptoms may be delayed.