



Right to Know Hazardous Substance Fact Sheet

Common Name: **ARSINE**

Synonyms: Arsenic Hydride; Hydrogen Arsenide

Chemical Name: Arsine

Date: June 1998 Revision: February 2008

CAS Number: 7784-42-1

RTK Substance Number: 0163

DOT Number: UN 2188

Description and Use

Arsine is a colorless gas with a garlic-like odor. It is used in making electronic components, in organic synthesis, in making lead acid storage batteries, and as a military poison gas.

Exposure to **Arsine** often occurs when **Arsine** is formed as a by-product of a chemical reaction between *Arsenic*, or a *Base Metal* containing *Arsenic impurities*, and an *acid* or *strong alkali* (*base*).

Reasons for Citation

- ▶ **Arsine** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH, NTP, DEP, IARC, 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

- ▶ Immerse affected part in warm 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.
- ▶ 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

EMERGENCY RESPONDERS >>>> SEE BACK PAGE

Hazard Summary

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

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

- ▶ **Arsine** can affect you when inhaled.
- ▶ **Arsine** is a CARCINOGEN. HANDLE WITH EXTREME CAUTION.
- ▶ Skin and eye contact with liquid can cause frostbite.
- ▶ Inhaling **Arsine** can irritate the lungs. Higher exposures may cause a build-up of fluid in the lungs (pulmonary edema), a medical emergency.
- ▶ High exposure to **Arsine** can destroy red blood cells (hemolysis), causing anemia.
- ▶ Repeated exposure may damage the kidneys and affect liver function.
- ▶ **Arsine** may damage the nervous system.
- ▶ **Arsine** is FLAMMABLE and REACTIVE and a DANGEROUS FIRE and EXPLOSION HAZARD.

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **0.05 ppm** averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit (REL) is **0.0006 ppm**, which should not be exceeded at any time.

ACGIH: The threshold limit value (TLV) is **0.005 ppm** averaged over an 8-hour workshift.

- ▶ **Arsine** is 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, 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 **Arsine**:

- ▶ Skin and eye contact with liquid can cause frostbite.
- ▶ Inhaling **Arsine** 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.
- ▶ High exposure to **Arsine** can destroy red blood cells (hemolysis), causing anemia with headache, weakness, nausea, vomiting, and abdominal pain. Acute kidney failure may follow, resulting in death.

Chronic Health Effects

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

Cancer Hazard

- ▶ **Arsine** is a CARCINOGEN in humans. There is evidence that *inorganic Arsenic compounds* cause liver, kidney, lung and bladder cancer.
- ▶ Many scientists believe there is no safe level of exposure to a carcinogen.

Reproductive Hazard

- ▶ While **Arsine** has not been identified as a teratogen or a reproductive hazard, *Arsenic* and certain *Arsenic compounds* are teratogens and may also cause reproductive damage, such as reduced fertility and interference with menstrual cycles. **Arsine** should be handled WITH EXTREME CAUTION.

Other Effects

- ▶ Repeated exposure may damage the kidneys and affect liver function.
- ▶ High or repeated exposure may damage the nerves, causing weakness, "pins and needles," and poor coordination in the arms and legs.

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
- ▶ Kidney function tests
- ▶ Test for urine *Arsenic*. This is most accurate at the end of the workday. Eating shellfish or fish may elevate *Arsenic* levels for up to two days. At NIOSH recommended exposure levels, urine *Arsenic* should not be greater than **100 micrograms per liter** of urine.

If symptoms develop or overexposure occurs, repeat the preceding tests as soon as possible. Also consider:

- ▶ Chest x-ray after acute overexposure
- ▶ Exam of the nervous system
- ▶ Liver function tests

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 may increase the liver damage caused by **Arsine**.

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 engineering controls are required for this chemical by OSHA. Refer to the OSHA *Compressed gases* Standard (29 CFR 1910.101).
- ▶ Before entering a confined space where **Arsine** 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 **Arsine**. 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.
- ▶ **Arsine** manufacturers recommend insulated materials with *Teflon*® inner gloves and safety equipment manufacturers recommend DuPont *Tychem*® BR, LV, *Responder*® and TK; Kappler *Zytron*® 500; and Saint-Gobain *ONESuit*®TEC, or equivalent, as protective materials for clothing.

- ▶ Where exposure to cold equipment, vapors, or liquid may occur, employees should be provided with special clothing designed to prevent the freezing of body tissues.
- ▶ 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.

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 **0.0006 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 **3 ppm** is immediately dangerous to life and health. If the possibility of exposure above **3 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).

- ▶ **Arsine** is a FLAMMABLE GAS.
- ▶ Stop flow of gas or allow fire to burn itself out.
- ▶ POISONOUS GASES ARE PRODUCED IN FIRE, including *Arsenic Oxide* and *Arsenic Trioxide*.
- ▶ CONTAINERS MAY VENT RAPIDLY AND EXPLODE IN FIRE.
- ▶ Use water spray to keep fire-exposed containers cool and to "wash" the *aerosol particulate* from the air.
- ▶ 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 **Arsine** is leaked, take the following steps:

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

- ▶ **Arsine** reacts with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE), STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC); POTASSIUM; and AMMONIA.
- ▶ Store in tightly closed containers in a cool, well-ventilated area away from LIGHT and MOISTURE.
- ▶ Sources of ignition, such as smoking and open flames, are prohibited where **Arsine** is used, handled, or stored.
- ▶ Metal containers involving the transfer of **Arsine** should be grounded and bonded.
- ▶ Use explosion-proof electrical equipment and fittings wherever **Arsine** is used, handled, manufactured, or stored.
- ▶ A continuous monitoring analytical system with an alarm should be installed.

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 (AEGs) 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 are intended to 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 maintained by federal EPA. The database contains information on human health effects that may result from exposure to various chemicals in the environment.

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.

PIH is a DOT designation for chemicals which are Poison Inhalation Hazards.

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

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 measure of how readily a liquid or a solid mixes with air at its surface. A higher vapor pressure indicates a higher concentration of the substance in air and therefore increases the likelihood of breathing it in.

Common Name: **ARSINE**

Synonyms: Arsenic Hydride; Hydrogen Arsenide

CAS No: 7784-42-1

 Molecular Formula: AsH₃

RTK Substance No: 0163

Description: Colorless gas with a garlic-like odor

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
4 - Health 4 - Fire 2 - Reactivity DOT#: UN 2188 ERG Guide #: 119 Hazard Class: 2.3 (Toxic gas)	FLAMMABLE GAS Stop flow of gas or allow fire to burn itself out. POISONOUS GASES ARE PRODUCED IN FIRE, including <i>Arsenic Oxide</i> and <i>Arsenic Trioxide</i> . CONTAINERS MAY VENT RAPIDLY AND EXPLODE IN FIRE. Use water spray to keep fire-exposed containers cool and "wash" the aerosol particulate from the air. Vapor is heavier than air and may travel a distance to cause a fire or explosion far from the source.	Arsine reacts with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC); POTASSIUM; and AMMONIA.

SPILL/LEAKS
Isolation Distance:

Small Spills: 60 meters (200 feet)

Large Spills: 420 meters (1,400 feet)

Fire: 9.5 km (5.9 miles)

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

 Can contaminate ground water with *Arsenic Trioxide*
 if water is used during a fire.

PHYSICAL PROPERTIES

Odor Threshold:	Does not provide adequate warning
Flash Point:	Flammable
LEL:	5.1%
UEL:	78%
Vapor Density:	2.7 (air = 1)
Vapor Pressure:	11,000 mm Hg at 68°F (20°C)
Specific Gravity:	2.69 (water = 1)
Water Solubility:	Soluble
Boiling Point:	-67°F (-55°C)
Ionization Potential:	9.89 eV
Molecular Weight:	77.95

EXPOSURE LIMITS
OSHA: 0.05 ppm, 8-hr TWA

NIOSH: 0.0006 ppm, Ceiling (15-min)

ACGIH: 0.005 ppm, 8-hr TWA

IDLH: 3 ppm

PROTECTIVE EQUIPMENT

Gloves:	Teflon® (inner glove); insulated (outer glove)
Coveralls:	DuPont Tychem® BR, LV, Responder® and TK; Kappler Zytron® 500; and Saint-Gobain ONESuit®TEC (>8-hr breakthrough)
Respirator:	>0.0006 ppm - Supplied air

HEALTH EFFECTS
Eyes: Contact with liquid can cause frostbite

Skin: Contact with liquid can cause frostbite

Inhalation: Lung irritation with coughing and/or
 shortness of breath

Chronic: *Inorganic Arsenic compounds* cause
 liver, kidney, lung and bladder cancer
 in humans

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.

Immerse affected part in warm water.

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

Transfer to a medical facility.

Medical observation is recommended as symptoms may be delayed.