

# Arsine and Stibine

## General information

### Key Points

#### Fire

- Extremely flammable
- Arsine and stibine react with strong oxidants. Stibine reacts with chlorine and concentrated nitric acid
- Arsine emits toxic fumes of arsenic when heated to decomposition
- In the event of a fire involving arsine or stibine, use fine water spray and liquid and gas tight chemical protective clothing with breathing apparatus

#### Health

- Toxic by inhalation
- Arsine is very toxic, stibine is harmful
- The health effects of arsine and stibine are similar and are characterised by damage to the red blood cells (haemolysis)
- The onset of symptoms following short-term exposure may be delayed for several hours
- Short-term inhalation of arsine or stibine may cause weakness, headache, drowsiness, sickness, anaemia, abdominal pain, shortness of breath, yellow skin and eyes and red urine
- The effect of long-term exposure is thought to cause similar symptoms as short-term exposure
- Arsine is not thought to cause damage to the unborn child

#### Environment

- Dangerous for the environment
- Inform Environment Agency of substantial incidents

## Background

Arsine is a colourless, non-irritating gas with a mild garlic-like odour. It is formed when arsenic or arsenic-containing compounds react with acid or water. Arsine is extremely flammable and is soluble in water. Other names for arsine include arsenic hydride or arsenic trihydride.

Stibine is also a colourless gas with a disagreeable odour that resembles rotten eggs. It is produced when antimony or antimony-containing compounds react with an acid or water. Other names for stibine include antimony hydride or antimony trihydride.

Both arsine and stibine are used in the semiconductor industry to manufacture microchips. Industrial processes, including welding, soldering, refining, galvanising and etching may lead to the accidental formation of arsine or stibine. Overcharging of lead storage batteries can also lead to the production of arsine and stibine.

Exposure to arsine or stibine is most likely to occur in an occupational setting where they are used or accidentally formed during industrial processes. Arsine and stibine are not used domestically; therefore exposure in the home is unlikely.



When breathed in, arsine and stibine enter the blood via the lungs, where they damage red blood cells. Symptoms may be delayed for several hours. Short term exposure to low to moderate levels may cause weakness, headache, drowsiness, sickness, abdominal pain, shortness of breath, yellow skin and eyes and red urine.

Exposure to high concentrations can result in loss of consciousness and death.

People who survive a short-term exposure may suffer from long term health effects including kidney damage, confusion, memory loss, and numbness and pain in the extremities.

The effects of long term exposure are similar to those observed following short term exposure.

Arsine is unlikely to cause damage to the unborn child.



## Production and Uses

### Key Points

- Arsine and stibine are used in the semiconductor industry to produce microchips

Arsine is prepared for industrial use by the reaction of aluminium arsenide with water or hydrochloric acid. It is also formed by treating arsenic compounds with acid and then subjecting them to electrolytic action. Stibine is prepared in a similar way, but the process involves using antimony compounds.

Arsine and stibine are extensively used in the semiconductor industry as doping agents. Arsine is also used as an agent in the manufacture of light-emitting diodes and glass dyes.

## Frequently Asked Questions

### **Arsine**

#### *What is arsine?*

Arsine is a colourless, non-irritating, flammable, toxic gas that has a mild garlic odour.

#### *What is arsine used for?*

Arsine is used in the semiconductor industry in the production of microchips.

#### *How does arsine get into the environment?*

Small amounts of arsine may be produced and released into the environment from natural processes involving bacteria and fungi. Arsine is also released into the air from human activities including welding and soldering.

#### *How could I be exposed to arsine?*

Exposure is most likely to occur in the workplace where arsine is used or accidentally formed.

#### *If there is arsine in the environment will I have any adverse health effects?*

The presence of arsine in the environment does not always lead to exposure. Clearly, in order for it to cause any adverse health effects you must come into contact with it. You may be exposed by breathing, eating, or drinking the substance or by skin contact. Following exposure to any chemical, the adverse health effects you may encounter depend on several factors, including the amount to which you are exposed (dose), the way you are exposed, the duration of exposure, the form of the chemical and if you were exposed to any other chemicals.

Minor to moderate exposures may result in weakness, fatigue, headache, drowsiness, shortness of breath, sickness, abdominal pain, yellow skin and eyes and red urine. Exposure to a high concentration of arsine may cause fitting loss of consciousness and may even death. Symptoms of poisoning usually develop within 1 – 24 hours following the exposure to arsine. Severely exposed individuals who survive the initial exposure may experience long term health effects including kidney damage, memory loss, confusion, and numbness and pain in the extremities.

#### *Can arsine cause cancer?*

There are no data available to assess the carcinogenicity of arsine itself. It is broken down in the body to a number of compounds some of which are recognised by the International Agency for Research on Cancer (IARC) as known human carcinogens. Prolonged exposure may therefore result in an increase in risk of cancer.

### *Does arsine affect children or damage the unborn child?*

There is no evidence to suggest that arsine, at concentrations that do not affect the mother, can affect the health of the unborn child. However, exposure to arsine during pregnancy should be avoided because of its general toxic effects.

### *What should I do if I am exposed to arsine?*

It is very unlikely that the general population will be exposed to a level of arsine high enough to cause adverse health effects.

## **Stibine**

### *What is stibine?*

Stibine is a colourless gas with a disagreeable odour that resembles rotten eggs.

### *How does stibine get into the environment?*

Stibine is released into the air from human activities including welding and soldering.

### *How will I be exposed to stibine?*

Exposure is most likely to occur in the workplace where stibine is used or accidentally formed.

### *If there is stibine in the environment will I have any adverse health effects?*

The presence of stibine in the environment does not always lead to exposure. Clearly, in order for it to cause any adverse health effects you must come into contact with it. You may be exposed by breathing, eating or drinking the substance or by skin contact. Following exposure to any chemical, the adverse health effects you may encounter depend on several factors, including the amount to which you are exposed (dose), the way you are exposed, the duration of exposure, the form of the chemical and if you were exposed to any other chemicals.

The adverse health effects associated with exposure to stibine are thought to resemble those associated with short-term exposure to arsine. Symptoms include weakness, fatigue, headache, drowsiness, shortness of breath, sickness, abdominal pain, yellow skin and eyes and red urine. Exposure to a high concentration of stibine may lead to loss of consciousness, fitting and in severe cases may lead to death.

### *Can stibine cause cancer?*

There are no data available to assess the carcinogenicity of stibine.

### *Does stibine affect children or damage the unborn child?*

There are no data available to assess the reproductive and developmental effects of stibine. Exposure to arsine during pregnancy should be avoided because of its general toxic effects.

### *What should I do if I am exposed to stibine?*

It is very unlikely that the general population will be exposed to a level of stibine high enough to cause adverse health effects.

This document will be reviewed not later than 3 years or sooner if substantive evidence becomes available.