**Risk assessment for use of diborane in the diamond lab**

Risks associated with the hot filament reactor are the same as for the other hot filament reactor, with the additions of these for use of diborane.

***Remember!***

1. Diborane is toxic and explosive, and has its own tickbox on the Risk assessment checklist. Ensure you are familiar with this (see below) before using diborane.
2. This cylinder is 5% diborane in H2, so is not as toxic or explosive as pure diborane, but it should still be treated as very hazardous, and it should never be allowed to be in contact with air.
3. ***No person (undergrad, PhD student or postdoc) is allowed to use this cylinder without express permission and training***. Training is given by Paul May, James Smith or Keith Rosser.
4. Ensure gas lines are vacuum-tight and leak-free before use – especially if this system hasn’t been used for more than a week. Pump out all gas lines back to cylinder regulator before use, to prevent contamination by air.
5. When making up diborane dilutions, follow the written procedure *exactly*. Do *not* do this from memory.
6. If filling the removable cylinder, ensure it is pumped down to base pressure before filling with diborane. This may take overnight.
7. The insides of the hot filament chamber will become boron contaminated. Use gloves when touching any component of the chamber.

**General information about Diborane Risks**

Risk Category: C or Bu

Hazards: - FLAMMABLE - TOXIC

Use in conjunction with the Risk Assessment form for [Toxic, Explosive and Flammable Gases](http://www.chm.bris.ac.uk/safety/exgas.htm).

* Highly toxic by inhalation.
* Contact with air or halogenated compounds results in fires and explosions

**Properties of Diborane**

* Diborane is a colourless gas.
* Boiling point is -93°C.
* Melting point is -165°C.
* Vapour Density is 0.96 (air = 1.0). Diborane gas is lighter than air.
* Flash Point is -90°C.
* Auto-ignition temperature is 38°C to 52°C.
* Exposure limit is 0.1 p.p.m (see references).
* The odour of diborane cannot be detected below the permissible exposure limit.
* Diborane is a flammable gas that ignites spontaneously in moist air at room temperature and forms explosive mixtures with air from 0.8% up to 88% by volume. Delayed ignition may be followed by violent explosions.
* Explodes on contact with: **fluorine**; **chlorine** (to form explosive compound **dimethylsulphoxide**); halogenated hydrocarbons (*e.g*., **chloroform** and **carbon tetrachloride**); **fuming nitric acid**; **tetravinyllead**; and **nitrogen trifluoride**. Therefore, fire-extinguishing agents such as Halon or carbon tetrachloride are not recommended.
* Diborane is a strong reducing agent that produces hydrogen upon heating or upon reaction with water.

**Precautions**

* Follow the guidelines for other toxic gases outlined in Use of [Flammable, Explosive or Toxic Gases](http://www.chm.bris.ac.uk/safety/exgas.htm).
* Procedures using diborane must never be attempted by an untrained person.
* Procedures using diborane must never be attempted out of normal working hours and it is strongly advised that procedures are restricted over the lunch period when trained First Aiders may not be available.
* Procedures using diborane must never be attempted by someone working alone.
* Diborane should be used only in a fume hood free of ignition sources and should be stored in a cold, dry, well-ventilated area separated from incompatible substances and isolated from sources of sparks and open flames.
* Diborane is incompatible with aluminium, lithium, and other active metals forms metal hydrides, which may ignite spontaneously. Diborane is incompatible with oxidising agents, halogens, and halogenated compounds. Diborane will attack some forms of plastics, rubber, and coatings.
* Carbon dioxide extinguishers should be used to fight diborane fires. Fires involving diborane sometimes release toxic gases such as boron oxide smoke.

**Toxicity**

Toxicity has not been found to have significant effects on the skin and mucous membranes, but high concentrations can cause eye irritation, and contact with the liquid can cause burns. Chronic exposure to low concentrations of diborane may cause headache, light-headedness, fatigue, weakness in the muscles, and tremors. Repeated exposure may produce chronic respiratory distress, particularly in susceptible individuals. An existing dermatitis may also be worsened by repeated exposure to the liquid. Diborane has not been shown to have carcinogenic or reproductive or developmental effects in humans.

**Training**

Training by a competent person is absolutely essential before this material is used.

**Level of Risk Remaining**

Constant vigilance is required in the use of diborane but risks should be low if the procedures outlined above are followed.

**Emergency Procedures**

**Skin or Eye Contact**

* In the event of skin contact, immediately wash with soap and water and remove contaminated clothing.
* In case of eye contact, promptly wash with copious amounts of water for 15 min (lifting upper and lower lids occasionally) and obtain medical attention. If this compound is inhaled, move the person to fresh air and seek medical attention at once.

**Leakage**

* If the leak is small, attempt to close off the cylinder valve but do not endanger yourself. Eliminate all sources of ignition, ventilate and evacuate the laboratory.
* If the leak is large, evacuate the laboratory and sound the fire alarm. See "Coping with an Emergency" in the [School of Chemistry Safety Handbook](http://www.chm.bris.ac.uk/safety/handbook.htm). Respiratory protection and protective clothing may be necessary.
* Persons affected by inhalation should seek immediate medical attention.

**Fire**

* Evacuate and sound the alarms.
* Water spray may be used to cool the container and to reduce corrosive vapours, keeping in mind that if the flames are extinguished, explosive re-ignition can occur.

**References**

* See any [MSDS](http://www.chm.bris.ac.uk/safety/msds.htm) for Diborane