














## Hydrogen sulfide &amp; other sulfides

including carbon disulfide, ammonium sulfide and most metal sulfides

Substance	Hazard	Comment
<b>Hydrogen sulfide</b> Gas	 FLAMM.  TOXIC   ENVIRON. HAZ.	DANGER: extremely flammable gas; fatal if inhaled; very toxic to aquatic organisms. Mixtures of hydrogen sulfide with air containing between 4% and 45% hydrogen sulfide are explosive. For a 15-minute exposure, the concentration of the gas in the atmosphere should not exceed $14 \text{ mg m}^{-3}$ . It has a very strong smell of rotten eggs and the human nose can detect as little as $0.01 \text{ mg m}^{-3}$ . At higher concentrations it anaesthetises (deadens) the sense of smell and so the danger may not be realised. It may sometimes be found in coal mines ( <i>stinkdamp</i> ) and is produced by rotting seaweed and is the commonest cause of death in sewer workers.
<b>Hydrogen sulphide</b> Solution in water	 TOXIC	DANGER: hydrogen sulfide gas is acutely toxic by inhalation and diffuses readily from solutions. However, use of solutions of hydrogen sulfide is safer than using the gas.
<b>Carbon disulfide</b> Liquid	 FLAMM.  IRRIT.   HEALTH HAZARD	DANGER: highly flammable liquid & vapour; causes skin and serious eye irritation; suspected of damaging fertility and the unborn child; causes damage to organs through prolonged or repeated exposure. For a 15-minute exposure, the concentration of the gas in the atmosphere should not exceed $45 \text{ mg m}^{-3}$ ; flash point $-30 \text{ }^\circ\text{C}$ . Very volatile. The demonstration involving the reaction with nitrogen monoxide (the 'barking dog') is very dangerous, especially if the oxide is not pure.
<b>Ammonium sulfide</b> Solution in water	 FLAMM.  CORROS.   ENVIRON. HAZ.	DANGER (if more than 20%, ~3M): flammable liquid & vapour; causes severe skin burns & eye damage; contact with acids liberates toxic gas; very toxic to aquatic organisms. DANGER (if more than 0.4 M but less than ~3M): causes severe skin burns & eye damage; contact with acids liberates toxic gas. WARNING (if more than 0.1 M but less than 0.4M): irritating to eyes & skin; contact with acids liberates toxic gas. All the solutions are strongly alkaline. Dilute acid reacts to produce hydrogen sulfide. Absorbs carbon dioxide from the atmosphere, producing hydrogen sulfide.
<b>Sodium sulfide</b> Hydrated solid & solutions in water	 CORROS.  TOXIC   ENVIRON. HAZ.	DANGER (solid): harmful if swallowed; toxic in contact with skin; causes severe skin burns & eye damage; contact with acid liberates toxic gas; very toxic to aquatic organisms. DANGER (solution if more than 0.4M): harmful if swallowed; causes severe skin burns & eye damage; contact with acid liberates toxic gas. WARNING (solution if more than 0.1M but less than 0.4M): irritating to skin and eyes; contact with acid liberates toxic gas. All the solutions are strongly alkaline. Absorbs carbon dioxide from the atmosphere, producing hydrogen sulfide.
<b>Most metal sulfides</b> Insoluble solids	LOW HAZARD	Includes <b>copper(II) sulfide, copper pyrites, iron(II) sulfide, iron pyrites ('fool's gold'), zinc sulfide</b> . Dilute acid reacts to produce hydrogen sulfide. If heated strongly in air, may produce toxic sulfur dioxide (see CLEAPSS Student Safety Sheet 52).

**Typical control measures to reduce risk**

- If producing the gas, use the smallest amounts possible, eg no more than a few drops of acid on excess sulfide.
- Wear eye protection.
- Use a fume cupboard if adding more than a few drops of dilute acid to excess sulfide; ensure good laboratory ventilation and quickly dispose of solutions containing hydrogen sulfide.
- If smelling the gas, follow the safe technique: use your hand to waft the gas towards your nose.

**Assessing the risks**

- **What are the details of the activity to be undertaken? What are the hazards?**
- **What is the chance of something going wrong?**  
eg, a leak of gas into the laboratory from apparatus or a warmed solution.
- **How serious would it be if something did go wrong?**
- **How can the risk(s) be controlled for this activity?**  
eg, can it be done safely? Does the procedure need to be altered? Should goggles or safety spectacles be worn?

**Emergency action**

- **In the eye** Flood the eye with gently-running tap water for 10 minutes. Consult a medic.
- **Vapour breathed in** Remove the casualty to fresh air. Consult a medic if breathing is difficult.
- **Gas escape in lab.** Open all windows. If over 1 litre of gas is released, evacuate the laboratory.