# Introduction and scope

The purpose of this document is to provide health and safety information for Hydrogen Sulfide (H2S).

Hydrogen Sulfide has the chemical formula H2S with the chemical structure H-S-H. Hydrogen sulfide is a colourless, poisonous and flammable gas with the smell of rotten eggs.

The following generic Code of Practice applies to all work areas within the University of Alberta that use hydrogen sulfide gas or where hydrogen sulfide containing materials (e.g. materials from upstream oil and gas operations) are present. It outlines responsibilities, safe work procedure and training, personal protective equipment and emergency response procedure requirements. All work areas where hydrogen sulfide is used or may be present within the University of Alberta must implement the requirements identified in this Code of Practice.

1. **Purpose**

The purpose of a Code of Practice is to:

* Outline responsibilities for users of a particular chemical;
* Provide general information on the hazards and proper controls to protect employees and prevent release;
* Provide information on first aid, emergency, and decontamination procedures as applicable;
* Provide details on waste management;
* Outline monitoring and follow up requirements;
* Outline training requirements; and
* Provide contact details for further information.

# Responsibilities

Describe the role for each of the following:

* 1. **Supervisors**
* Identify research projects and experiments that use hydrogen sulfide (H2S) or where H2S may be present.
* Assess hazards associated with the use of hydrogen sulfide in the specific project or experiment.
* Implement appropriate engineering controls;
* Develop safe work procedures
* Provide the necessary personal protective equipment to address the identified hazards.
* Implement emergency response procedures that provide clear instructions on actions to take in the event of an emergency
* Train all workers that work with hydrogen sulfide so they understand the hazards associated with the use of hydrogen sulfide and the safe work procedures.
* Ensure others present in the laboratory are aware of hydrogen sulfide hazards and the emergency response procedure.
* Provide portable gas detectors and ensure they are calibrated and maintained as per manufacturer’s recommendations.
* Maintain records of all training provided.
  1. **Laboratory Personnel**
* All workers using hydrogen sulfide must participate in training and follow the established safe work procedures.
  1. **Department Heads**
* Ensure the elements identified in this Code of Practice are implemented.
* Approve safe work procedures
  1. **Environment, Health and Safety**
* Assists departments in the development of safe work procedures, training and other matters related to the health & safety of University staff.
* Provide current regulatory information updates necessary for compliance with Occupational Health & Safety legislation.
* Review laboratory-specific safe work procedures
* Review and update the Code of Practice for H2S as necessary.

# Hydrogen Sulphide Use

The most common place H2S gas found on campus is in calibration gas canisters for multi-gas detectors. The gas canisters contain 25ppm per canister and pose very little hazard to the user. More concentrated H2S gas cylinders can be found in analytical labs, especially environmental labs, which conduct analysis of metal ions. You may discover other sources of H2S gas on campus that are used for organic synthesis or precursors to metal sulfides, but most laboratories will choose to work with a less dangerous alternative. These concentrated cylinders of H2S are stored in their own enclosures with an independent exhaust and fire suppression system.

# Hazards Identification, Assessment and Control

* 1. **Health Hazards**

Hydrogen Sulfide has the chemical formula H2S with the chemical structure H-S-H. Hydrogen sulfide is a colourless, poisonous and flammable gas with the smell of rotten eggs.

It can be detected by smell at very low concentrations ranging from 0.01 – 0.3 parts per million. Detection by odour is not reliable because at high concentrations (e.g. 100 ppm), hydrogen sulfide deadens a person’s sense of smell thus make it non-detectable.

Hydrogen sulfide is very quickly absorbed into the lungs. Short term exposure may cause irritation of nose, throat, eyes and lungs. The Alberta Occupational Exposure Limit (O.E.L) is 10 parts per million (ppm) for 8 hours and 15 ppm as a ceiling limit. The Immediately Dangerous to Life and Health concentration of 100 ppm has been established by the National Institute for Occupational Safety and Health (NIOSH). Alberta Workplace Health and Safety has published a bulletin, CH029 – Hydrogen Sulphide[[1]](#footnote-1), which outlines the health effects. These effects are shown in Table 1: Health Affects from Short-Term Exposure to Hydrogen Sulphide.

**Table 1:** Health Affects from Short-Term Exposure to Hydrogen Sulfide

|  |  |  |
| --- | --- | --- |
| **Concentration (ppm)(1)** | **Health Effect** | |
| 0.01 – 0.3 | Odour Threshold | |
| 1 – 20 | Offensive odour, possible nausea, tearing of the eyes or headaches with prolonged exposure. | |
| 20 – 50 | Nose, throat and lung irritation; digestive upset and loss of appetite; sense of smell starts to become fatigued; acute conjunctivitis may occur (pain, tearing and light sensitivity) | |
| 100 – 200 | Severe nose, throat and lung irritation; ability to smell odour completely disappears. | |
| 250 – 500 | Pulmonary edema (build-up of fluid in the lungs) | |
| 500 | Severe lung irritation, excitement, headache, dizziness, staggering, sudden collapse (knockdown), unconsciousness and death within a few hours, loss of memory for the period of exposure. | |
| 500 – 1000 | Respiratory paralysis, irregular heartbeat, collapse and death without rescue. | |
| >1000 | Rapid collapse and death | |
| Notes:   1. ppm – parts per million | |  |

* 1. **Hazard Assessment**

Supervisors are required to conduct hazard assessment of the research project or experiment to identify specific hazards and implement appropriate control measures. The University’s [Hazard Assessment Form](http://www.ehs.ualberta.ca/en/EHSDivisions/SafetySystemsAndStandards/HazardManagement.aspx)  may be used to record the results of your hazard assessment.

* 1. **Hazard Controls**

A number of controls are required to handle hydrogen sulphide. In general, the following controls are required:

* Clearly indicate on the hazard signage on the laboratory door that hydrogen sulfide gas is in use in the laboratory. Indicate emergency contact information during work hours and after hours. University’s standard laboratory hazard signage can be requested from EHS by completing the [hazard sign order form](http://www.ehs.ualberta.ca/DocumentsandProcedures/PoliciesandProcedures/SetuporCloseoutaLaboratory.aspx) .
* Clearly indicate the area within the laboratory where hydrogen sulfide gas is used.
* Develop laboratory-specific safe work procedures that address the use, handling, storage, disposal of hydrogen sulfide. Include emergency response actions to be undertaken and by whom in the event of an accidental release or exposure. A [blank safe work procedure template](http://www.ehs.ualberta.ca/en/EHSDivisions/OccupationalHygieneandChemicalSafety.aspx) is available on EHS website.
* Engineering controls e.g. appropriate ventilation such as a properly functioning fume hood, ventilated gas cabinet or another type of local exhaust enclosure must be used to protect workers from potential exposures to hydrogen sulfide.
* Appropriate personal protective equipment (e.g. gloves, laboratory coat or coveralls, air-tight goggles (hydrogen sulfide gas is irritating to the eyes) must be available.
* Engineering controls such as local exhaust ventilation must be the first option to control exposures to hydrogen sulfide. If that is not possible then a full-facepiece positive pressure supplied air respirator is required for work areas where hydrogen sulfide concentrations exceed the 8-hour OEL of 10 ppm or the ceiling OEL of 15 ppm. NIOSH allows the use of air-purifying respirators for hydrogen sulfide ONLY FOR ESCAPE purposes at concentrations above 10 ppm and below 100 ppm. Workers must undergo health evaluation and fit testing before respiratory protection can be used.
* Hydrogen sulfide detectors are required in all areas that use hydrogen sulfide. All workers performing experiments involving hydrogen sulfide gas must have on them personal detectors when working with hydrogen sulfide. The detectors must be maintained and calibrated on a regularly scheduled basis as per the manufacturer’s recommendations.
* All unattended experiments must be approved by the supervisor and Department Head.
* Working alone with hydrogen sulfide is not allowed.

# Training

All workers working with hydrogen sulfide must be trained in safe use, storage, and handling of hydrogen sulfide gas. The training will include but not limited to:

* Understanding of the hazards associated with the use of hydrogen sulfide gas and the information contained in the hazard assessment documents and safe work procedures and how the hazards will be managed
* Selection, use and maintenance of the required personal protective equipment
* How to use the control measures e.g. fume hood operation and use, monitoring of scrub solution.
* Emergency response procedures to follow in the event of an accidental leak or exposure
* Use and maintenance of the H2S detectors
* Fire extinguisher use

1. Work Safe Alberta (August, 2010), Workplace Health and Safety Bulletin - Hydrogen Sulphide at the Work Site. Retrieved from https://work.alberta.ca/documents/WHS-PUB-CH029.pdf. [↑](#footnote-ref-1)