Michigan Department of Labor and Economic Opportunity
Michigan Occupational Safety and Health Administration
Consultation Education and Training Division

# HYDROGEN SULFIDE ($H_2S$)

Employers are responsible to maintain air contaminant concentrations within the limits, as required by the following occupational health air contaminant standards:

1. Part 301 (General Industry), R325.51101 *et seq*., and
2. Part 601 (Construction), R325.60151, *et seq*.

Where employees have exposures to air contaminants, the employer must provide appropriate protections and hazard communication training.

## WHAT IS HYDROGEN SULFIDE ($H_2S$)?

Hydrogen sulfide, variously known as sulferetted hydrogen and hydrogen sulfuric acid, is a colorless, flammable gas having a sweetish taste and an odor of rotten eggs. It forms naturally when sulfur-containing organic matter decays and hence may be found in confined spaces (e.g. sewers), landfill areas, gypsum mines, coal mines, railroad tunnels, oil fields, oil refineries and natural gas. It is present in certain petroleums as high as 10-12% by volume and in refinery gases as high as 50-75%. It can also be found following blasting with black powder and in chemical laboratories.

Hydrogen sulfide is highly flammable and burns in oxygen emitting sulfur dioxide and water. In a low oxygen atmosphere, water and elemental sulfur is produced. It forms an explosive mixture with oxygen between 4% and 45% by volume.

Hydrogen sulfide is a hazardous compound not only because of its toxicological properties, but more so because of its peculiar warning properties. The odor threshold, the minimum concentration producing a faint odor, is in the parts per billion range in air. However, continued exposure results in a loss of sensitivity of smell and exposure continues without apparent discomfort until acute poisoning occurs. At concentrations greater than 150-200 ppm, olfactory nerve paralysis occurs and the warning odor disappears. If a worker detects the odor of hydrogen sulfide from an uncontrolled source, the area should be evacuated until the source and concentration are determined

## WHAT ARE THE HEALTH EFFECTS OF $H_2S$?

When inhaled, hydrogen sulfide is absorbed through the lungs and is mainly eliminated via the same route. A small amount is excreted through the urine. Absorption through the skin is possible, but at too slow a rate to produce poisoning.

Hydrogen sulfide poisoning may be acute or subacute.

Subacute Poisoning: $H_2S$ poisoning is primarily manifested by swollen eyelids, itchiness, smarting, pain, blurring of vision and possible irritation of the eyes and respiratory tract.

Acute Poisoning: $H_2S$ acts on the nervous system. In low concentrations, it has depressant effects. In higher concentrations, it has a stimulating action and in very high concentrations (400-700 ppm), it paralyzes the respiratory center causing cessation of respiration. Unconsciousness may occur suddenly without warning or pain and the heart may continue to beat 5-10 minutes after breathing has stopped. The victim dies of asphyxiation.

## ARE THERE LEGAL EMPLOYEE EXPOSURE LIMITS RELATED TO $H_2S$?

For General Industry, the primary limit is an eight hour Time-Weighted Average (TWA). Other limits are a Short Term Exposure Limit (STEL) and a Ceiling limit (C). For Construction, the primary limit is called the Maximum Allowable Concentration (MAC). The exposure limits for H2S are listed below. Specific sampling equipment is necessary to test the air and determine an employee's exposure to air contaminants.

**MIOSHA Part 301 Air Contaminants for General Industry, Rule 8, Table G-1-A**
**Time-Weighted Average (TWA) = 10 ppm** (parts per million parts of air)

**Short Term Exposure Limit (STEL) = 15 ppm**

**MIOSHA Part 601 Air Contaminants for Construction, Rule 5, Table 3**
**Maximum Allowable Concentration (MAC) = 10 ppm**

**WHAT IF AIR SAMPLING SHOWS EXPOSURE CONCENTRATIONS ABOVE THE LEGAL EXPOSURE LIMITS?**

The exposure limits listed above must not be exceeded. If they are exceeded, control measures must be implemented to reduce employee exposure. Adequate general or local exhaust ventilation should be utilized to minimize employee exposure. If engineering control measures are not feasible or interim protection is needed, the use of respiratory protection can be evaluated as well.

**References:**

Part 301 Air Contaminants for General Industry

Part 601 Air Contaminants for Construction

Parts 90/490, Permit-Required Confined Spaces

Note: This guide is intended for the benefit of the public and may not contain all of the information pertinent to a specific hazard and/or control of exposure. For further information, consult MIOSHA, Consultation Education and Training Division, 530 W. Allegan Street, P.O. Box 30643, Lansing, Michigan 48909-8143. Telephone: (517) 284-7720.