I. RECOMMENDATIONS FOR A HYDROGEN SULFIDE STANDARD

The National Institute for Occupational Safety and Health (NIOSH) recommends that worker exposure to hydrogen sulfide in the workplace be controlled by adherence to the following sections. The standard is designed to protect the health and to provide for the safety of employees for up to a 10-hour work shift, 40-hour workweek, over a working lifetime. Compliance with all sections of the standard should prevent adverse effects of hydrogen sulfide on the health and safety of workers. Techniques recommended in the standard are valid, reproducible, and available to industry and government agencies. Sufficient technology exists to permit compliance with the recommended standard. The criteria and standard will be subject to review and revision as necessary.

Hydrogen sulfide is a nearly ubiquitous, acute acting toxic substance. It is a leading cause of sudden death in the workplace. Brief exposures to hydrogen sulfide at high concentrations have caused conjunctivitis and keratitis, and exposures at very high concentrations, have caused unconsciousness, respiratory paralysis, and death. Conclusive evidence of adverse health effects from repeated, long-term exposure to hydrogen sulfide at low concentrations was not found. However, there is some evidence that hydrogen sulfide alone at low concentrations or in combination with other chemical substances (eg, hydrocarbons or carbon disulfide) has caused nervous-system, cardiovascular, and gastrointestinal disorders, and effects on the eyes.

Hydrogen sulfide is especially dangerous when it occurs in low-lying areas or confined workspaces or when it exists in high concentrations under

pressure. As a result, work practices, such as continuous monitoring and the use of specified respiratory protective equipment in certain work situations, are of great importance.

"Hydrogen sulfide" refers to either the gaseous or liquid forms of the compound. Synonyms for hydrogen sulfide include hydrosulfuric acid, sulfurated hydrogen, sulfur hydride, rotten-egg gas, and stink damp. "Occupational exposure to hydrogen sulfide" refers to any workplace situation in which hydrogen sulfide is stored, used, produced, or may be evolved as a consequence of the process. All sections of this standard shall apply where there is occupational exposure to hydrogen sulfide.

Section 1 - Environmental (Workplace Air)

(a) Concentration

Exposure to hydrogen sulfide shall be controlled so that no employee is exposed to hydrogen sulfide at a ceiling concentration greater than 15 mg of hydrogen sulfide per cubic meter of air (15 mg/cu m or approximately 10 ppm), as determined with a sampling period of 10 minutes, for up to a 10-hour work shift in a 40-hour workweek. Evacuation of the area shall be required if the concentration of hydrogen sulfide equals or exceeds 70 mg/cu m.

(b) Sampling and Analysis

Procedures for sampling and analysis of workplace air for the ceiling limit shall be as provided in Appendices I and II or by any other methods shown to be at least equivalent in precision, accuracy, and sensitivity to the methods specified.

Monitoring for the evacuation limit shall be as provided in Appendix III, or by any method shown to be at least equivalent in accuracy, reliability, sensitivity, and speed to that specified.

Section 2 - Medical

Medical surveillance shall be made available as outlined below to all workers subject to occupational exposure to hydrogen sulfide.

(a) Preplacement examinations shall include at least:

(1) Comprehensive medical and work histories with special emphasis directed to symptoms related to the eyes and the nervous and respiratory systems.

(2) Physical examination giving particular attention to the eyes and to the nervous and respiratory systems.

(3) A judgment of the worker's ability to use positive and negative pressure respirators.

(b) Periodic examinations shall be made available at least every 3 years to any workers who have been exposed to hydrogen sulfide above the recommended ceiling limit and shall include:

(1) Interim medical and work histories.

(2) Physical examination as described for the preplacement examination.

(c) During examinations, applicants or employees having medical conditions which would be directly or indirectly aggravated by exposure to hydrogen sulfide shall be counseled on the increased risk of impairment of

their health from working with this substance and on the value of periodic physical examinations.

(d) Initial medical examinations shall be made available to all workers within 6 months after the promulgation of a standard based on these recommendations.

(e) In the event of adverse effect or illness known or suspected to be caused by exposure to hydrogen sulfide, a physical examination, as described above for preplacement, shall be made available.

(f) If an emergency involving hydrogen sulfide arises, rescuers using respiratory protection shall remove victims to a safe area quickly and initiate appropriate first aid, including artificial respiration if necessary. The victim's lungs should first be cleared of hydrogen sulfide by applying back-pressure artificial respiration briefly before using the more effective mouth-to-mouth artificial respiration. Provision shall be made for prompt transportation to hospital of workers exposed to hydrogen sulfide who have become unconscious, who have respiratory distress, or who feel unwell. Appropriate local hospitals and medical and paramedical personnel shall be informed by the employer of the possibility of hydrogen sulfide poisoning, even if the chance of emergency is considered remote. Workers sent to the hospital because of hydrogen sulfide exposure shall be identified as such to emergency-room personnel. A qualified medical attendant designated by the employer shall examine all employees who may have been exposed above the occupational exposure limits. Written emergency medical procedures shall be posted where hydrogen sulfide is used.

(g) Pertinent medical records shall be maintained for all employees who are involved in the manufacturing, processing, or handling of hydrogen sulfide or are in any other way exposed to it in the workplace. Such records shall be kept for at least 30 years after termination of employment. These records shall be made available to the designated medical representatives of the Secretary of Health, Education, and Welfare, of the Secretary of Labor, of the employer, and of the employee or former employee.

Section 3 - Labeling and Posting

All containers of hydrogen sulfide shall be labeled and all areas where hydrogen sulfide is stored, handled, used, produced, or released shall be posted in accordance with the following subsections.

All warning signs and labels shall be printed in English and in the predominant language of non-English-reading workers. Employers shall ensure that all employees are informed of the hazards of working with hydrogen sulfide and of the hazardous areas within the establishment in which they work, special care being taken to ensure that workers unable to read labels and signs understand the hazards of working with hydrogen sulfide, the areas of the plant that are particularly likely to become hazardous, and the appropriate self-help and first-aid procedures in suspected cases of intoxication by hydrogen sulfide vapor or of direct contact of eyes and skin with liquid hydrogen sulfide.

(a) Cylinders of hydrogen sulfide shall bear the following label in addition to, or in combination with, labels required by other statutes, regulations, or ordinances:

HYDROGEN SULFIDE

DANGER! POISON

LIQUID AND GAS UNDER PRESSURE

DEADENS SENSE OF SMELL
DO NOT DEPEND UPON ODOR

GAS IS NOT VISIBLE

FLAMMABLE--KEEP AWAY FROM HEAT AND OPEN FLAME

Do not breathe gas.
Use only with adequate ventilation.

First Aid: Remove patient to fresh air. Administer artificial respiration if breathing has stopped. Obtain medical care; keep patient warm.

(b) The following warning sign shall be posted in a readily visible location at or near entrances to areas in which hydrogen sulfide is stored, handled, used, produced, or potentially released:

WARNING--HAZARDOUS AREA

HYDROGEN SULFIDE

EXTREME HEALTH HAZARD
FATAL OR HARMFUL IF INHALED

Keep upwind.
Do not breathe gas.
In emergency, enter area ONLY if wearing approved respiratory protection.
Untrained and unauthorized persons keep out.

First Aid: Remove patient to fresh air. Administer artificial respiration if breathing has stopped. Obtain medical care; keep patient warm.

Section 4 - Personal Protective Equipment

Employers shall use engineering controls and safe work practices to keep exposure to hydrogen sulfide below the prescribed limits. When necessary, these shall be supplemented by the use of personal protective equipment, in accordance with 29 CFR 1910, subpart I. Emergency equipment shall be located at clearly identified stations within the work area and shall be adequate to permit all employees to escape safely from the area. Protective equipment suitable for emergency use shall be located at clearly identified stations outside the exposure area.

(a) The only times when compliance with the permissible exposure limit may be achieved by the use of respirators are:

(1) During the time necessary to install and test the required engineering controls.

(2) During nonroutine operations, such as maintenance and repair activities causing brief exposure at concentrations in excess of the ceiling concentration limit.

(3) In emergencies when air concentrations of hydrogen sulfide may exceed the ceiling concentration limit.

(b) When use of a respirator is permitted or required by paragraph (a) of this section, it shall be selected in accordance with the specifications in Table I-1 and shall comply with the standards jointly approved by NIOSH and the Mining Enforcement and Safety Administration, as specified in 30 CFR 11. Employers shall provide respiratory protection for each employee and shall establish and enforce a respiratory protection program meeting the requirements of 29 CFR 1910.134, as amended, and shall

ensure that employees use the respiratory protective equipment when necessary.

(c) Employers shall ensure that respirators are properly cleaned and maintained and that employees are trained and drilled in the location and use of respirators assigned to them and in testing donned respirators for leaks.

(d) Respirators shall be easily accessible and employees shall be informed of their location and recognition if respirators for more than one purpose are present.

(e) Any respirator recommended for use in higher concentrations of hydrogen sulfide may be used for any lower concentrations.

(f) Training in respiratory protection shall include actually wearing and using the equipment. Training in respiratory equipment shall be started before a worker goes on the job and shall be repeated at least quarterly and each time a new crew is formed. All members of a crew should receive the same training, even if some have had a previous training session in the same quarter. Workers actually or potentially exposed frequently to hydrogen sulfide shall receive training in respiratory protection before starting work.

(g) Full-facepiece respiratory protection also protects the eyes.

TABLE I-1

RESPIRATOR SELECTION GUIDE FOR HYDROGEN SULFIDE

Concentration	Respirator Type Approved under Provisions of 30 CFR 11
Less than or equal to 70 mg/cu m	(1) Any supplied-air respirator with full facepiece (2) Any self-contained breathing apparatus with full facepiece
Greater than 70 mg/cu m	(1) Self-contained breathing apparatus with full facepiece operated in pressure-demand or other positive pressure mode (2) Combination Type C supplied-air respirator with full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode
Emergency (entry into area of unknown concentration for emergency purposes, eg, firefighting)	(1) Self-contained breathing apparatus with full facepiece operated in pressure-demand or other positive pressure mode (2) Combination Type C supplied-air respirator with full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode
Escape (from an area of unknown concentration)	(1) Any self-contained breathing apparatus (2) Any gas mask providing adequate protection against hydrogen sulfide (not to be used in confined spaces)

Section 5 - Informing Employees of Hazards from Hydrogen Sulfide

(a) Employees who will do primary or maintenance work in areas required to be posted in accordance with Section 3 shall be informed of the hazards from hydrogen sulfide exposure, symptoms of overexposure, emergency and first-aid procedures, and precautions to ensure safe use of the gas and to minimize exposure; all shall be taught the meaning of alarms and evacuation procedures. Employers shall post this information in the workplace and shall keep it on file, readily accessible to employees.

(b) Employers shall institute a continuing educational program, conducted by persons qualified by experience or training, for employees whose jobs may involve exposure to hydrogen sulfide, including employees engaged in maintenance and repair. This is to ensure that all such employees have current knowledge of job hazards, procedures for entering confined spaces, relevant maintenance procedures, and cleanup methods, and that they know how to use respiratory protective equipment.

(c) Required information shall be recorded on the "Material Safety Data Sheet" shown in Appendix IV or on a similar form approved by the Occupational Safety and Health Administration, US Department of Labor, and shall be kept on file, readily accessible to employees.

Section 6 - Work Practices

(a) Emergency Procedures

For all work areas where there is a potential for the occurrence of emergencies involving hydrogen sulfide, employers shall take all necessary steps to ensure that employees are instructed in and follow the procedures

specified below and any others appropriate for the specific operation or process.

(1) Procedures shall include prearranged plans for immediate evacuation of employees exposed to hydrogen sulfide at potentially life-threatening concentrations, designation of medical receiving facilities, and provision of appropriate emergency telephone numbers, including those for alerting medical facilities of the impending arrival of ill employees and for calling public safety and environmental protection agencies in major emergencies. Reentry procedures for maintenance or cleanup of areas where leaks or discharges of hydrogen sulfide have occurred shall be prepared.

(2) Approved respiratory protection as specified in Section 4 shall be used by personnel essential to emergency operations.

(3) Employees not essential to emergency operations shall be evacuated from hazardous areas during emergencies. Perimeters of these areas shall be delineated, posted, and secured. Wind direction indicators should be used outdoors, and safe areas designated upwind.

(4) Only personnel properly trained in emergency procedures and protected against the attendant hazards shall shut off sources of hydrogen sulfide, clean up spills, and control and repair leaks.

(5) In case of fire, hydrogen sulfide cylinders should be removed to a safe place, or cooled with water if they cannot be removed safely and if no leaks exist.

(6) If workers or designated emergency teams cannot cope with the emergency, assistance shall be requested. Telephone numbers for emergency help shall be prominently posted.

(7) Employees who inhale hydrogen sulfide shall be removed to an uncontaminated atmosphere and given artificial respiration if it is needed. Victims shall be kept quiet and warm; medical attention shall be summoned as quickly as possible.

(b) Control of Airborne Hydrogen Sulfide

Engineering controls shall be used when needed to keep hydrogen sulfide concentrations at or below the recommended limit. The use of enclosed processes is an effective method for controlling hydrogen sulfide. Local exhaust ventilation may also be effective, used alone or in combination with process enclosure. Nonsparking ventilation systems shall be designed to prevent accumulation or recirculation of hydrogen sulfide in the workroom, to keep concentrations within the limits of the recommended standard, and to remove hydrogen sulfide from the breathing zones of workers. Ventilation systems shall be inspected for corrosion, subjected to regular preventive maintenance, and cleaned at least every 6 months to ensure effectiveness, which shall be verified by periodic airflow measurement at least annually or more frequently according to the judgment of an industrial hygienist. Tempered makeup air shall be provided as required to workrooms in which exhaust ventilation is operating.

(c) Storage

Storage areas shall be isolated, well ventilated, and fire-resistant. Hydrogen sulfide cylinders shall be stored away from strong oxidizing materials and corrosive liquids and gases, heat, heated surfaces, open flames, and spark-producing devices. When cylinders are stored in the open, no dirt, snow, or other debris shall be allowed to accumulate on or

around them. No hydrogen sulfide cylinders shall be exposed to direct sunlight.

(d) Confined and Enclosed Spaces

(1) Entry into confined spaces, such as tanks, pits, tank cars, barges, process vessels, and tunnels, shall be controlled by written permit or an equivalent system. Permits shall be signed by an authorized representative of the employer certifying that the confined space has been prepared as described in this section, and that precautions have been taken to ensure that prescribed procedures will be followed. Signed permits shall be kept on file for 1 year after the date of use.

(2) Confined spaces which have contained hydrogen sulfide shall be inspected and tested before and during entry for oxygen deficiency, hydrogen sulfide, and flammable or explosive gas mixtures, shall be thoroughly ventilated, cleaned, neutralized, and washed, as necessary, shall be sealed off from adjacent spaces or vessels prior to entry of employees, and shall be mechanically ventilated during entry.

(3) Employees entering confined spaces where they may be exposed to hydrogen sulfide shall wear respiratory protective equipment in accordance with Table I-1, if there is a chance that mechanical ventilation may not be adequate to control a surge of released hydrogen sulfide. In confined spaces, supplied-air respirators shall be operated only in the positive pressure continuous-flow or pressure-demand mode and shall have an auxiliary self-contained air supply sufficient to permit escape.

(4) Employees entering confined spaces shall also wear suitable harnesses with lifelines tended by an employee outside the confined space who shall also be equipped with the appropriate respiratory

protective equipment. The two workers shall be in constant communication by some appropriate means and shall be under the surveillance of a third person equipped to take appropriate action to rescue them if necessary.

(5) Confined spaces shall be ventilated while work is in progress to keep the concentration of hydrogen sulfide below the recommended environmental limit and to prevent oxygen deficiency.

(6) Enclosed spaces, such as rooms or buildings, which ordinarily are safe to enter but which, in the event of failure of a system inside, could contain hydrogen sulfide at hazardous concentrations, shall have a continuous automatic monitor set to sound an alarm that is audible both inside and outside the enclosed space if hydrogen sulfide concentrations exceed the peak concentration limit of 50 ppm. An easily visible and distinctive warning light is recommended as a supplement to or as a substitute for an audible alarm in noisy areas. If such areas are not monitored in this way, any employee entering the area shall wear a suitable respirator and a lifeline with safety harness and shall be observed by a coworker, unless the hydrogen sulfide concentration is measured and determined to be at a safe level and the enclosed space does not contain a source of hydrogen sulfide.

(e) Maintenance

Lines and fittings which may carry hydrogen sulfide shall be made of appropriate materials and must be inspected frequently for corrosion, embrittlement, and leaks. All hydrogen sulfide equipment, including valves, fittings, and connections, shall be checked for tightness and good working order. Such inspections shall be made immediately after new

connections are made and after hydrogen sulfide is introduced. Needed repairs and adjustments shall be made promptly.

Section 7 - Sanitation

(a) Sanitation shall meet the requirements of 29 CFR 1910.141.

(b) Smoking shall be prohibited in areas where hydrogen sulfide is used, transferred, stored, manufactured, or potentially released.

(c) Waste material contaminated with hydrogen sulfide and containers of hydrogen sulfide under pressure shall be disposed of in a manner not hazardous to employees. The disposal method must conform to applicable local, state, and federal regulations and must not constitute a hazard to the surrounding population or environment. Pressure containers shall be disposed of by trained personnel.

Section 8 - Monitoring and Recordkeeping Requirements

Within 6 months of the promulgation of a standard based on these recommendations, employers shall determine by an industrial hygiene survey at each location where hydrogen sulfide may be released into workplace air where exposure to hydrogen sulfide at concentrations above the recommended occupational exposure limits may occur. Employers shall keep records of these surveys. If an employer concludes that concentrations are at or below the recommended ceiling limit, the records must contain the basis for this conclusion. Surveys shall be repeated at least once every 3 years and immediately after any process change likely to result in increased

concentrations of airborne hydrogen sulfide. If it has been determined that there is occupational exposure to hydrogen sulfide, the employer shall fulfill the following requirements:

(a) Personal Monitoring

(1) A program of personal monitoring shall be instituted to determine the ceiling exposures of each employee occupationally exposed to hydrogen sulfide. Source and area monitoring may be used to supplement personal monitoring. Such monitoring may be done quarterly or as recommended by an industrial hygienist. Recording automatic monitors shall be permitted to show short-term (<1 minute) peaks of up to 70 mg/cu m (50 ppm), as long as no more than one such peak appears in any 30-minute record. The recording automatic monitor shall be arranged to signal as specified in paragraphs (b)(1) and (3) below.

(2) In all personal monitoring, samples representative of the exposure to hydrogen sulfide in the breathing zone of the employee shall be collected. Procedures for sampling, calibration of equipment, and analysis of hydrogen sulfide samples shall be as provided in Section 1(b).

(3) If an employee is found to be exposed to hydrogen sulfide above the recommended ceiling concentration limit, the exposure of that employee shall be monitored at least once a week, control measures shall be initiated, and the employee shall be notified of the exposure and of the control measures being implemented. Weekly monitoring shall continue until two consecutive determinations, at least 1 week apart, indicate that the employee's exposure no longer exceeds the recommended environmental limit; then, quarterly or less frequent monitoring may be resumed as specified above.

(b) Alarm/Evacuation Monitoring for Peak Concentrations

(1) A program of continuous monitoring shall be instituted to signal a spark-proof audible or visual alarm, as appropriate, if and when the concentration of hydrogen sulfide in workplace air equals or exceeds 70 mg/cu m (50 ppm). Requirements for such a system are given in Appendix III.

(2) When an alarm signals that hydrogen sulfide is present at a concentration of 50 ppm or greater, the workers in the contaminated area shall be evacuated immediately to safe areas. Workers using appropriate respiratory protection may reenter the contaminated area for rescue, repair, or contingency activity.

(3) Fixed monitors shall also have a different alarm to signal the presence of hydrogen sulfide at concentrations of 15-70 mg/cu m (10-50 ppm). This alarm is for alert only and shall not require evacuation. The workers shall be trained to recognize and distinguish between the alarms.

(4) Continuous direct-reading hydrogen sulfide monitors shall be used in fixed locations near the ground or near operations where hydrogen sulfide may be released. This may be done only if air currents will not move air from areas where hydrogen sulfide is released away from the detector.

(5) Portable monitors shall be used in areas where fixed monitors are not appropriate or to supplement fixed monitoring, for example, where there are air currents.

(6) NIOSH-approved detector tubes for hydrogen sulfide shall be an acceptable substitute for continuous monitoring where there are no air currents, as in some confined spaces.

(c) Recordkeeping

Employers or their successors shall keep records of environmental monitoring for each employee for at least 30 years after the individual's employment has ended. These records shall include: dates of measurements, job function and locations of the employees at the worksite, sampling and analytical methods used, number, duration, and results of the samples taken, ceiling concentrations estimated from these samples, type of personal protective equipment used, and the exposed employees' names. Employees shall have access to information on their own environmental exposures. Environmental records shall be made available to designated representatives of the Assistant Secretary of Labor for Occupational Safety and Health and of the Director of the National Institute for Occupational Safety and Health. Pertinent medical records shall be retained by the employer for 30 years after termination of employment. Records of environmental exposures applicable to an employee shall be included in that employee's medical records.

II. INTRODUCTION

This report presents the criteria and the recommended standard based thereon which were prepared to meet the need for preventing occupational disease or injury arising from exposure to hydrogen sulfide. The criteria document fulfills the responsibility of the Secretary of Health, Education, and Welfare under Section 20(a)(3) of the Occupational Safety and Health Act of 1970 to "...develop criteria dealing with toxic materials and harmful physical agents and substances which will describe...exposure levels at which no employee will suffer impaired health or functional capacities or diminished life expectancy as a result of his work experience."

The National Institute for Occupational Safety and Health (NIOSH), after a review of data and consultation with others, formalized a system for the development of criteria upon which standards can be established to protect the health and to provide for the safety of employees exposed to hazardous chemical and physical agents. Criteria for an environmental standard should enable management and labor to develop better engineering controls and more healthful work practices and should not be used as a final goal.

These criteria for a standard for hydrogen sulfide are part of a continuing series of documents published by NIOSH. The recommended standard applies to workplace exposure to hydrogen sulfide resulting from its processing, manufacture, storage, handling, use, generation, or liberation as applicable under the Occupational Safety and Health Act of 1970. The standard was not developed for the population-at-large, and any

extrapolation beyond occupational exposures is not warranted. It is intended to (1) protect against sudden death caused by unexpected high concentrations of hydrogen sulfide, (2) protect against the development of eye irritation or other harmful effects of hydrogen sulfide exposures, (3) protect against the fire hazards posed by hydrogen sulfide, (4) be measurable by techniques that are valid, reproducible, and available to industry and government agencies, and (5) be attainable with existing technology.

Hydrogen sulfide is a leading cause of sudden death in the workplace. Occupational exposure to hydrogen sulfide has been shown to have adverse effects on the eyes and the respiratory system. Brief exposures to hydrogen sulfide at high concentrations (for example, 140 mg/cu m) have commonly caused conjunctivitis and keratitis, and, at very high concentrations (for example, above 280 mg/cu m), unconsciousness, respiratory paralysis, and death. Case histories have shown that cardiovascular, nervous-system, and gastrointestinal disorders also have resulted from exposure to hydrogen sulfide. No conclusive reports were found of adverse health effects from repeated, long-term exposure to hydrogen sulfide alone at low concentrations. Reports of long-term human exposures to carbon disulfide have indicated the concurrent presence of hydrogen sulfide, but possible toxic synergism has not been thoroughly investigated.

Hydrogen sulfide is nearly ubiquitous. It occurs naturally in volcanic gases, in sulfur springs and fumaroles, in decaying of plant and animal protein, and in intestines as a result of bacterial action. Hydrogen sulfide is a serious hazard to the health of workers employed in

energy production from hydrocarbon or geothermal sources, in the production of fibers and sheets from viscose syrup, in the production of deuterium oxide (heavy water), in tanneries, sewers, sewage treatment and animal waste disposal, in work below ground, on fishing boats, and in chemical operations. NIOSH recognized the hazards posed by hydrogen sulfide in the gas and oil industry and issued recommendations for work practices (Appendix V).

The development of the recommended standard for occupational exposure to hydrogen sulfide has revealed the need for additional data in several areas. The following research is needed: (1) epidemiologic studies of chronic exposure to hydrogen sulfide, (2) studies correlating measured concentrations of hydrogen sulfide with health effects, (3) further studies on possible teratogenesis and brain damage from hydrogen sulfide exposure, and (4) studies designed to assess the possible synergism of toxic effects when carbon disulfide and hydrogen sulfide occur together.

The recommended standard has been developed to protect workers from different hydrogen sulfide hazards. A ceiling concentration has been proposed to prevent eye effects and other possible adverse effects, including anorexia, nausea, weight loss, insomnia, fatigue, and headache, from prolonged exposure to hydrogen sulfide at low concentrations, and to prevent acute eye effects, unconsciousness, and death, which can rapidly follow exposure to hydrogen sulfide at high concentrations.