AMERICAN SAFETY SERVICES INC

Hydrogen Sulfide Safety

1. Introuduction

Hydrogen Sulfide or *sour gas* (H_2S) is a flammable, colorless gas that is toxic at extremely low concentrations. Hydrogen sulfide is a common but sometimes very dangerous substance. It's produced both naturally, from the decay of organic matter, and in a number of industrial processes. It is heavier than air, and may accumulate in low-lying areas. It smells like "rotten eggs" at low concentrations and causes you to quickly lose your sense of smell.

Areas where the gas is found are:

- Oil and Gas well Drilling Operations
- Oil and Gas well Servicing Operations
- Tank Batteries
- Pipelines
- Disposals
- Land farms

2. Characteristics of H2S

- Toxic
- Colorless
- Aromatic Odor similar to rotten eggs at low concentrations
- Flammable: 4.3-46 percent vapor by volume in air
- Auto ignition Temperature: 500° F
- Soluble in water and oil: solubility decreases as the fluid temperature increases

3. Exposure Limits

The American Conference of Governmental Industrial Hygienists recommends a Threshold Limit Value of 10ppm and a short-term exposure (STEL) limit of 15 ppm averaged over 15 minutes. Exposure at the STEL should not be repeated more than four times per day with at least 60 minutes between successive exposures in this range.

4. Effects of Exposure

Inhalation at certain concentrations can lead to injury of death. The 300 ppm is considered by the ACGIH as Immediately Dangerous to Life and Health. In low concentrations, H_2S sometimes can be detectable by its characteristic odor; however, the smell cannot be relied upon to forewarn of dangerous concentrations (greater than 100ppm) of the gas because it rapidly paralyzes the sense of smell due to paralysis of the olfactory nerve. A longer exposure to the lower concentrations has a similar desensitizing effect on the sense of smell.

Exposure to hydrogen sulfide causes death by poisoning the respiratory system at the cellular level. Symptoms from repeated exposures to low concentrations usually disappear after not being exposed for a period of time. Repeated exposures to low concentrations that do not produce effects eventually may lead to irritation if the exposures are frequent. While the greatest health risks come from inhaling the gas, prolonged exposure may also

cause burning, itching skin, and burning eyes. If you should have direct skin contact with the gas in its liquefied form, there's also a risk of burns or frostbite. Also, contact with your eyes in the liquid form may burn.

5. Training

Comprehensive training should be provided for workers in H_2S operations. Training should be performed at initial assignment and retraining should take place annually. Site specific procedures, contingency, and emergency plans should be identified in Job Safety Analysis (JSA) or site orientation briefings before work on the site begins.

Training should cover the following topics:

1. Identification of the characteristics, sources, and hazards of Hydrogen Sulfide.
2. Proper use of the Hydrogen Sulfide detection methods.
3. Recognition of, and proper response to, Hydrogen Sulfide warnings at the workplace.
4. Symptoms of Hydrogen Sulfide exposure.
5. Proper rescue techniques and first-aid procedures to be used in a Hydrogen Sulfide exposure.
6. Proper use and maintenance of personal protective equipment. Demonstrated proficiency in using PPE should be required.
7. Worker awareness and understanding of workplace practices and maintenance procedures to protect personnel from exposure to hydrogen sulfide.
8. Wind direction awareness and routes of egress.
9. Locations and use of safety equipment.
10. Locations of safe briefing areas.
11. Use and operation of all Hydrogen Sulfide monitoring systems.
12. Emergency response procedures, corrective action, and shutdown procedures.

6. H2S Monitors

- Each of American Production Service's field employees will be assigned a H2S
- monitor, it will be his/her responsibility to take care of the monitor and assure that it is turned in for scheduled maintenance.
- All H2S monitors will be calibrated on a monthly basis. The alarms will be set at 10ppm on monitors with two alarm points, monitors with only one alarm point will be set at 10ppm.
- If at any time you feel that you monitor is not functioning correctly, contact your supervisor and he will make arrangements to have it repaired.
- Never use a H2S personnel monitor to check for hydrogen sulfide.

7. Fresh Air Breathing Equipment

Breathing equipment suitable for use in H2S areas are Self Contained Breathing Apparatus (SCBA) or Supplied Air Respirator (SAR) with escape SCBA capabilities.

- This equipment will be inspected, cleaned, disinfected, and refilled (if necessary) on a monthly basis, and after each use.
- American Safety Services will maintain records of all maintenance and repairs performed on this equipment.
- Fresh air breathing equipment will be checked at the beginning of each work day to assure that it is in good working condition, and is ready for use.
- All employees will practice with this equipment and rescue drills will be conducted.
- Any time you suspect an area of containing concentrations of hydrogen sulfide, put your fresh air breathing equipment on, prior to entering.

8. Safety Procedures

The following safety procedures should be followed whenever H2S is detected at the worksite or when monitor alarms sound.

- Immediately vacate the area by moving up wind or crosswind away from any potential source of H2S.
- Once you reach a safe briefing area, make sure all employees are accounted for.
- If someone is missing, call, or radio for assistance, two people will don fresh air breathing equipment and return to the contaminated area, find the missing person and drag him/her to a safe area.
- Call for assistance, remain up wind, and keep everyone out of the contaminated area.

9. First Aid

For serious exposures, medical help may be necessary. Someone having trouble breathing may need oxygen. Artificial respiration is called for if breathing stops. In either case, trained first-aid help is needed, followed by medical attention. Also get medical attention if hydrogen sulfide is somehow swallowed.

If the problem is a liquid splash, follow MSDS instructions, which will probably tell you to flush eyes, if splashed, with warm water immediately.

WARNING

YOU ARE ENTERING AN H_2S AREA
AUTHORIZED PERSONNEL ONLY

1. BEARDS OR CONTACT LENSES NOT ALLOWED
2. HARD HATS REQUIRED
3. SMOKING IN DESIGNATED AREAS ONLY
4. BE WIND CONSCIOUS AT ALL TIMES
5. CHECK IN WITH R360 FOREMAN AT MAIN OFFICE

R360 PERMIAN BASIN

1-832-442-2200

R360 Environmental Solutions Inc.

Halfway SWD #1 APD, Blue Bird Drilling Island

H_2S Plan

1. Hydrogen Sulfide Training

All personnel, whether regularly assigned, contracted, or employed on an unscheduled basis, will receive training from a qualified instructor in the following areas prior to commencing drilling operations on this well:

A. The hazards and characteristics of hydrogen sulfide (H_2S).
B. The proper use and maintenance of personal protective equipment and life support systems.
C. The proper use of H_2S detectors, alarms, warning systems, briefing areas, evacuation procedures, and prevailing winds,
D. The proper techniques for first aid and rescue procedures.

In addition, supervisory personnel will be trained in the following areas:

A. The effects of H_2S on metal components. If high tensile tubulars are to be used, personnel will be trained in their special maintenance requirements.
B. Corrective action and shut-in procedures when drilling or reworking a well and blowout prevention and well control procedures.
C. The contents and requirements of the H_2S Drilling Operations Plan and the Public Protection Plan.

There will be an initial training session just prior to encountering a known or probable H_2S zone (within 3 days or 500 feet) and weekly H_2S and well control drills for all personnel in each crew. The initial training session shall include a review of the site specific H_2S Drilling Operations Plan and the Public Protection Plan. This plan shall be available at the well site. All personnel will be required to carry documentation that they have received the proper training.

2. H_2S Safety Equipment and Systems

All H_2S safety equipment and systems will be installed, tested, and operational when drilling reaches a depth of 500 feet above, or three days prior to penetrating the first zone containing or reasonably expected to contain H_2S.

A. Well Control Equipment:
- Flare line.
- Choke manifold with remotely operated choke.
- Blind rams and pipe rams to accommodate all pipe sizes with properly sized closing unit.
- Auxiliary equipment to include: annular preventer, mud-gas separator, rotating head.

B. Protective equipment for essential personnel:
- Mark II Surviveair 30-minute units located in the dog house and at briefing areas.

C. H_2S detection and monitoring equipment:

- (2) Portable H_2S monitor positioned on location for best coverage and response. These units have warning lights and audible sirens when H_2S levels of 20 ppm are reached.

D. Visual warning systems:
- Caution/Danger signs shall be posted on roads providing direct access to location. Signs will be painted a high visibility yellow with black lettering of sufficient size to be readable at a reasonable distance from the immediate location. Bilingual signs will be used, when appropriate. See attached example.

E. Mud Program:
- The mud program has been designed to minimize the volume of H_2S circulated to the surface.

F. Metallurgy:
- All drill strings, casings, tubing, wellhead, blowout preventers, drilling spool, kill lines, choke manifold and lines, and valves shall be suitable for H_2S service.

G. Communication:
- Company vehicles equipped with cellular telephone.

R360 Permian Basin LLC has conducted a review to determine if an H_2S contingency plan is required for the above referenced well. We were able to conclude that any potential hazardous volume would be minimal. H_2S concentrations of wells in this area from surface to TD are low enough; therefore, we do not believe that an H_2S contingency plan is necessary.