

H2S FREQUENTLY ASKED QUESTIONS

1. What is H₂S?

Hydrogen Sulfide (H₂S) is a colorless, transparent gas. It has a rotten-egg odor at low concentrations and is not detectable by odor at high concentrations. H₂S is extremely toxic in high concentrations.

Chemical symbol: H₂S

Specific Gravity: 1.192 (heavier than air)

Explosive limits: Lower: 4%, Upper: 44% volume in air

Ignition Temperature: 500°F

Solubility in water: 2.9 volumes of gas, per volume of water at 20°C

2. What are the effects of exposure to H₂S?

This information is excerpted from the American National Standards Institute standard: Z37.2-1972 Acceptable Concentrations of Hydrogen Sulfide.

Hydrogen Sulfide is an extremely toxic and irritating gas. Free hydrogen sulfide in the blood reduces its oxygen-carrying capacity, thereby depressing the nervous system. Hydrogen sulfide is oxidized quite rapidly to sulfates in the body, therefore no permanent after effects occur in cases of recovery from acute exposures unless oxygen deprivation of the nervous system is prolonged. There is no evidence that repeated exposures to hydrogen sulfide result in accumulative or systemic poisoning. Effects such as eye irritation, respiratory tract irritation, slow pulse rate, lassitude, digestive disturbances, and cold sweats may occur but these symptoms disappear in a relatively short time after removal from the exposure.

Odors become detectable in concentrations as low as .008 parts per million (ppm) (California studies) but the sense of smell is lost after 2-15 minutes at 100 ppm.

Physiological response:

10 ppm	Beginning eye irritation
50-100 ppm	Slight conjunctivitis and respiratory tract irritation after 1 hour exposure
100 ppm	Coughing, eye irritation, loss of sense of smell after 2-15 minutes. Altered respiration, pain in the eyes and drowsiness after 15-30 minutes followed by throat irritation after 1 hour. A several hour exposure results in gradual increase in severity of these symptoms and death may occur within the next 48 hours.
200-300 ppm	Marked conjunctivitis and respiratory tract irritation after 1 hour of exposure
500-700 ppm	Loss of consciousness and possibly death in 30 minutes to 1 hour.
700-1000 ppm	Rapid unconsciousness, cessation of respiration and death.
>1000 ppm	Unconsciousness at once, with early cessation of respiration and death in a few minutes. Death may occur even if individual is removed to fresh air at once.

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To avoid discomfort, the (8 hour) time weighted average (TWA) concentration of hydrogen sulfide shall not exceed 10 ppm. According to OSHA, the 8-hour TWA is 20 ppm, with a 10-minute peak concentration of up to 50 ppm allowable.

3. How does H₂S occur in oil and gas wells?

Hydrogen Sulfide can occur naturally in natural gas or oil. In these cases the oil or natural gas are classified as “sour”. Naturally occurring sour gas and oil are rare in Colorado. Another type of hydrogen sulfide is generated from sulfur reducing bacteria. The bacteria can create hydrogen sulfide when combined with water and sulfur. Hydrogen sulfide needs to be managed in many industrial processes including oil refining, mining, tanning, wood pulp processing, food processing, paper production, and rayon manufacturing.

4. What is done to protect citizens in locating oil and gas wells with H₂S?

Permits are reviewed for the probability of encountering H₂S gas based on knowledge of the rock formations from other wells.

Wells may be no closer than 150 feet to building units or no closer than 350 feet to building units in an area designated as “high density”.

Prior to drilling or servicing a well in zones containing H₂S in excess of 100 ppm, the operator must prepare and submit an H₂S drilling operations plan that complies with [BLM Onshore Order No. 6](#).

This H₂S drilling operations plan identifies:

- Circumstances that activate the plan.
- Initial procedures to be followed to account for all staff, to restrict access, and to notify the general public, public authorities and safety agencies.
- Procedures and triggers for evacuating the public.
- Procedures for burning any gas released from the well.
- A map showing within 1,300 feet of the well the following information:
 - All occupied structures, public recreation areas, roads and railroads
 - Names, telephone numbers and addresses for residents, businesses, schools
 - Churches, hospitals, offices and public camping or gathering areas.
- Emergency telephone numbers including permittee, drilling contractor, police, ambulance, hospital, fire department, and COGCC.

The permittee must notify the local emergency coordinators (Fire, police, hospitals, etc.), not less than 24 hours before commencing to drill an H₂S well.

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5. How do H₂S drilling operations plans protect the public during drilling and operations?

H₂S drilling operations plans typically include features to protect the public including:

- Ensuring that the drilling rig contains wind direction indicators, hydrogen sulfide detection monitors (with an audible alarm at 10 ppm), emergency escape breathing apparatus.
 - Separating free gas from the drilling fluid to flare and test for H₂S.
 - Using proper drilling fluids to prevent formation fluids or gases from escaping from the well.
 - Using blowout preventers capable of immediately closing in the well.
 - Cementing in place multiple, concentric strings of casing to protect fresh waters and confining fluids or gases to within the well bore.
 - Posting warning signs at the well and along the flow line.
 - Marking flow lines to first point of sale to denote the presence of a buried line containing hydrogen sulfide, the owner's name and emergency number.
 - Pressure testing flow lines or facility piping for wells.
 - Protecting above ground lines from accidental damage.
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6. What training is provided for the people who work on wells containing H₂S?

[OSHA](#) requires that all employees, including drilling contractors or other independent contractors, who are involved in drilling, completing, testing, producing, repair, workover or servicing on an H₂S well be trained regarding:

- The properties and effects of H₂S.
 - Workers working in [confined space](#).
 - Emergency escape procedures.
 - Location and use of safety equipment, briefing areas, detection and warning systems.
 - Corrective actions, shut-in procedures, well ignition procedures and how to notify local emergency coordinators identified in the H₂S plans.
 - Contents of the H₂S contingency plans.
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7. Can odors be completely eliminated?

Hydrogen Sulfide can be detected by smell at concentrations as low as a few parts per billion. For this reason it is extremely difficult to totally eliminate all odors all the time. It is incumbent for operators to inform COGCC per Rule 607.c. when H₂S is present. Upon receiving complaints, the COGCC may require the permittee to monitor, measure and calculate the predicted concentration of H₂S in the air to the closest occupied structure or public recreation area and may then require appropriate emission control measures as per BLM Onshore Order No. 6.

8. Who monitors air emissions of H₂S from an oil and gas well site?

[OHS](#) regulates the breathing space of a worker. COGCC per Rule 607 monitors H₂S at a well site and through BLM Onshore Order No. 6. A radius of exposure is computed for public protection. The Air Pollution Control Division of the Colorado Department of Public Health and Environment (CDPHE) inventories H₂S.

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9. What should I do if I smell H₂S?

Never enter an area to see where the smell is coming from or to rescue downed personnel. H₂S is extremely toxic in high concentrations.

Notify personnel who can address the problem as follows.

WHO CAN I CALL FOR HELP?

Emergencies:

If the problem is more than just odors such as burning in your eyes or nose, immediately move away from any well or facilities near you by going perpendicular to the wind direction and contact your local 911, fire or police department. Avoid low-lying areas. .

Odor complaints:

If it appears only to be an odor problem, notify the company at the number posted on the well sign, the COGCC at 303-894-2100, or the CDPHE Air Pollution Control Division at 303-692-3100. Avoid low-lying areas, as H₂S gas can accumulate there.