

Hydrogen Sulfide Exposure as a Cause of Sudden Occupational Death

To the Editor.—We wish to remind forensic pathologists of the importance of blood thiosulfate postmortem testing to document occupational fatalities from hydrogen sulfide (H₂S) exposures. H₂S is a byproduct of many industrial processes and is an important but infrequently reported cause of sudden death in the workplace. In 2007, the Occupational Safety and Health Administration recorded 13 work-related asphyxiation deaths due to H₂S exposure.

H₂S is a toxic, flammable, moderately water soluble, colorless gas that is a byproduct of organic decomposition. Because H₂S is heavier than air, it accumulates in low-lying areas or in confined spaces. It is recognized by its distinctive “rotten egg” odor and is found in natural gas wells, sulfur springs, coal pits, and other areas where organic, decaying matter is present. The Occupational Safety and Health Administration General Industry Permissible Exposure Limit is a ceiling of 20 ppm with a 50 ppm 10-minute peak allowed once during an 8-hour shift. The National Institute for Occupational Safety and Health Immediately Dangerous to Life and Health concentration for H₂S is 100 ppm.¹

H₂S is an irritant to human tissues causing keratoconjunctivitis, lacrimation, nasal irritation, dyspnea, and

coughing. At levels above 100 to 150 ppm, workers rapidly lose the ability to smell the characteristic “rotten egg” odor because it causes fatigue and then paralysis of the olfactory system. At 300 ppm or higher, rapid onset of pulmonary edema, agitated behavior, cyanosis, and hemoptysis can occur. At exposure levels between 500 ppm to 1000 ppm, H₂S is neurotoxic, abruptly causing sudden dizziness, unconsciousness, respiratory paralysis, and/or sudden death. Exposure to higher levels (>1000 ppm) causes an immediate loss of consciousness, cessation of breathing, and death if the exposed individual is not expeditiously removed.¹ Tragically, workers who observe a sudden collapse of a coworker often become victims themselves when attempting rescue without respiratory protection.²

H₂S poisoning should be considered if a victim suffers a sudden collapse, especially in a confined space such as a sewer, well, or septic tank. A “rotten egg” smell may be reported at the scene or detected upon autopsy. Other autopsy findings may include hemorrhagic pulmonary edema, visceral congestion, scattered petechiae, myocarditis, or a greenish color of the brain, viscera, and bronchial secretions. Pathologic findings are variable.^{1,2}

Blood thiosulfate, submitted as a 5-mL sample in a red top tube, is the preferred postmortem laboratory test to document death from H₂S exposure. Levels ranging from 8 to 77 times the normal level of 0.3 µg/mL

have been documented in fatalities^{3,4} and elevated tissue levels of thiosulfate have been demonstrated in the brain and lungs as well.⁵ Therefore, consideration should be given to saving or sampling of these tissues. Blood sulfide levels are useful if obtained within 2 hours of exposure but sulfhemoglobin levels are not useful for documenting H₂S exposure.^{3,4} Urine thiosulfate elevation does not occur with rapid fatalities but may be present in nonfatally exposed coworkers.⁴

DIANE BALLERINO-REGAN, MD,
MPH, MS
ATKINSON W. LONGMIRE, MD
Occupational Safety and Health
Administration
Office of Occupational Medicine
Washington, DC 20210

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The authors have no relevant financial interest in the products or companies described in this article.