G105 Worker Fatalities by Hydrogen Sulfide Poisoning: Autopsy and Toxicological Findings

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After attending this presentation, attendees will have an understanding of some particular aspects of Hydrogen Sulfide poisoning which is an important cause of work-related death.

This presentation will impact the forensic community by emphasizing the fact that Hydrogen Sulfide (H2S) is a harmful and lethal chemical, and accidents may occur upon exposure to it in its natural gaseous state in various work environments.

The goal of this presentation is to recount the story of the deaths of five men who, while working in a truck tank which transported liquid sulfur, were poisoned by Hydrogen Sulfide. Variations in pathological and histological findings, coupled with toxicological results, and crime scene investigations will be illustrated.

Hydrogen Sulfide is a powerful, rapidly acting, colorless, poisonous gas. H_2S has a specific gravity (1.19) higher than air, and its presence
can be detected by its characteristic odor of rotten eggs. Acute
occupational poisoning and fatalities have been reported from exposure to H_2S in industrial settings, sewage disposal facilities, and septic tanks. This gas is very unstable and thiosulfate is its major metabolized substance. For this reason, the presence of thiosulfate is known to be a useful indicator of Hydrogen Sulfide poisoning in forensic analysis.

Case History: Five workers were found motionless in an empty truck tank which had previously contained liquid sulfur. They were soon removed from the tanker; four of the five men had already died. The fifth man, who was also the youngest, died at the hospital the following day. Crime scene investigation revealed that the first of the victims began the cleaning operation of the truck tank when he became unconscious. One by one, fellow colleagues attempted to rescue their co-workers, each succumbing to the toxic gas, and each falling into unconsciousness, ultimately followed by death

Autopsy Findings: The workers had a mean age of 37.6 years (range 20-64). External examination of the bodies revealed congestion of the head, neck, and shoulders with cyanosis of lips and fingernails in all cases. The ocular conjunctiva showed marked hyperemia and a few petechiae. Two workers displayed traces of solid yellow sulfur on their faces and on the soles of their shoes. One of the workers, who was 23- years-old, displayed a very characteristic greenish discoloration of his eyes, anterior cervical region, and precordia. Only one worker showed signs of putrefaction. Two of the men presented with blunt force injuries on the occipital areas with subgaleal contusions which resulted from falling.

Upon internal examination, it was noted that the lungs of all the workers were heavy with edema and congestion which was also present in the kidneys and spleen. The 23-year-old worker displayed a greenish discoloration both in the thorax muscles, as well as on the surface of the stomach. There were no remarkable findings related to the other organs except for slight cerebral edema which was present in all five victims. In addition, an aortocoronary bypass graft was present in the oldest victim. Microscopic examination revealed passive congestion which was evident in the lungs, spleen, kidneys, and adrenal glands. Massive hemorrhagic edemas were found in all the workers, most notably in the youngest victim who died 12 hours after the tragic event.

Toxicological results: Toxicological analyses of peripheral blood vessels (femoral) were negative for alcohol and illicit drugs in all of the workers. Thiosulfate in the heart blood was quantified using a gas chromatography-mass spectrometry (GC/MS) technique after derivatization with pentafluorobenzyl bromide. Each of the victims had a blood thiosulfate level that, according to other international reports, was enough to determine that the cause of death was due to fatal hydrogen sulfide poisoning: thiosulfate levels ranged from 2.6 mg/l (first worker in who entered into the tank) to 183 mg/l.

The analyses performed on air samples collected from inside the truck tank, as well as analogous trunk tanks used for liquid sulfur transport revealed that H_2S air concentration levels were high to have caused these occupational fatalities.

Hydrogen Sulfide, Worker Fatalities, Thiosulfate

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