

# Accidental Death of Workers in Manhole during Sewage Cleaning: A Case Report

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## ABSTRACT

Hydrogen sulphide in combination with CO<sub>2</sub> and methane formed in sewers is known as 'sewer gas'. Hydrogen sulphide causes reversible inhibition of the respiratory enzyme cytochrome oxidase. Higher levels depress the central nervous system, and almost instantaneous loss of consciousness. It is the second leading cause of toxin-related deaths (after carbon monoxide) in the workplace.

Two workers, working for Municipal Corporation of Patna died inside the manhole of sewerage pipe while trying to clean it. Initially one of them got in and became unconscious after a couple of minutes. Then the other person also got into the manhole to check on him but he also become unconscious. Both were rescued and were immediately rushed to nearby hospital where doctors declared brought dead to both of them. On post-mortem examination, face was congested and cyanosis was present on fingers. 'Rotten Egg' odour was noted. Internal findings showed greenish discoloration of grey matter of brain and bronchial secretion. All viscera were congested and oedematous with a greenish tinge. In the present cases, there are specific features of H<sub>2</sub>S poisoning at

autopsy. Death due to hydrogen sulphide poisoning is mostly accidental in manner. Awareness regarding prevention, health hazards, safety measures and use of respiratory personal protective equipment while at work should be promoted amongst the sewage workers and rescuer both.

**Key words:** Hydrogen Sulphide, Manhole, Knockdown Concentration, Rotten Egg.

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## INTRODUCTION

Hydrogen sulphide in combination with CO<sub>2</sub> and methane formed in sewers is known as 'sewer gas'. Sulphureted hydrogen is the chief and dangerous constituent in sewer gas.<sup>1</sup> Hydrogen sulphide which acts in a similar manner to cyanide, with reversible inhibition of the respiratory enzyme cytochrome oxidase. Concentrations above 200 parts per million (ppm) produce direct irritant effects on exposed surfaces, and pulmonary oedema on prolonged inhalation. Higher levels (above 500 ppm) depress the central nervous system, with paralysis of the respiratory centre, and almost instantaneous loss of consciousness. The familiar smell of 'rotten eggs' is not a reliable warning sign as paralysis of the olfactory nerve makes the gas odourless at lethal levels.<sup>2</sup>

Approximately, around 1.27% of all reported work related deaths are due to toxicant related in whom hydrogen sulphide was responsible for about 7.7% of total work related deaths due to toxic gases. It is the second leading cause of toxin-related deaths (after carbon monoxide) in the workplace.<sup>3</sup>

In 2007, OSHA (Occupational Safety and Health Administration) recorded 13 work-related asphyxiation deaths'. OSHA General Industry permissible exposure limit is ceiling of 20 ppm with a 50 ppm 10 minutes peak, once during 8-hr shift.<sup>4</sup>

## CASE REPORT

As per the history given by the police, on 03/05/17 at around 11:00 AM, two workers 25 years old male and 35 years old male respectively, working for municipal corporation of Patna on contract basis died inside the manhole of sewerage pipe located at Income Tax Golambar, Patna while trying to clean the pipe. They were almost immediately evacuated to hospital but were declared 'brought dead'.

Both of them were sent to clean the manhole, where they opened the lid of the manhole. Initially one of them got in and after a couple of minutes, other one called out for him but got no response. Then the other person also got into the manhole to check on him but he also become unconscious, as stated by the bystanders. Both were brought out of the manhole by well-equipped firemen personnel after which they were immediately rushed to nearby New Gardiner Road Hospital, Income Tax Golambar, Patna where doctors declared brought dead to both of them.

## Autopsy Findings

Two dead bodies were brought to the mortuary of Dept. of Forensic Medicine, IGIMS, Patna for post-mortem examination on

the same day at 01:00 PM. The 1<sup>st</sup> case was a 25 yr. old, thin built male whose post-mortem was done on same day at 1:30 PM, while the 2<sup>nd</sup> case was that of a 35 yr. old, average built male whose post-mortem was done on the same day at 2:00 PM. Post-mortem findings were similar in both the cases. On post-mortem examination, externally, rigor mortis was developed; post mortem staining was developed and fixed on the back. Face was congested and cyanosis was present on fingers. No external injuries were seen. No signs of decomposition were noted. 'Rotten Egg' odour was noted. Internal findings showed greenish discoloration of grey matter of brain and bronchial secretion. All viscera were congested and oedematous with a greenish tinge. Heart was filled with dark colored blood and blood clots.

### DISCUSSION AND CONCLUSION

The toxic effects of hydrogen sulphide have been well documented<sup>5</sup> and, although no qualitative or quantitative gas analysis was made at the scene, the clinical picture is consistent with inhalation of a high concentration of hydrogen sulphide. In the present cases, there are specific features of H<sub>2</sub>S poisoning at autopsy i.e. greenish discoloration of tissues, organs and bronchial secretion. The sudden loss of consciousness was presumably due to paralysis of the respiratory centre with resulting hypoxia. Grand mal fits and long-term neurological sequelae along with cardiovascular complications like supraventricular tachycardia and sinus tachycardia have been reported, to be associated with hydrogen sulphide poisoning.<sup>6</sup> Despite its distinctive odour, smell is not a dependable way to detect as it rapidly paralyzes olfactory nerve ending at high concentration.<sup>7</sup> Loss of smell at 100-200 ppm, pulmonary edema at 250-500 ppm, and concentrations greater than 500 ppm often called the "Knockdown concentration"- can cause respiratory arrest, collapse, and death within minutes.<sup>8</sup> Majority of poisonings (approx. 86%) occur in confined spaces and are the direct result of others trying to help co-workers in need.<sup>9</sup> After removal from the toxic environment, further management of hydrogen sulphide is mainly supportive, with the need for oxygen administration, cardiopulmonary resuscitation and mechanical ventilation being determined by the severity of intoxication. Inhaled or intravenous nitrite has been suggested as a measure to protect and reactivate cytochrome oxidase<sup>10</sup> but the need for its early, and probably pre-hospital, administration limits its efficacy. The resulting formation of methaemoglobin is, moreover, not without its own hazards. Death due to hydrogen sulphide poisoning is mostly accidental in manner. Awareness regarding safety measures and use of respiratory personal protective equipment while at work should be promoted amongst the sewage workers. Awareness about health hazards, safety measures and use of self-contained breathing apparatus should be promoted amongst the rescuer. Appropriate preventive steps must be taken to prevent fatalities associated with H<sub>2</sub>S poisoning.

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