The Bahamas Maritime Authority

Version No. 1

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Safety Alert 26-01 - Hydrogen Sulphide

1. Purpose

1.1. This Safety Alert is issued by the Bahamas Maritime Authority to raise awareness of the serious hazards associated with Hydrogen Sulphide (H_2S). It also highlights the requirement for risk assessment and precautions to be in place prior to opening any enclosed space that may contain this, or any other, toxic gas. It is based on the preliminary findings of a marine safety investigation, the second very serious marine casualty involving hydrogen sulphide that The Bahamas fleet suffered in 2025.

2. Introduction

2.1. On 23 December 2025, a Bahamas flagged passenger vessel experienced a toxic gas release when three crew members unsealed a manhole cover for a ballast water tank being used to store grey water. A fourth crew member supervising the job was standing a few meters away. Their task was to open the tank for stripping with an external pump, which did not involve tank entry. An enclosed space entry permit was not issued.

2.2. When the manhole cover for the tank was unsealed, the crew heard a sound indicating a release of gas. The three crew in the immediate area of the manhole lost consciousness within a few seconds. The fourth crew member left the compartment after opening the nearest watertight door and radioed for help, initiating a Code Alpha medical emergency response.

2.3. The opening of the watertight door allowed an ingress of air to the compartment, providing temporary relief to the incapacitated crew, and they evacuated after regaining consciousness. During the emergency response, three additional crew members lost consciousness near the unsealed tank, later being removed from the space by crew.

2.4. Two crew members died, and five were hospitalised ashore and subsequently discharged. Their symptoms, along with testimony from crew are consistent with exposure to H_2S gas.

2.5. This is an ongoing investigation, and a marine safety investigation report will be published in due course.

3. Hydrogen Sulphide

3.1. Hydrogen Sulphide (H_2S) is a colourless, highly toxic, heavier-than-air gas produced by the breakdown of organic matter or by certain chemical and biological processes. It is

commonly found in sewage systems, greywater tanks, ballast contaminated by organic waste, cargo residues, stagnant water, and enclosed spaces that have been sealed for extended periods.

3.2. H_2S presents significant risks to seafarers, due to its:

- Toxicity: it can cause rapid unconsciousness, respiratory paralysis and death at high concentrations.
- Flammability: it is highly flammable and has a large explosive range in air (4-45%). It produces other toxic vapours and gases, such as sulphur dioxide when burned.
- Accumulation: as a heavier-than-air gas, it settles in low areas such as bilges and tank bottoms.

3.3. Typical exposure symptoms include[1]:

- 1-5ppm - a smell similar to rotten eggs or a strong odour.
- 20-150ppm - nose and throat feel dry and irritated; eyes sting, itch or water and prolonged exposure causes coughing, hoarseness, shortness of breath and runny nose. At **100ppm** and higher H_2S is immediately dangerous to life and health
- 150-200ppm - sense of smell is blocked due to olfactory fatigue.
- 200-250ppm - major irritation of the nose, throat and lungs occur along with headaches, nausea, vomiting and dizziness. Prolonged exposure can cause fluid build-up in the lungs which can be fatal.
- 300-500ppm - same symptoms as above with fatality within 1-4 hours of exposure.
- 500ppm and greater - immediate loss of consciousness and death can be immediate.

4. Identifying the hazard

4.1. IMO Resolution MSC. 581 (110) *Revised Recommendations for Entering Enclosed Spaces Aboard Ships* was adopted in December 2025. The new Recommendations provide updated safety measures, definitions, and procedural requirements aimed at reducing fatalities during enclosed space entry.

4.2. One significant enhancement is the need to conduct a risk assessment **prior to opening an enclosed space**. The risk assessment should assess the likelihood of a dangerous atmosphere being present or subsequently developing within the space along with any other potential hazards in the space, as identified in the vessel's Enclosed Space Register.

4.3. In order to identify any risks of H_2S exposure the risk assessment should include:

- Identification of any potential sources of H_2S contamination including, as a minimum, any previous use of the space for storage of sewage or grey water.

[1] WorkSafeNZ Preventing harm from hydrogen sulphide

- Evaluation of ventilation arrangements and potential use of any sampling points for pre-opening testing.
- Appropriate controls to be implemented to address any risk of exposure when the space is opened to atmosphere. This should include gas monitoring, emergency readiness and information sharing as a minimum.

4.4. No opening or venting of an enclosed space should be permitted until a risk assessment is completed and appropriate controls are implemented. This should be reflected in the Safety Management System's permit to work procedure.

5. Safe Work Practices

5.1. Where a space cannot be tested prior to opening, controls must be in place. If partial opening is required to allow testing, crew should open the space incrementally and from a safe upwind position. Crew should be provided with approved multigas meters capable of measuring H_2S, oxygen, flammable gases and any other gases that might be present. If H_2S is detected during opening, the space should be secured and steps taken to make the space safe.

5.2. **Note that odour cannot be relied upon to detect dangerous levels of H_2S as olfactory fatigue can occur quickly, causing victims to lose the ability to detect its presence.**

5.3. Practices across the industry for safe work entry include, but is not limited to:

- Maintaining ventilation before, during, and after entry.
- Never entering or leaning into a space without confirmed safe atmosphere readings.
- Ensuring rescue and retrieval equipment is ready, with trained personnel standing by.
- Conducting toolbox talks covering H_2S risks and emergency procedures.
- Stopping work immediately if any monitor alarm activates, crew smells an odour, or begins showing symptoms of H_2S exposure.

6. Potential Generation

6.1. There are presently no international requirements dealing with the discharge of grey water. However, its potential for generation of H_2S on board needs to be assessed and reflected in shipboard handling procedures.

6.2. Grey water can contain organic matter and nutrients, bacteria, chemicals and detergents. For extended storage periods, biological activity can occur leading to an anaerobic environment, producing sulphate reducing bacteria and increasing the potential for H_2S generation.

6.3. H_2S can remain dissolved in mixtures while stored in tanks depending on pressure, temperature, and agitation (amongst other factors), but its solubility will decrease with

a drop in pressure (such as opening a tank) and can potentially release a dangerous amount of H_2S gas.

6.4. H_2S remains a significant hazard throughout the maritime industry. The BMA strongly advises all companies to review their operating procedures in relation to opening and ventilation of enclosed spaces along with extended periods of storage for mixtures that can lead to H_2S generation. Companies should ensure their permit to work reflects the latest guidance. Awareness of the breadth of the risk is essential in preventing further incidents and protecting life at sea.

7. Further reading

7.1. There are numerous marine safety investigation reports relating to death due to exposure to hydrogen sulphide in grey water tanks and similar spaces. The following reports highlight that exposure in what was previously considered a safe space is not an isolated incident.

7.2. **Valaris DS-17 (2023) Marshall Islands**. In preparation to mechanically ventilate a bilge water tank, the second engineer and motorman went into the aft pump room and climbed down a vertical ladder to remove a manhole cover. When climbing back up the ladder, the motorman noticed the 2/E stopped climbing. The motorman attempted to grab the 2/E's coveralls and called for help. A first responder observed both crew members kneeling on the deck plates before falling. Both died as a result of hydrogen sulphide exposure. See: Marshall Islands - Valaris DS-17

7.3. **MV La Solognais (2019) Malta**. An engine room crew member entered the grey water tank after it was declared gas free. When he arrived at the bottom of the tank, he experienced difficulty breathing and began to climb out, but lost consciousness and fell to the bottom of the tank. Medical reports indicated he suffered from possible toxic encephalopathy caused by inhalation of a high concentration of H_2S. See: Malta - MV La Solognais

7.4. **Monarch of the Seas (2005) Bahamas.** When performing maintenance on pulper system pipe work, hydrogen sulphide was released when pipe flanges were broken by two engine room crew. The pulper system had a holed pipe which passed through an adjacent fresh water tank, depositing food waste and generating the hydrogen sulphide gas. The release of the gas resulted in three fatalities and 18 other crew members being treated in the hospital. See: BMA - Monarch of the Seas

8. Validity

8.1. This Safety Alert is valid until further notice