UNITED STATES COAST GUARD
U.S. Department of Homeland Security

MARINE SAFETY ALERT

Inspections and Compliance Directorate

June 8, 2018
Washington, DC

Safety Alert 08-18

Overeating Can Create Dangerous Gas!
(Especially with Anaerobic Bacteria)

This safety alert shares important information related to a unique, not very well known and potentially deadly hazard that recently developed on a vessel involving the formation of dangerous levels of Hydrogen Sulfide (H_2S)[1] gas within a waste oil tank. This was determined to be due to the use of biodegradable cleaners and the chemical reactions and resultant H_2S byproduct involved in breaking down oils in an anaerobic (low oxygen) environment like that found in a full slop tank. In this case, vessel officers had detected significant H_2S concentrations (>200 PPM) in the vessel's engine room bilge holding tank. This circumstance had existed for quite some time as crewmembers had previously reported smelling the distinctive odor of rotten eggs in the vicinity of the slop tank, which is an indicator of the gas.

Two hundred (200) PPM of H_2S is considered Immediately Dangerous to Life and Health (IDLH). Furthermore, the Lower Explosive Limit (LEL) was found to be in the dangerous flammable range, at 100% LEL, in the same tank. Vessel crew responded to the immediate hazardous condition by continually monitoring the tank atmosphere, inerting the tank and ultimately discharging its contents onto a slop barge for processing. During the company's subsequent investigation and research they discovered other instances involving the same type of problem which had pointed to the use of biodegradable cleaners as the primary cause for high levels of H_2S gas.

Another similar case involved dangerous levels of H_2S gas concentrations found on several tug boats. Initially, H_2S gas was discovered when personnel began to transfer waste ashore from a pressed up and nearly full slop tank containing typical oily bilge slops. A marine chemist investigated the issue and examined a total of three similar towing vessels for comparison. Two of the three tugs examined had dangerously high levels of H_2S gas attributable to the use of a biodegradable soy based cleaner. The third tug did not use a biodegradable product. In these instances the cleaner provided micro-nutrients to the waste water thus causing the bacteria to thrive resulting in increased rates of H_2S production.

As a result of a tragic accident where three sailors were asphyxiated when a bilge waste tank containing about 82 tons of waste spilled into an inhabited space releasing H_2S gas, the Royal Australian Navy sponsored scientific research and issued a series of four reports related to H_2S development in oily waste and ballast tanks. The final report of the research into the H_2S issue was titled **"Hydrogen Sulfide Generation in Shipboard Oily-Water Waste, Part 4, Minimization of the Problem"**[2] and it states the following:

[1] https://www.osha.gov/SLTC/hydrogensulfide/hazards.html
[2] http://www.dtic.mil/get-tr-doc/pdf?AD=ADA301431

“The hydrogen sulfide problem has resulted from efforts to protect the marine environment from pollution. Unfortunately, there is no single straightforward solution to the problem as the primary ingredients - sea-water and biodegradable detergents - are an essential part of a ship's operation. The solution would appear to lie in attention to oily-water waste management procedures and machinery space housekeeping practices. Elimination or minimization of the hydrogen sulfide problem will come from ensuring that the contents of the oily-water waste holding tank do not provide an optimal growth medium for sulfate reducing bacteria. The following recommendations can be made:

1. Review machinery space cleaning practices; clean machinery spaces with detergents when the ship is in port, preferably using fresh water; do not add the washings to the oily-water holding tank but, instead, pump them directly to a shore-based disposal facility; if possible, avoid the use of biodegradable detergents at sea to prevent their addition to the holding tank.

2. Review drainage pathways of all nutrient-bearing "non-oily" wastes (washdown water from galleys, heads, etc.) and ensure they do not enter the oily-water waste system.

3. Keep the sea-water content of the oily-water waste as low as possible; always use fresh water for cleaning operations when it is available; handle "emulsified" oily-water waste apart from "non-emulsified" oily-water waste so that separation equipment can be used effectively.

4. Be aware of the chemical composition of cleaning agents and other substances entering bilge; use biodegradable detergents sparingly; avoid the addition of phosphates to the oily-water waste; DSTO (Commonwealth of Australia, Dept. of Defense, Defense Science and Technology Organization) advice should be sought before introduction of new cleaning agents.

5. Prevent the oily-water waste from becoming anaerobic; remove bilge from machinery spaces frequently; keep the contents of the holding tank well aerated.

6. Finally, do not store oily-water waste on a ship unnecessarily, dispose of it at every available opportunity.”

The Coast Guard **strongly recommends** that Owners and Operators, vessel crewmembers, Port and Flag State examination personnel and other persons associated with the operation of vessels of any size ***evaluate the information presented in this alert*** and where appropriate incorporate it into onboard operations, training, awareness and H_2S exposure prevention efforts.

Special thanks to the U.S. Operator for sharing their experience with this issue.

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