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MARINE SAFETY ALERT

Inspections and Compliance Directorate

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HIDDEN HAZARDS CREATED BY SYSTEMIC FAILURES IN GAS DETECTION PRACTICES

Two explosions aboard bulk carriers fully laden with methane-emitting coal, which occurred in 2023 and 2025, highlight the serious hazards associated with cargoes that may emit flammable or toxic gases. The marine casualty investigations into the explosions remain ongoing, and no cause has been determined. However, these incidents underscore the importance of proper operation, maintenance, and crew familiarity with equipment used to assess atmospheric conditions within cargo spaces and enclosed spaces. U.S. Coast Guard inspectors frequently find systemic deficiencies in atmosphere testing and gas detection practices on bulk carriers transporting gas-emitting solid bulk cargoes, such as coal. Despite existing international regulations, gas detection systems are frequently not maintained, tested, or used in a manner that ensures effective hazard monitoring.

Common deficiencies include:

- Absence of required calibration/span gas, use of expired gas, or gas mixtures that do not match the hazards of the cargo (e.g., isobutane span gas where methane monitoring was required).
- Gas detection instruments that are overdue for calibration, not maintained, or non-functional.
- Masters, Chief Mates, and other ship's officers are unable to properly select calibration gas or demonstrate correct calibration and bump test procedures per manufacturer instructions.
- Use of incorrect regulators or delivery hardware such as free-flow regulators where on-demand regulators are required by the manufacturer. Figures 1 and 2 show examples of two regulator types commonly seen throughout the marine industry.



Figure 1: Fixed flow regulator



Figure 2: Demand flow regulator

International requirements address the carriage, calibration, use, and crew familiarity associated with atmosphere testing equipment. The International Convention for the Safety of Life at Sea (SOLAS) Chapter VI, Regulation 3.2, requires steps to ensure that crews of ships are trained in such instruments. SOLAS Chapter XI-1, Regulation 7, establishes carriage and calibration requirements for portable atmosphere testing instruments capable of measuring atmospheric conditions.

Furthermore, the International Safety Management (ISM) Code, including sections 6.3 and 6.5, requires companies to ensure personnel are properly familiarized with their duties and receive necessary training in support of the Safety Management System (SMS). International Maritime Organization Resolution MSC.581(110) also provides guidance for companies' SMSs to establish appropriate procedures for safe entry and atmosphere testing.

In addition to the potential for increased risks to crews, vessels and port infrastructure, deficiencies involving gas detection equipment, calibration gas, crew familiarity, or atmosphere testing procedures may result in port state control deficiencies, operational controls, or detention under SOLAS and the ISM Code, depending on the nature and severity of the condition identified.

The U.S. Coast Guard **strongly recommends** that vessel owners, operators, Masters, and crew members:

- Verify calibration gas suitability and availability. Ensure that calibration and bump-test gases match the instrument manufacturer's specifications (gas type, concentration, balance gas), are appropriate for the cargo's hazards, and are within their stated shelf life.
- Use the correct regulators and delivery hardware. Confirm that regulators and all delivery hardware are those specified by the instrument's manufacturer.
- Integrate manufacturer instructions into the SMS. Incorporate manufacturer-specified calibration intervals, bump-test procedures, and regulatory requirements into company procedures, and ensure SMS documentation reflects the correct models of instruments carried on board.
- Ensure crew is competent and regularly exercises procedures. Provide hands-on training to ensure officers are fully familiar with the specific equipment on board, the correct selection of calibration gas and regulators, and the detailed procedures in the manufacturer's instructions.
- Prior to loading cargoes that may emit flammable or toxic gases, verify and document that gas detection equipment is operational and calibrated, correct support hardware is ready for use, and officers can demonstrate proper operation of the instruments. Conduct pre-load and pre-operation verification.

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