



# UNITED STATES COAST GUARD

U.S. Department of Homeland Security

## MARINE SAFETY ALERT

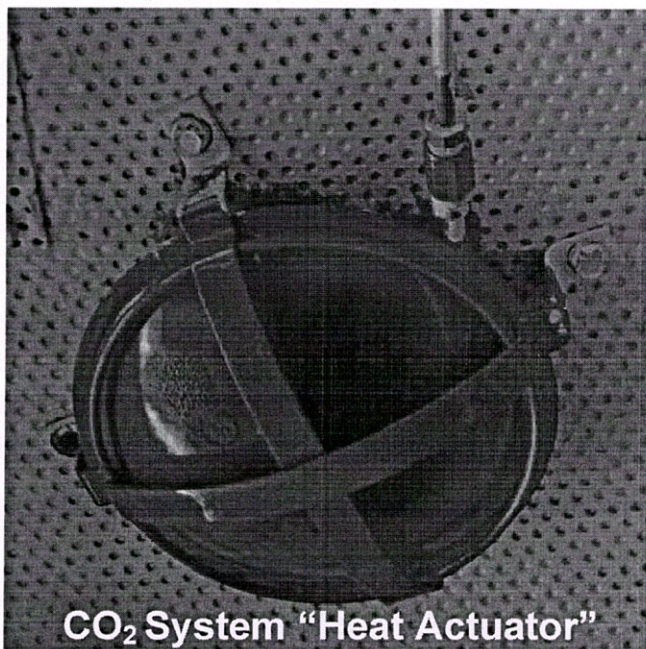
*Inspections and Compliance Directorate*

July 20, 2017  
Washington, DC

Safety Alert 07-17

### **CO<sub>2</sub> Hazards are Nothing New** ***But we'd like to remind you of what not to do!***

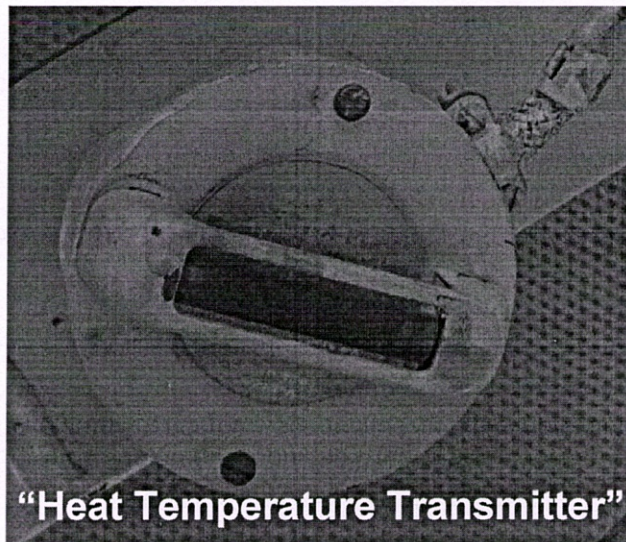
During two recent vessel inspections Coast Guard Marine Inspectors participated in and witnessed occasions where the testing and maintenance of a CO<sub>2</sub> system resulted in serious safety threats that could have easily led to loss of lives. The incidents included an accidental release in the space where a sensor was being tested that nearly resulted in a fatality and another situation where CO<sub>2</sub> came close to being released without warning into an occupied engine room space after errors were made during routine system maintenance. CO<sub>2</sub> fire extinguishing systems present an inherent risk to the personnel involved with their inspection, testing, and maintenance. Over the years the Coast Guard has become aware of multiple events where these systems have inadvertently released or leaked and caused the deaths of shipboard personnel, technicians and inspection personnel. CO<sub>2</sub> system inspection, testing, and maintenance require thoughtful planning and risk mitigation efforts to prevent such events from happening.



**CO<sub>2</sub> System "Heat Actuator"**

In the first instance, the vessel's Chief Mate and a Coast Guard Inspector were testing the fire detection system. The Mate and Inspector went to the vessel's hydraulic equipment room and the Mate stood on a spare parts box in order to apply a heat gun to the heat actuator. The CO<sub>2</sub> subsequently discharged directly above their heads and filled the room. The mate was overcome by the CO<sub>2</sub> release and had to be revived by CPR after being pulled out of the space unconscious.

The problem was that the Mate directed the heat to a "heat actuator" and not a "heat temperature transmitter." The difference between these components is substantial. The detector is connected by wires to the monitoring system on the bridge while the release actuator directly connects to its local CO<sub>2</sub> system through tubing. The heat actuator when heated creates a slight pressure in the tubing immediately activating the pneumatic control head of the CO<sub>2</sub> bottle, releasing CO<sub>2</sub> into the space without delay or warning.



**"Heat Temperature Transmitter"**

Crewmembers were unfamiliar with the vessel's system and had not referred to the associated manuals. Thus, their testing of the system was conducted without an understanding of the impacts of their actions, placing them and the Coast Guard inspectors at risk.

In a second unrelated event, an inspection for certification involving four Inspectors was taking place while technicians were working on the CO<sub>2</sub> system. A Coast Guard Inspector in the machinery space was told that CO<sub>2</sub> technicians were going to release the CO<sub>2</sub> which was not part of the planned inspection. He was informed that the system became accidentally primed for release when the pilot system was activated by a technician in training. As the technician was reconnecting the cable actuated release levers attached to the tops of the bottles, the activation cables remained connected to the levers. When the bottles were moved later in the servicing process, the cable tension increased to the point where the levers were lifted resulting in the release of charged bottles against a closed valve which prevented immediate release into the space.

The technicians ultimately decided they needed to release the entire engine room CO<sub>2</sub> system to remedy the situation. They communicated their intentions to the vessel's engineers, who performed an accountability of all personnel in the space. However, their count was incorrect as they missed a Coast Guard Inspector who was still in the engine room. Only after the Inspector's partner realized his associate was missing was another more thorough sweep of the engine room made and the missing inspector found. Even after clearing the engine room the situation remained hazardous as various personnel stood by in the engine control room while the gas was released. After realizing the magnitude of the CO<sub>2</sub> being released, the personnel in the control room evacuated to the vessel's main deck and no further entry was made into the engine room until the fire department ruled it safe for human occupancy.

As a result of inadequate accountability measures and hazard communications, the safety of crew members and a Coast Guard inspector was placed at risk.

The Coast Guard notes that both of these instances reflect a lack of knowledge and risk awareness by the persons involved. The Coast Guard **strongly recommends** that:

- Only persons adequately trained and properly evaluated be permitted to participate in CO<sub>2</sub> testing and maintenance procedures onboard vessels;
- Every person involved must know and consider the resulting outcomes for each step of the testing procedure prior to it taking place; and
- Risks associated with CO<sub>2</sub> and other systems should never be underestimated. Risk prevention activities should always lean towards providing the greatest safety margins for those involved including 100% accountability of all personnel aboard the vessel prior to conducting an operational test of a system.

Coast Guard Navigation and Vessel Inspection Circular (NVIC) 09-00, Change 1, "CARBON DIOXIDE FIRE EXTINGUISHING SYSTEM SAFETY", contains additional CO<sub>2</sub> safety and inspection information.  
<https://www.uscg.mil/hq/cg5/nvic/pdf/2000/NVIC%2009-00,Change%201.pdf>

This safety alert is provided for informational purposes only and does not relieve any domestic or international safety, operational, or material requirements. Developed by the Investigations Division of Marine Safety Unit Portland, Coast Guard District 13 Prevention Division and the Office of Investigations and Casualty Analysis. Questions may be sent to [HQS-PF-flr-CG-INV@uscg.mil](mailto:HQS-PF-flr-CG-INV@uscg.mil).

*Note: The Coast Guard has previously released CO<sub>2</sub> related safety alerts. Safety Alert 15-14 recommends conducting a comprehensive pre-test meeting and simulated step-by-step "walk-through" between involved parties prior to actual testing of complex or potentially confusing systems. Operational controls for those involved should be implemented to maximize safety and reduce risk. Additionally, the Coast Guard strongly reminds all maritime operators of the importance in performing regular vessel specific emergency drills and to ensure that all crewmembers have the proper knowledge, skills, and abilities to respond to any potential emergency.*