

ENGINE ROOM FIRE ON A BULK CARRIER ON LAKE ERIE

A SELF-UNLOADING BULK CARRIER OPERATING ON THE GREAT LAKES EXPERIENCED A SERIOUS ENGINE ROOM FIRE WHILE NORTHBOUND ON LAKE ERIE, OFF KINGSVILLE, ONTARIO. ALTHOUGH NO INJURIES OR POLLUTION WERE REPORTED, THE DAMAGE TO THE ENGINE ROOM WAS EXTENSIVE.



FIGURE 1 VIEW OF VESSEL, SHORTLY AFTER THE FIRE
SOURCE TSB

INCIDENT OVERVIEW

BACKGROUND OF SHIP AND VOYAGE DETAILS

The ship was originally built in 1943, as a steamship and later converted to diesel propulsion.

Due to the date of build, many safety features that are now mandatory were not required and therefore not fitted. For example, the main engine could not be stopped from the ship's bridge, requiring stoppage locally or by closing fuel supply valves.

Similarly, the main engine pressurised fuel supply lines were not fitted with spray shielding in case of containment failure.

Small fuel leaks on the main engine fuel supply and return lines were considered common. Due to the busy routine of the crew, temporary fixing of leaks had become the norm, with no deeper investigation of the cause.

The ship's machinery space was located aft, and as common with ships of this era, it was fitted with a skylight. The skylight was opened and closed using a winch, the remote control of which was located within the engine control room. Local operation was possible using a manual cranking device.

To improve ventilation some portholes and fire doors were secured in the open position, however these could not be closed remotely.

The machinery space was protected by a carbon dioxide (CO₂) fixed firefighting system, that could be remotely activated from a safe position without having to enter the CO₂ storage compartment.

Safety equipment met the minimum requirements, meaning the ship had only two firemen outfits, one located aft and one forward.

On the day of the incident, the ship had loaded a cargo of crushed stone at Marblehead, Ohio. The voyage plan called for a northbound transit of Lake Erie to Kingsville, Ontario; a relatively short passage compared with transoceanic trade but one requiring careful navigation due to the high density of shipping on the Great Lakes. The ship carried a complement of twenty crew members, including deck officers, engineers, and support staff. The crew was familiar with the trade, conducting routine voyages between US and Canadian ports.

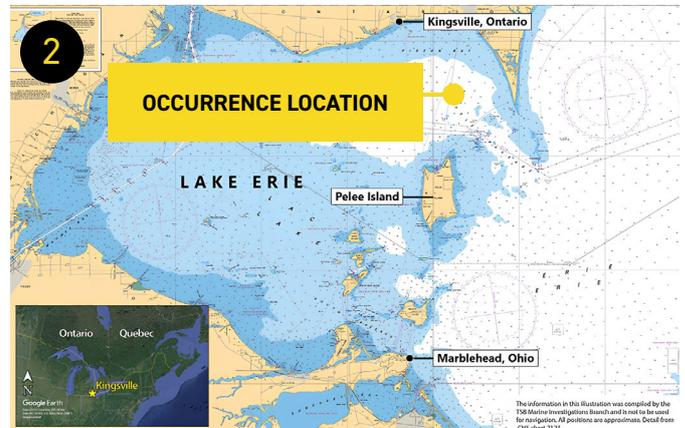


FIGURE 2 AREA OF OCCURRENCE
SOURCE MAP DATA © [2026] GOOGLE

WHAT HAPPENED

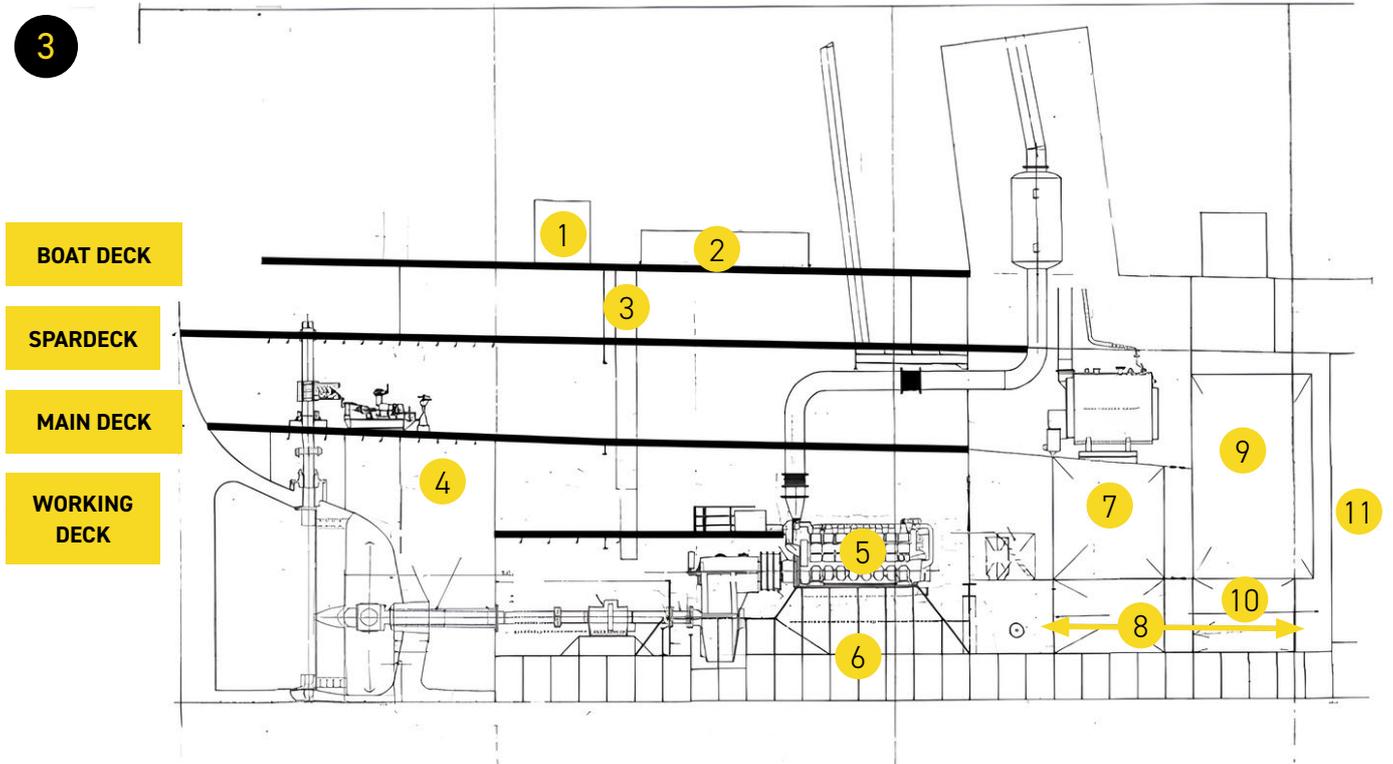
At approximately 2159 hours, flames were observed at the top of the main engine during routine engine room rounds. The duty engineer, attempted to stop the engine but could not reach the control room due to flames and intense heat. The duty engineer subsequently evacuated the engine room and manually raised the general alarm.

The crew mustered according to established emergency procedures, with groups assembled forward and aft. The second engineer did not initially muster at the aft station, later having found to have slept through the alarm. The aft muster station personnel commenced closing machinery space vents and preparing fire hoses for use.

At 2204 the emergency generator was started to ensure continued power supply to essential systems, and the engine room fans were stopped. All personnel were accounted for at 2208. The master notified the ship managers and shore authorities of the situation, before transmitting a Mayday signal, prompting Canadian and US Coast Guard units to stand by.

At approximately 2209 the chief engineer ordered that the quick-closing fuel valves of the main and auxiliary engines were to be activated. At the same time, he started the emergency fire pump.

The engineers could not reach the engine room skylight to close it manually due to the heat and smoke from the fire, and the remote control was inaccessible, being located within the engine room. Despite the skylight and some portholes within the engine room still being open, the master ordered that the ship's fixed CO₂ firefighting system be activated.



1 CO₂ room, 2 Skylight, 3 Vent, 4 Aft peak, 5 Main engine, 6 Tank top, 7 Water ballast, 8 Unloading tunnel (to cargo hold), 9 Fuel oil bunker, 10 Fuel oil day tank, 11 Cargo hold.

FIGURE 3 PROFILE VIEW OF THE STRUCTURE
SOURCE TSB, BASED ON MACHINERY ARRANGEMENT DRAWINGS

The CO₂ system, intended as the ship's primary means of extinguishing a machinery space fire, failed to operate as designed. When the chief engineer attempted to activate it remotely, the CO₂ did not discharge. The release wires had parted and had therefore not opened the gas cylinders. A local release attempt was then made from within the CO₂ cylinder room at 2215. After operating the release levers, it became apparent that the CO₂ cylinder room was filling with CO₂ gas, and the chief engineer had to evacuate the space.

At 2217 the ship's engine had stopped, and the forward anchors were deployed.

At 2221 it was noted that although the emergency fire pump was running, no water was present in the fire main. Initial trouble shooting failed to identify the problem, with the pump apparently running normally, and indicating sufficient discharge pressure.

By 2231 the chief engineer noted a reduction in smoke coming from the engine room skylight, and by 2328, no more smoke was observed.

POST-INCIDENT RESPONSE

As a precaution, life rafts and the rescue boat were prepared in case abandonment became necessary.

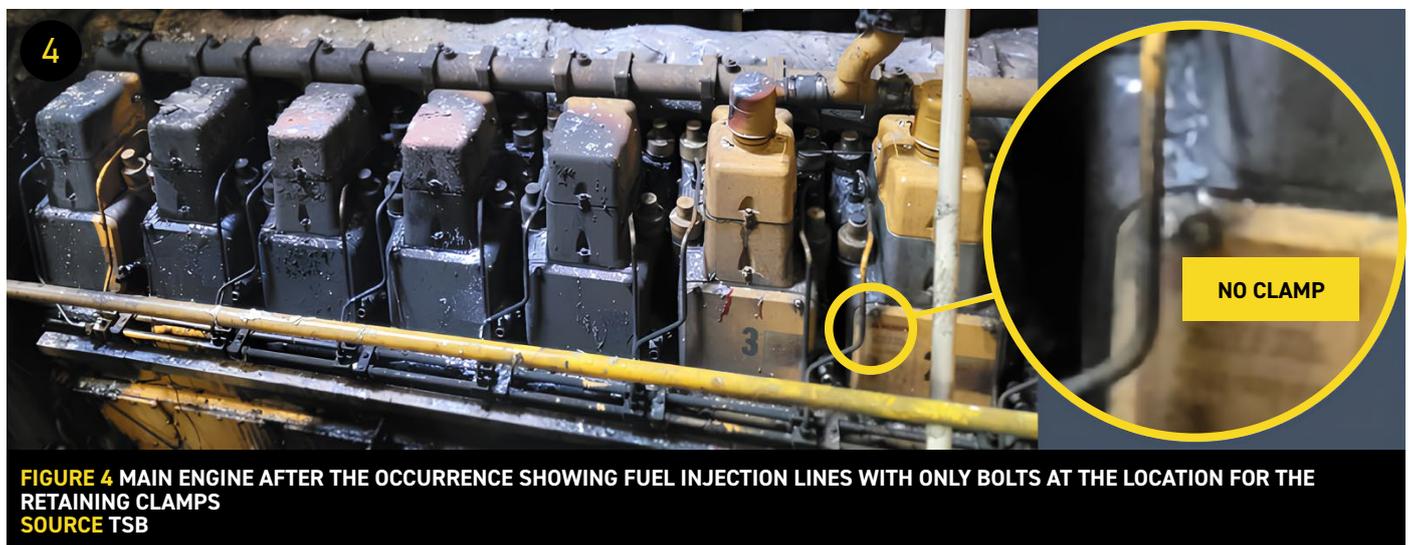
By 2328 no more smoke was observed, and the fire was considered to be under control. Eight non-essential crew members were evacuated to a coast guard auxiliary vessel and brought ashore.

The ship was eventually taken under tow to Kingsville, Ontario, where authorities carried out inspections. No injuries to the crew were reported, and no pollution was detected from fuel or cargo. Despite this, the ship's engine room was found to be substantially damaged.

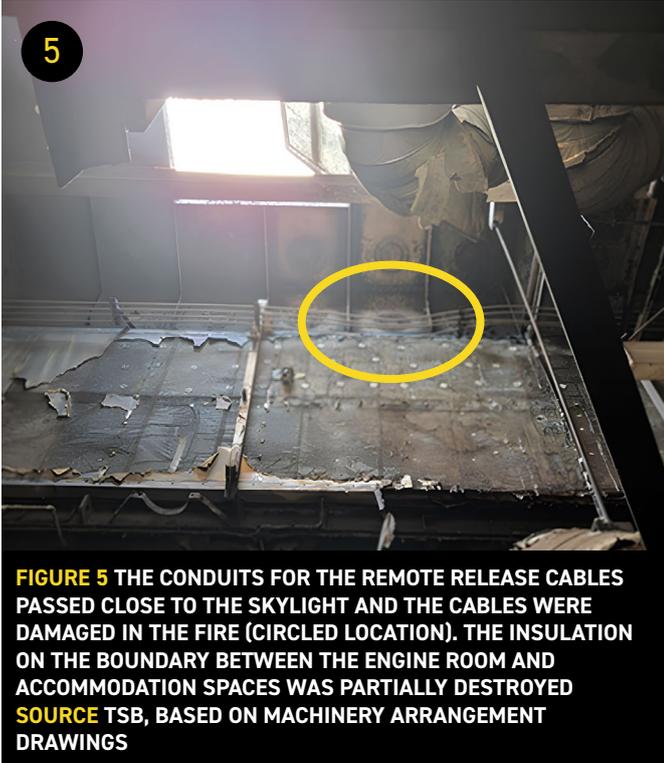
INVESTIGATION FINDINGS

The fire originated at the top of the main engine and spread rapidly through the machinery space. The immediate cause was traced to a loosened fuel injection return line connection on one of the cylinders, which allowed pressurised diesel fuel to spray onto hot engine surfaces. The problem was exacerbated by missing retaining clamps on the fuel lines, poor vibration control, and deteriorated exhaust insulation.

The fuel line retaining clamps were likely removed during fuel line maintenance at an earlier date and not replaced. This lack of securing contributed to the increased vibration of the fuel lines. Numerous observable leaks had occurred since the fuel line maintenance; however, no internal investigation was conducted into why the leaks kept happening.



The remote release cables for the CO₂ system were located in an exposed position in the engine room and had been damaged by the fire, resulting in the cables failing when attempted to use. A subsequent manual release of the CO₂ locally, resulted in the loss of all CO₂. This highlights a poor design and lack of training.



Post-incident investigation found that an isolation valve for the fire main had failed in the closed position due to corrosion, and this is why no water was delivered to the hydrants.

Open portholes, vents, and a skylight hatch at the time of the fire allowed fresh air to enter the space. This both fed the flames and delayed effective sealing. Prompt closure of ventilation openings is a key element of machinery space fire control, with delays in securing these openings contributing to the severity of the fire.

The Transportation Safety Board emphasised the influence of organisational context. Operations on the Great Lakes trade are characterised by intense schedules with limited maintenance opportunities. The result is deferred inspections and a reliance on temporary repairs rather than permanent solutions.

Although fire safety procedures existed within the company's SMS, oversight and verification were insufficient. While crew training and drills had been conducted, they did not address scenarios involving failure of the CO₂ system. This gap reduced the crew's preparedness when the system malfunctioned during the actual emergency.

CONTACT

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THIS CASE STUDY IS DRAWN FROM THE TRANSPORTATION SAFETY BOARD OF CANADA'S MARINE TRANSPORTATION SAFETY INVESTIGATION REPORT M23C0104.

THE PURPOSE OF THIS CASE STUDY IS TO SUPPORT AND ENCOURAGE REFLECTIVE LEARNING. THE DETAILS OF THE CASE STUDY MAY BE BASED ON, BUT NOT NECESSARILY IDENTICAL TO, FACTS RELATING TO AN ACTUAL INCIDENT. ANY LESSONS LEARNED OR COMMENTS ARE NOT INTENDED TO APPORTION BLAME ON THE INDIVIDUALS OR COMPANY INVOLVED. ANY SUGGESTED PRACTICES MAY NOT NECESSARILY BE THE ONLY WAY OF ADDRESSING THE LESSONS LEARNED, AND SHOULD ALWAYS BE SUBJECT TO THE REQUIREMENTS OF ANY APPLICABLE INTERNATIONAL OR NATIONAL REGULATIONS, AS WELL AS A COMPANY'S OWN PROCEDURES AND POLICIES.

BRITANNIA COMMENTARY ON INCIDENT ON NEXT PAGE

BRITANNIA COMMENTARY ON INCIDENT

ENGINE ROOM FIRES

Engine room fires continue to be the most common type of shipboard fire. This case again shows how familiar hazards - fuel leaks, vibration, and hot surfaces - combine into a high-energy ignition source when not rigorously controlled.

The investigation confirmed that repeated fuel leaks on the ship had become normalised as part of routine maintenance. Over time, this led to leaking fittings being tightened or replaced without investigating the root cause, allowing the underlying hazard to persist unnoticed.

MAINTENANCE IS KEY

The importance of maintenance in both preventing and in tackling fires is clear. Critical but inexpensive components, such as fuel line retaining clamps, correctly torqued fittings, and properly installed insulation, serve as key safety barriers. However, when these same components are not maintained properly, or are not replaced after maintenance, major barriers to a catastrophic incident are removed.

Ensuring that a ship's planned maintenance system tasks match the manufacturer's instructions is important. This should include any task-specific instructions, and/or the need to replace components after removal for access or maintenance. Regardless of how busy the ship's schedule, maintenance must be prioritised.

It is recommended to record all unplanned maintenance/repairs to allow analysis of repair trends and to provide advance warning of failure. For major mechanical components, it is also important to be aware of any technical bulletins or service letters and ensure that any new instructions are implemented as soon as practicable.

KEEP FIREFIGHTING SYSTEMS READY

A CO₂-fixed firefighting system is the last line of defence. It must work when called upon. Remote release cables were routed through the engine room near the skylight and were subsequently heat-damaged, causing them to part when pulled. We would therefore recommend that the path and condition of remote release cables for any fixed firefighting system is regularly checked and assessed for usability during an emergency.

After the remote release failed, the crew attempted the local release procedure. The instructions provided on board were incorrect for the vessel's specific installation order, resulting in all CO₂ discharging into the cylinder room instead of into the engine room. Further investigation showed that several cylinder discharge heads had loose fittings or missing O-rings, indicating long-standing maintenance lapses and undetected defects. The ship's crew should regularly check the onboard procedures during emergency drills, both to increase familiarity with the process and to check for any errors.

In addition to the above, the emergency fire pump, could not deliver water because its isolation valve was internally corroded and stuck shut. Although the spindle gave the impression of movement, internally the gate had detached. Because the valve was never opened for inspection, the defect remained hidden until the emergency. This condition should have been identified during regular tests of the emergency fire pump, where the ability to provide water at two hydrants should be checked.

This reinforces that compliance on paper is not enough - system functionality must be verified through proper installation, routine inspection, and trained personnel.

BRITANNIA COMMENTARY ON INCIDENT

CREW PREPAREDNESS

Emergency drills are essential, but only effective when they simulate credible complications such as:

- missing crew members
- blocked access routes
- equipment failures
- delayed boundary closure

The crew had trained regularly, but drills did not incorporate system-failure scenarios. During the actual event, the absence of the second engineer, combined with the inability to safely enter certain compartments, complicated the response.

MINIMUM STANDARDS ARE NOT ENOUGH

This case clearly illustrates that meeting only minimum statutory requirements can leave ships inadequately prepared for real-world emergencies. Particularly in older ships, where exemption from some current requirements can allow dangerous conditions to develop. The inability to stop the main engine from the bridge and the lack of spray shielding on fuel lines contributed to a worse situation for the crew on board the ship and would have been beneficial had they been installed regardless of the regulations applicable to the ship due to build date.

Where ventilation within the engine room is lacking, it may be acceptable to have open port holes, fire doors, and skylights, but these must be able to be closed remotely from a safe position or be fitted with a fail-safe arrangement.

The ship also carried only the regulatory minimum of two firefighter outfits and SCBAs, stored far apart. This proved insufficient as only one two-person attack team could be assembled, no backup team was available - contrary to standard firefighting doctrine, and this meant that most crew involved in the fire response had no protective equipment and were exposed to smoke and heat.

CONCLUSION

The engine room fire serves as a reminder of the risks associated with machinery space fires, particularly on older ships.

The incident resulted from a combination of interrelated failures: loosened fuel fittings caused by vibration, missing clamps that should have secured them, and degraded insulation that exposed hot surfaces. While any single deficiency alone might not have led to a major incident, together they created conditions conducive to a serious fire. Safety boundaries were also narrowly maintained; once multiple barriers failed simultaneously, the ship was left heavily exposed.

Preventive maintenance, robust documentation, reliable suppression systems and comprehensive crew training remain central to mitigating such incidents. For operators of ageing fleets, the challenge is to balance commercial pressures with robust safety standards. The incident demonstrates that when safety barriers are allowed to degrade, the outcome can be a major casualty, even without loss of life, injury or pollution.

REFLECTIVE LEARNING MATERIAL ON NEXT PAGE

REFLECTIVE LEARNING MATERIAL - ENGINE ROOM FIRE ON A BULK CARRIER ON LAKE ERIE

THE QUESTIONS BELOW WILL HELP YOU TO REVIEW THE INCIDENT CASE STUDY EITHER INDIVIDUALLY OR IN SMALL GROUPS. IF POSSIBLE, DISCUSS YOUR CONCLUSIONS WITH OTHERS, AS THIS IS AN EFFECTIVE WAY OF THINKING ABOUT THE ISSUES IN MORE DEPTH.

PLEASE USE THE INFORMATION PROVIDED IN THE CASE STUDY TOGETHER WITH YOUR OWN EXPERIENCES AND THOUGHTS, TO REFLECT ON THE INCIDENT AND HOW THE ISSUES IDENTIFIED MIGHT RELATE TO YOUR OWN SITUATION.

WHAT DO YOU BELIEVE WAS THE IMMEDIATE CAUSE OF THE INCIDENT?

WHAT OTHER FACTORS DO YOU THINK CONTRIBUTED TO THE INCIDENT?

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WHAT BARRIERS OR SAFEGUARDS SHOULD HAVE PREVENTED THIS INCIDENT FROM OCCURRING?

WHY DO YOU THINK THESE BARRIERS MIGHT NOT HAVE BEEN EFFECTIVE ON THIS OCCASION?

WHAT ACTIONS COULD THE SHIPBOARD MANAGEMENT TEAM (E.G. MASTER, CHIEF ENGINEER, OFFICERS) HAVE TAKEN TO REDUCE THE LIKELIHOOD OF THIS INCIDENT?

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WHAT PROCEDURES, MAINTENANCE PRACTICES, OR MONITORING PROCESSES WOULD HAVE BEEN APPROPRIATE TO PREVENT SUCH AN INCIDENT?

HOW COULD WATCHKEEPING PRACTICES AND MANPOWER ALLOCATION HAVE BEEN IMPROVED TO DETECT OR RESPOND MORE EFFECTIVELY TO THE DEVELOPING SITUATION?

HOW COULD THE CREW HAVE BETTER PREPARED FOR FIREFIGHTING OPERATIONS?

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NOTES