



AVIATION



HIGHWAY



MARINE



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PIPELINE

March 11, 2026

MIR-26-08

Engine Room Fire aboard Cargo Vessel *Lem Verbena*

On January 4, 2025, about 2323 local time, the bulk cargo vessel *Lem Verbena* was docked at the Alabama State Docks on the Mobile River in Mobile, Alabama, with 19 crewmembers on board when a fire started in the engine room (see figure 1 and figure 2).¹ The crew activated the vessel's carbon dioxide fixed fire extinguishing system. Shoreside firefighters later determined the fire had been extinguished. There were no injuries, and no pollution was reported. Damage to the vessel was estimated at \$5.5 million.



Figure 1. *Lem Verbena* underway in Santos, Brazil. (Source: Guilherme Ceccato, shipspotting.com)

¹ (a) In this report, all times are central standard time. (b) Visit [ntsb.gov](https://www.ntsb.gov) to find additional information in the [public docket](#) for this NTSB investigation (case no. DCA25FM014).

Casualty Summary

NTSB casualty category	Fire/Explosion
Location	Alabama State Docks, Mobile River, Mobile, Alabama 30°42.85'N, 88°2.59'W
Date	January 4, 2025
Time	2323 central standard time (coordinated universal time -6 hrs)
Persons on board	19
Injuries	None
Property damage	\$5.5 million est.
Environmental damage	None
Weather	Visibility 10 mi, cloudy, winds east-southeast 12 kts, air temperature 57°F, water temperature 55°F
Waterway information	River; depth 40 ft

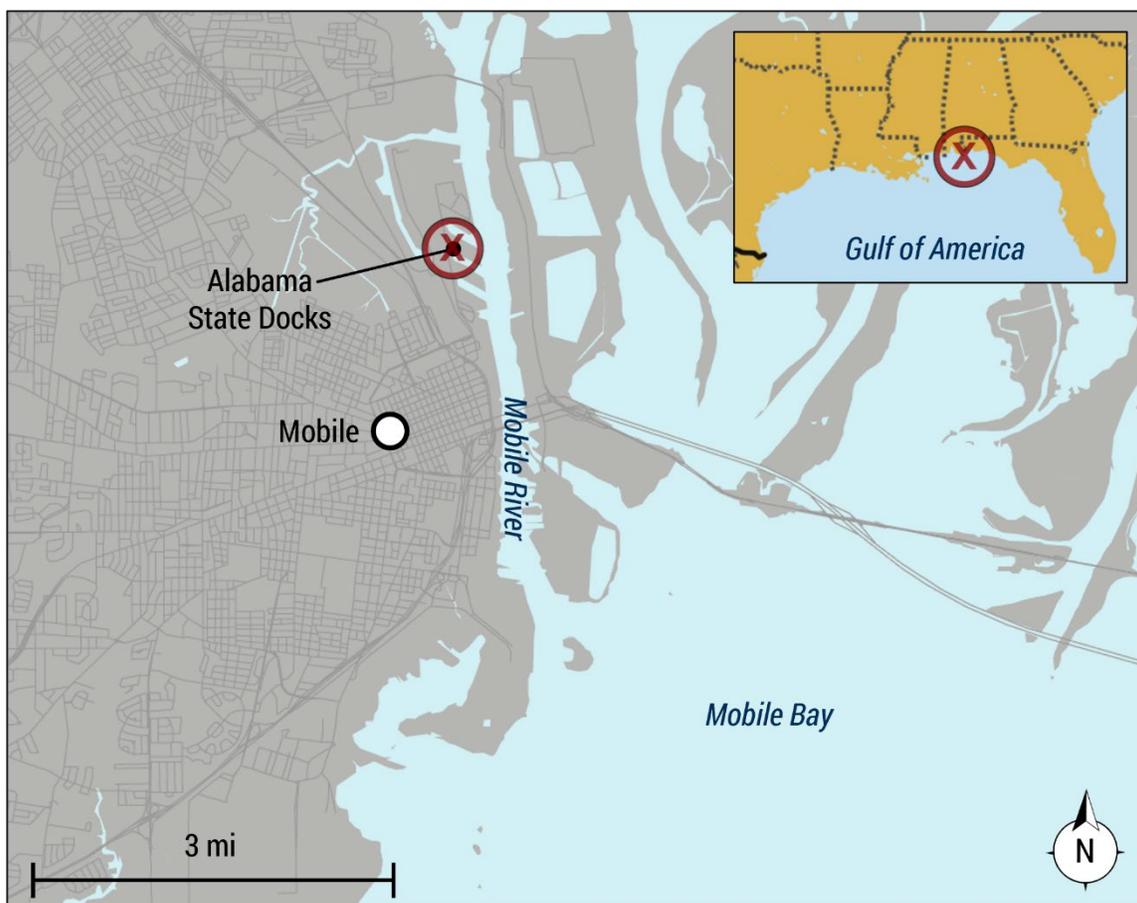


Figure 2. Area where the fire occurred on the *Lem Verbena*, as indicated by a circled X. (Background source: Google Maps)

1 Factual Information

1.1 Background

The 655-foot-long steel-hulled bulk carrier *Lem Verbena* was owned by Banc of America Leasing & Capital, LLC and operated by Lemissoler Shipmanagement. The vessel had five cargo holds and four deck-mounted cargo cranes positioned on the centerline used to load and offload cargo.

The vessel's engine room was comprised of two levels: the upper engine room and the lower engine room. The upper engine room was comprised of the engine room upper deck and upper platform. The upper platform contained the engine control room (ECR), and the upper deck contained the composite boiler and associated components.² The lower engine room was comprised of the engine room lower platform and engine room floor, which contained three diesel generators and the main engine.

1.2 Event Sequence

On January 4, 2025, about 0040, the *Lem Verbena* arrived at the Alabama State Docks, pier D, on the Mobile River in Mobile, Alabama. At 0900, offloading operations began in cargo hold no. 3, which contained pig iron.³ Cargo operations continued throughout the day.

Late that evening, about 2250, the second and third engineers remotely started the no. 3 generator from the ECR to support cargo operations. (The no. 2 generator was already online supplying electrical power to the vessel, and the no. 1 generator was not running.) About 2300, the third engineer conducted a round of the upper engine room and the second engineer conducted a round of the lower engine room. During his round, the third engineer noted that the composite boiler burner unit was running at the time (the burner unit was actively firing into the boiler's furnace) and that there were no issues. The boiler was producing steam for heating the main engine and heavy fuel oil (HFO) tanks, and cleaning HFO tanks. After completing the round, the third engineer departed the engine room, and the second

² A composite boiler burner unit uses a combination of a fuel-fired burner unit and diesel engine exhaust gas to produce steam used for auxiliary purposes on board a vessel. See section 1.3.2 for more information about the vessel's composite boiler and burner unit.

³ Pig iron, or crude iron, is the direct product of smelting iron ore in a blast furnace and is used to produce steel, wrought iron, or ingot iron.

engineer went back to the ECR. At 2305, the second engineer stopped the no. 3 generator from the ECR.

At 2316, cargo operations were completed. The boiler logs showed that, about a minute later, at 2317, the boiler burner unit cycled off with no issues.

At 2322:41, a fire alarm activated in the ECR; the alarm indicated a fire in the “upper engine room” zone, where the boiler and the incinerator were located. At 2322:58, the vessel’s water mist system sensed smoke/heat in the upper engine room zone and automatically deployed in the space (see section 1.3.3). Upon activation of the fire alarm, the second engineer exited the ECR and observed ignited fuel “dropping down” from the engine room upper deck where the boiler burner unit was located, spreading the fire down to the engine room upper and lower platforms beneath it (see figure 3 and figure 4). The second engineer returned to the ECR and called the chief engineer.

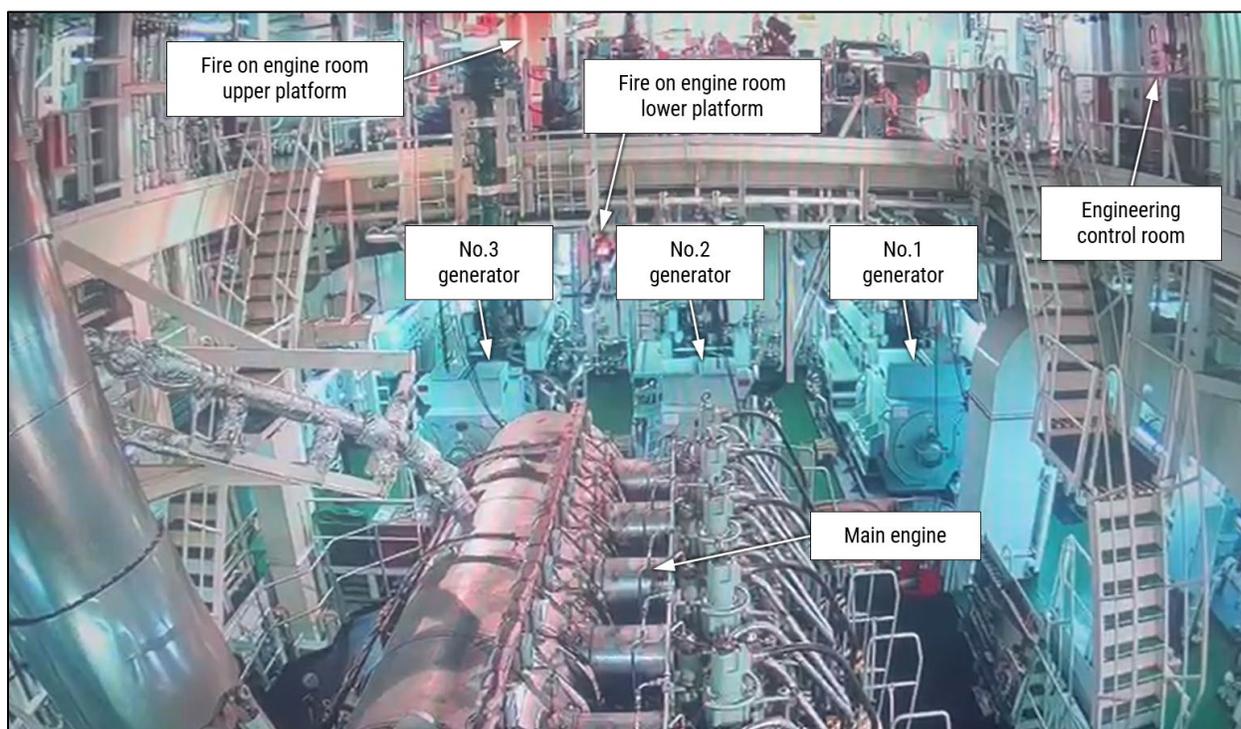


Figure 3. CCTV screenshot from the *Lem Verbena* engine room (facing aft), showing the fire on the engine room upper platform (one deck below the boiler) and engine room lower platform. (Background source: Lemissoler Shipmanagement)

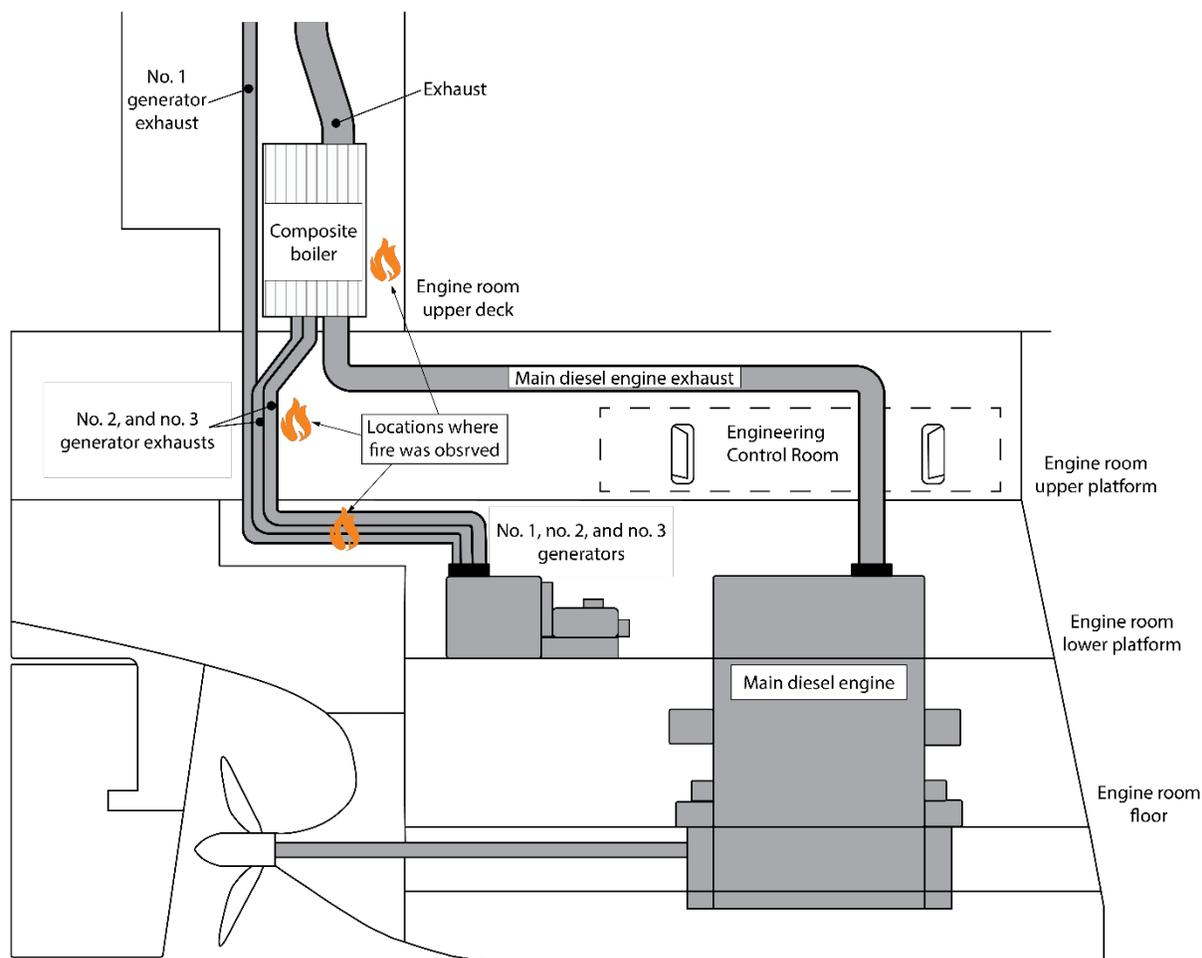


Figure 4. Simplified profile of the *Lem Verbena* engine room representing the arrangement of engine room spaces and exhaust components, and showing the location of initial fire near the boiler as well as the spread of the fire to lower decks. (Not to scale.)

After notifying the chief engineer, the second engineer evacuated the ECR via an emergency escape hatch leading to the main deck. On the main deck, he met the chief and third engineers at a fire control station just outside of the entrance to the engine room, where they shut off electrical power to the fuel pumps for the main engine and generators. They also closed the engine room ventilation and dampers. Shortly afterward, the no. 2 generator shut down. The emergency diesel generator automatically started, came online, and provided power to emergency equipment (such as emergency lighting and the emergency fire pump).

The chief engineer notified the master of the fire, and at 2328, the master sounded the general alarm from the bridge. Upon hearing the general alarm, the chief mate directed the crew to muster. The crew's typical muster point was on the port side of the vessel; however, the chief mate had crewmembers muster on the starboard side to allow for an easier evacuation if necessary (the vessel was starboard

side to the pier). At 2330, all crew were accounted for, and they prepared fire hoses and began boundary cooling the space. The master observed increasing smoke coming from the funnel during this time and used the vessel's satellite phone to notify the Mobile Fire-Rescue Department.

At 2334, the chief mate and an able seafarer (AB) donned firefighter outfits with self-contained breathing apparatus and prepared to enter the engine room upper deck through an external door. The chief mate noted that the door was hot, and upon entering the engine room, the chief mate and the AB encountered heat and heavy smoke, which limited their visibility. After about 30 seconds, they evacuated the space. They attempted to enter a second time but evacuated again due to the heat and smoke, and secured the door to the space. The chief mate later recalled that he did not see a fire but observed "some water drops falling" in the space. During this time, the master recalled that "smoke erupted from the funnel [exhaust stack]."

At 2340, due to the severity of the fire, the master decided to release the vessel's carbon dioxide (CO₂) fixed fire extinguishing system. A second muster was performed to account for all crew before the release. With all crew accounted for, the chief and second engineers went to the CO₂ room and released CO₂ into the engine room. The master noted that after the CO₂ was released, the smoke from the exhaust stacks dissipated.

About 2350, shoreside firefighters arrived on board and met with the chief mate to review the fire control plan and engine room layout. The crew advised the firefighters that CO₂ from the fixed fire extinguishing system had been released into the engine room. Shoreside firefighters did not immediately enter the space and allowed a "soak time" for the deployed CO₂ while they monitored the temperature of the surrounding bulkheads.⁴ During this time, the crew continued boundary cooling.

At 0012, on January 5, the shoreside firefighters, the chief mate, and an AB all donned self-contained breathing apparatus, entered the engine room, and went to the upper deck and upper platform. The firefighters observed "several piles of wood and fuel oil" but could not immediately determine an ignition source.

At 0037, the firefighters determined that the fire was extinguished. A fire watch was posted, and the crew began to ventilate the engine room. During this time, shoreside firefighters remained on board to monitor the space for a potential reflash.

⁴ *Soak time* refers to the duration of time that a space affected by fire remains closed, or sealed off, thereby allowing the fire suppressing agent, such as CO₂, to build and maintain a sufficient concentration to effectively suppress a fire.

The fire did not reflash, and the fire department confirmed that the fire had been extinguished. The firefighters departed the vessel at 0145.

Later that morning, the chief engineer donned a self-contained breathing apparatus and entered the engine room. Using a gas detector, he confirmed that the space was safe for entry and started the no. 1 generator (the exhaust for the no. 1 generator was not routed through the boiler, which remained shut down; see figure 4). An initial assessment by the chief engineer found that the fire started near the fuel flow meter on the boiler's burner unit.

1.3 Additional Information

1.3.1 Damage and Post-fire Survey

After the fire, a surveyor from the vessel's classification society completed a damage survey. The survey report noted extensive fire damage to the boiler's burner unit and adjacent burner control cabinet. The surrounding lights, electrical cabling, alarm light towers, piping and bulkhead insulation, fire alarm pull stations, general alarm horns, and fire doors in the engine room upper deck were also damaged by smoke and heat from the fire.

The surveyor observed the most severe fire damage on the fuel-handling side of the burner unit, which included the fuel flow meter and the oil fittings block (see figure 5). The other side of the burner unit was less severely damaged but showed heavy soot and signs of smoke damage. The engine room upper platform (a deck below the engine room upper deck, which contained the boiler) was also significantly damaged by the fire. A wooden supply shelf located directly below the burner unit through the metal grating of the engine room upper deck was destroyed by the fire, and fuel oil was observed on the deck below. Total damages were estimated at \$5.5 million.

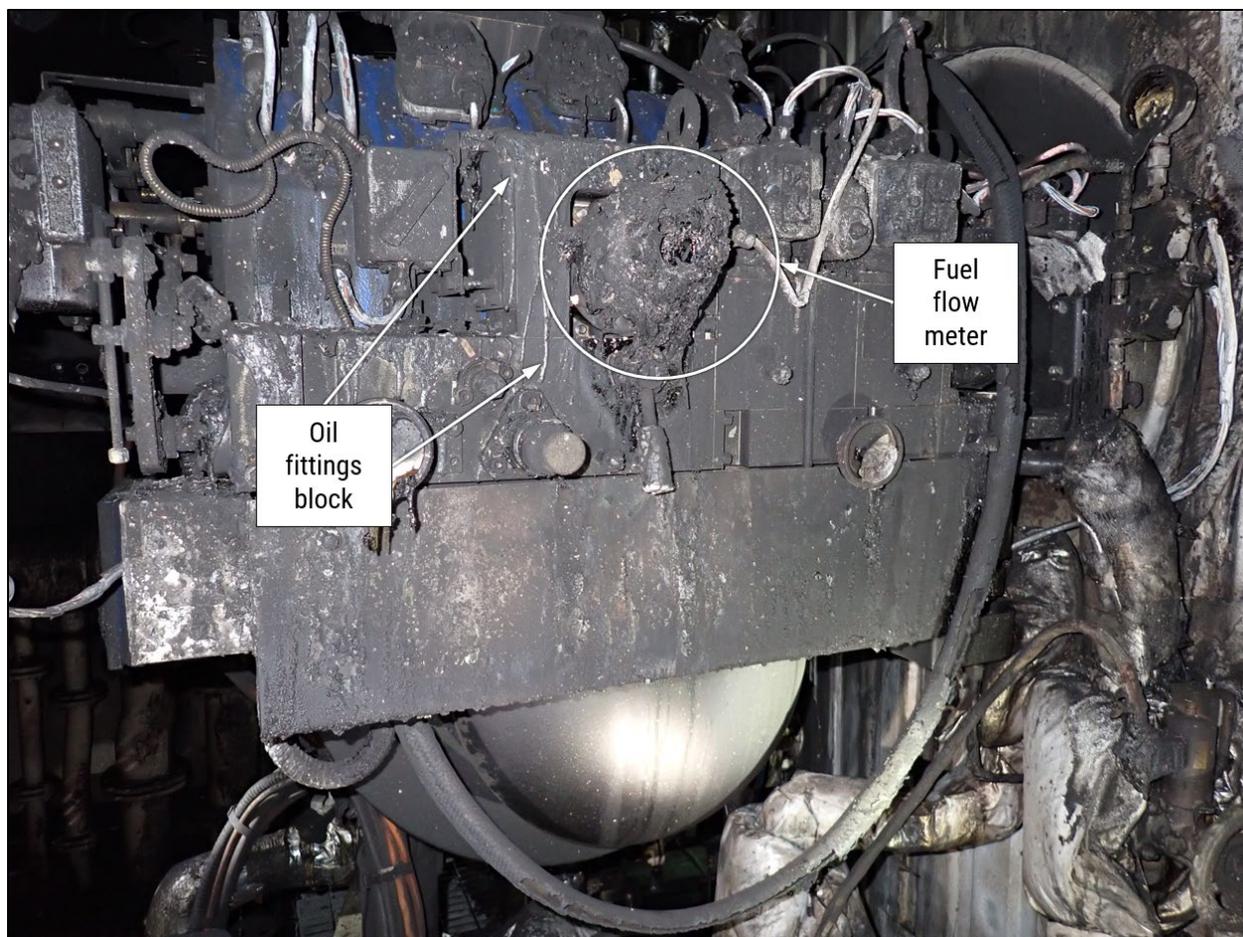


Figure 5. The *Lem Verbena* boiler's burner unit after the fire. (Background source: US Coast Guard)

1.3.2 Boiler

The *Lem Verbena*'s boiler created steam using two methods: a furnace heated by a burner unit fired from diesel oil, and waste heat from the main engine or the no. 2 and no. 3 diesel generator exhausts, which ran through vertical tubes within the boiler (the no. 1 diesel generator was not part of the boiler system). A portion of the no. 2 and no. 3 generator exhaust pipes ran directly below the burner unit in the engine room upper platform and through metal grating before it entered the boiler. Precasualty pictures of the no. 2 generator exhaust pipe showed that it was covered with protective lagging (see figure 6).⁵

⁵ *Lagging* insulates hot surfaces such as engine exhaust piping from combustible surfaces, such as wood or fiber-reinforced plastic, or from flammable liquids including oil and fuel leaks.

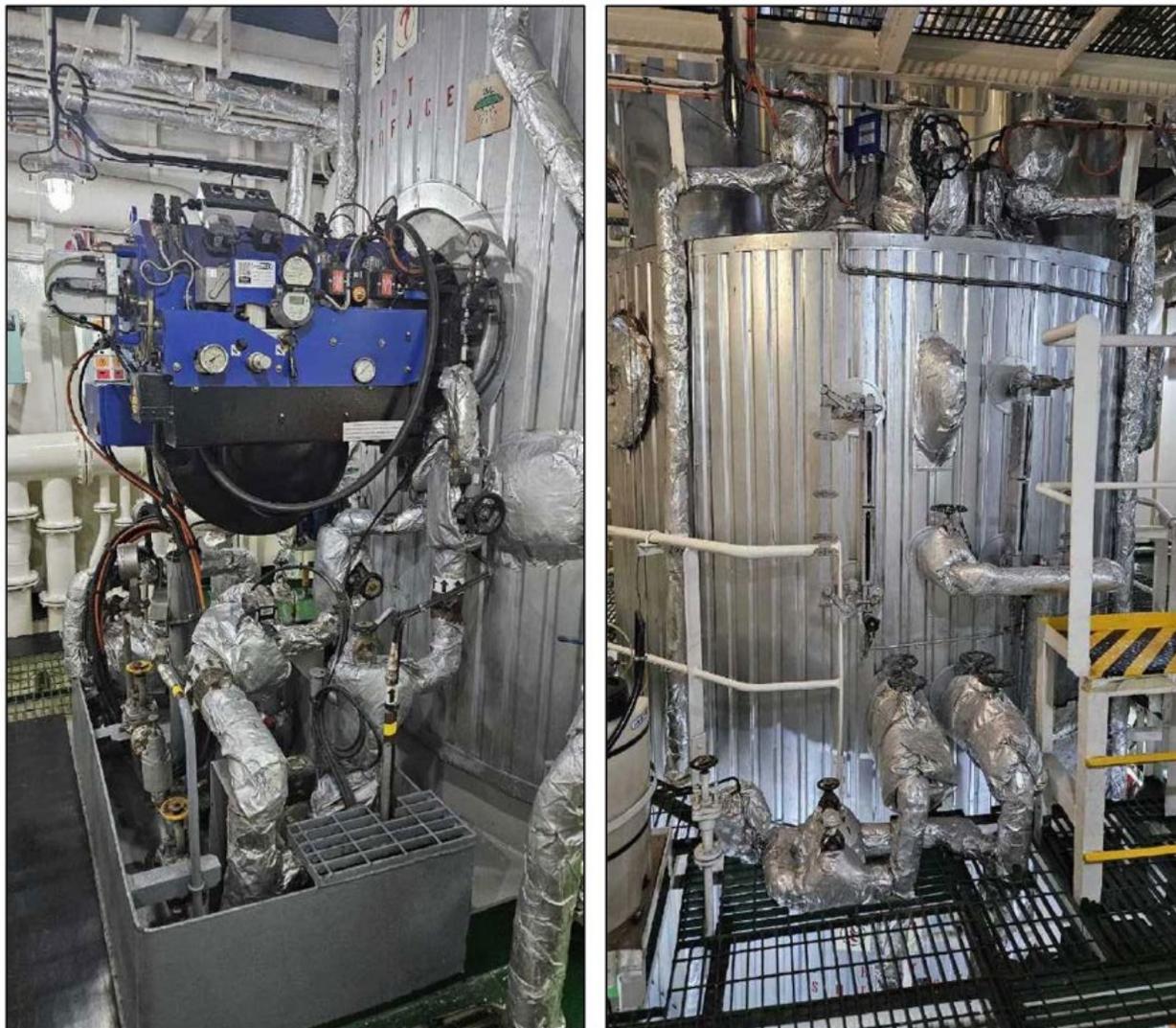


Figure 6. Left to right: Boiler's burner unit and boiler on the *Lem Verbena* shown before the fire. (Source: Lemissoler Shipmanagement)

On the night of the fire, the burner unit was in automatic mode and configured to use marine gas oil (MGO) (the burner unit could run on either HFO or MGO). About the time of the fire, the no. 2 generator was online, and its exhaust was routed into the boiler. The boiler logs showed that the burner unit typically cycled on for about 28 minutes before shutting down for about 20 minutes. According to the burner unit manufacturer, when operated in automatic mode, the burner unit's fuel pump was designed to shut off in between cycles when it was not actively firing into the boiler. When the fire alarm activated, the burner unit was not actively firing and had completed a cycle about 5 minutes before the activation of the alarm.

1.3.2.1 Maintenance

The vessel's planned maintenance system outlined all recurring maintenance tasks for the boiler and its burner unit. The third engineer was primarily responsible for all maintenance tasks on the boiler. All daily, weekly, and monthly maintenance tasks had been completed with no issues noted. Safety rounds, or visual checks, of the boiler space were also performed 5–6 times per day by the crewmember on watch and involved checking boiler pressure, checking for water leaks, and recording water level. Additionally, in accordance with guidance from the boiler manufacturer, quarterly maintenance and inspection tasks for the burner unit were completed by the ship's crew on November 17, 2024 (about 2 months before the fire), with no issues noted.

1.3.2.2 Postcasualty Examinations

Following the fire, a service technician from the boiler manufacturer examined the boiler. The technician found no internal or structural damage to the boiler (aside from smoke and heat damage to the exterior of the boiler) and successfully pressure-tested the unit. However, the technician determined that the burner unit was damaged beyond repair and required replacement. The service technician's report concluded that the concentration of damage on the fuel-handling side of the burner unit indicated possible fuel contamination or a sudden fuel leak. The report also stated that the burner unit was not properly tightened to the boiler's combustion chamber, citing "an observable gap between [the] air housing and burner."

US Coast Guard investigators disassembled and examined the burner unit's oil fittings block around the fuel flow meter. The oil fittings block was comprised of three separate modules that provided a path for pressurized fuel from the fuel pump, through the fuel flow meter and other components, and into the igniter. Investigators found that an O-ring between two of the modules overlapped into the corresponding fuel port and became pinched between the two modules (see figure 7 and figure 8). When the fuel pump was running, fuel pressure at this location in the system was 3 bar, or about 43 pounds per square inch. Coast Guard investigators also found that the bolt securing the burner unit to the boiler combustion chamber was partially stripped, preventing the burner from being tightly secured to the boiler.

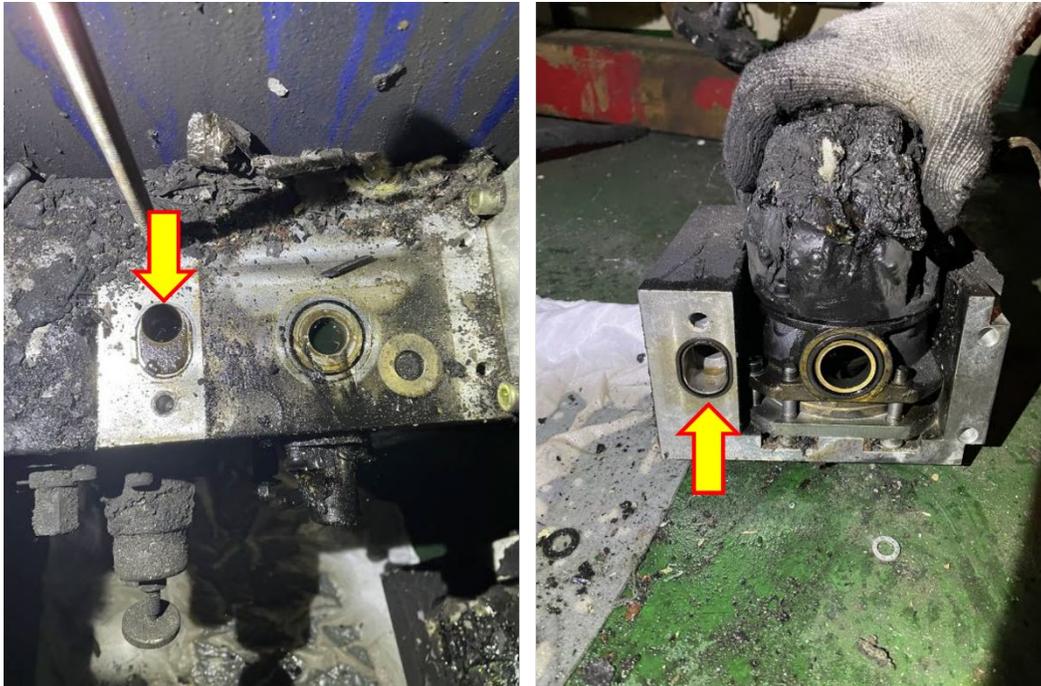


Figure 7. Left to right: Lower module of the oil fittings block showing overlap between the lower and upper module fuel ports as indicated by the arrow. Upper module of oil fittings block and fuel flow meter showing the pinched O-ring as indicated by the arrow. (Source: Lemissoler Shipmanagement)



Figure 8. Close-up view of O-ring on upper module of burner unit oil fittings block. (Background source: Coast Guard)

In the months after the fire, the *Lem Verbena* operating company replaced the burner unit with the same model that was destroyed by the fire. When installing the new burner unit, the new unit's SD card was inoperable, so the service technician used the undamaged SD card from the previous burner unit that was involved in the fire (the boiler's SD card stored operational data and contained software controlling the operation of the boiler and burner unit). During initial testing, the MGO fuel pump did not turn off when the burner unit shut down between cycles. (According to the burner unit manufacturer, as designed, the fuel pump should only run when the burner unit was running, and the pump should turn off when the burner unit was off in between cycles.) To correct this issue, the service technician modified the software configuration file on the SD card so that the MGO fuel pump stopped when the burner was off.

The operating company determined that the pinched O-ring was subject to accelerated degradation due to a combination of becoming pinched between the two modules and continuous exposure to hot, pressurized fuel in the system because of a software settings error on the system's SD card. The company concluded that the fire started from an "exploding leakage" from the weak point in the system created by the degraded and pinched O-ring. Investigators could not determine whether the block modules had been disassembled since they were manufactured or initially installed on the vessel.

1.3.3 Water Mist System

According to the alarm log, about 13 seconds after the fire alarm activated, the water mist system automatically deployed in the zone for the engine room upper deck containing the boiler and the incinerator.

The water mist system near the boiler was tested monthly by the *Lem Verbena* crew, with the last test occurring the day before the fire. No issues were noted; the system was found in "good working condition," and the "water pressure was in working range."

After the fire was extinguished, the chief engineer noted that there was water in the space containing the boiler. He believed that this water was from the water mist system because the fire team that entered the space did not discharge any hoses in the space.

2 Analysis

While the bulk cargo vessel *Lem Verbena* was docked at the Alabama State Docks in Mobile, Alabama, a fire broke out in the upper deck of the engine room near the boiler. Due to the severity of the fire, the crew activated the vessel's CO₂ fixed fire extinguishing system, and the fire was extinguished.

After the fire, the *Lem Verbena* operating company and Coast Guard investigators found that an O-ring on the oil fittings block upper module of the boiler's burner unit had become pinched on the fuel port for the lower module. This O-ring was intended to provide a seal between the corresponding fuel ports on the lower and upper modules (when bolted together) to contain pressurized fuel as it moved through the system to the burner unit igniter. O-rings are designed to protect against leaks by lying flat and becoming compressed between two machinery surfaces that are secured together, typically containing a material under pressure. If any portion of the O-ring does not lay flat between the two surfaces, full compression of the O-ring cannot be achieved. This weakens the seal created by the O-ring and increases the likelihood of failure. In this case, a portion of the O-ring on the upper module overlapped into the fuel port on the lower module, preventing the O-ring from lying flat and providing an adequate seal. This was because the two modules' ports were not aligned radially and created an uneven clearance gap when the ports were bolted together. This gap could not be seen or detected when the ports were bolted together. (Investigators could not determine whether the block modules had been disassembled since they were manufactured or initially installed on the vessel.)

Additionally, because of a software settings error discovered on the boiler unit's SD card, the fuel pump did not shut down between cycles as intended and the pinched O-ring was exposed to constant pressure. The operating company found that the O-ring's exposure to hot, pressurized fuel caused accelerated degradation of the O-ring, ultimately causing the seal to fail. Over time, the pinched portion of the O-ring was weakened until its seal failed under the fuel pressure in the ports. Because the fuel pump remained running even if the boiler burner was not firing and, thus, the fuel system was always pressurized, pressurized fuel about 43 pounds per square inch would have atomized around the boiler and ignited on a nearby hot surface, causing the fire.

Due to a lack of evidence, the exact ignition source and sequence (what caused the ignition and how the fire spread) could not be determined. However, post-fire damage assessments showed the most significant fire damage on the fuel-handling side of the burner unit and the immediately adjacent area. Significant fire damage was also found in the engine room upper platform, a deck below the boiler. Possible ignition sources in those areas included the boiler and burner unit,

which may have still been hot from a previous cycle (completed about 5 minutes before the fire), or the running no. 2 generator's exhaust, which ran into the boiler from directly below it. While the exhaust was covered with protective lagging, it is possible that the atomized fuel contacted an unprotected section of the exhaust pipe and ignited.

The water mist system around the boiler automatically activated and discharged (based on water found in the engine room post-fire), but it did not extinguish the fire. The crew attempted to enter the engine room but were unable to do so because of the high heat and smoke from the fire. Because the crew had secured the engine room, shut off ventilation, stopped the fuel pumps, and all crew were mustered, the master was able to make a quick decision to activate the CO₂ fixed fire extinguishing system and notify shoreside firefighters when it became clear that the crew was unable to fight the fire. When shoreside firefighters arrived on board, they coordinated with the ship's crew to determine the status of onboard efforts to suppress the fire, including the crew's securement of ventilation and fuel, muster of the crew, and deployment of CO₂ in the engine room. Because of their effective communication, shoreside firefighters decided not to immediately enter the engine room, and the engine room remained sealed off. This allowed the deployed CO₂ to displace the oxygen and cool the surrounding area while the firefighters and crew monitored bulkhead temperatures and continued boundary cooling. The crew's initial response to the fire (sealing the engine room, stopping fuel pumps, and mustering the crew) and coordination with shoreside firefighters maximized the effectiveness of the CO₂ fixed fire extinguishing system.

3 Conclusions

3.1 Probable Cause

The National Transportation Safety Board determines that the probable cause of the fire on the bulk carrier *Lem Verbena* was the failure of an O-ring seal on the composite boiler burner unit oil fittings block due to the radial misalignment of the two fuel ports on the block modules, causing pressurized diesel fuel to atomize and ignite on a nearby hot surface.

Vessel Particulars

Vessel	<i>Lem Verbena</i>
NTSB Vessel Group	Cargo, Dry Bulk (Bulk carrier)
Owner/Operator	Banc of America Leasing & Capital, LLC / Lemissoler Shipmanagement (Commercial)
Flag	Marshall Islands
Port of registry	Majuro, Marshall Islands
Year built	2020
Official number	8591
IMO number	9845829
Classification society	American Bureau of Shipping
Length (overall)	655.8 ft (199.9 m)
Breadth (max.)	105.8 ft (32.2 m)
Draft (casualty)	36.9 ft (11.2 m)
Tonnage	36,781 GT ITC
Engine power; manufacturer	10,057 hp (7,500 kW); MAN B&W 7G50ME-C9.6 diesel engine

NTSB investigators worked closely with our counterparts from **Coast Guard Sector Mobile** throughout this investigation.

The National Transportation Safety Board (NTSB) is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant events in other modes of transportation—railroad, transit, highway, marine, pipeline, and commercial space. We determine the probable cause of the accidents and events we investigate, and issue safety recommendations aimed at preventing future occurrences. In addition, we conduct transportation safety research studies and offer information and other assistance to family members and survivors for any accident or event investigated by the agency. We also serve as the appellate authority for enforcement actions involving aviation and mariner certificates issued by the Federal Aviation Administration (FAA) and US Coast Guard, and we adjudicate appeals of civil penalty actions taken by the FAA.

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For more detailed background information on this report, visit the [NTSB Case Analysis and Reporting Online \(CAROL\) website](#) and search for NTSB accident ID DCA25FM014. Recent publications are available in their entirety on the [NTSB website](#). Other information about available publications also may be obtained from the website or by contacting—

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