Issued May 17, 2022 MIR-22/17

Engine Room Fire aboard Towing Vessel *Mary Lynn*

On May 18, 2021, about 0653 local time, the towing vessel *Mary Lynn*, with a crew of six, was pushing two barges, transiting upbound near mile 176 on the Upper Mississippi River near St. Louis, Missouri, when a fire broke out in the engine room.[1] A nearby Good Samaritan towing vessel and a St. Louis Fire Department fire boat helped put out the fire, which was extinguished at 0810. There were no injuries or pollution reported. Damage to the *Mary Lynn* was estimated at over $700,000.

Figure 1. *Mary Lynn* under way at 0652 on May 18, 2021, about a minute before the fire broke out. (Source: American River Transportation Company [ARTCO])

[1] (a) In this report, all times are central daylight time, and all miles are statute miles. (b) Visit ntsb.gov to find additional information in the public docket for this NTSB investigation (case no. DCA21FM028). Use the CAROL Query to search investigations.

Casualty Type	Fire/Explosion
Location	Upper Mississippi River, mile 176, near St. Louis, Missouri 38°34.83′ N, 090°13.06′ W
Date	May 18, 2021
Time	0653 central daylight time (coordinated universal time -5 hrs)
Injuries	None
Property damage	$700,000 est.
Environmental damage	None
Weather	Visibility 3 mi, overcast, winds southeast at 10 kts, river surface conditions rippled, air temperature 63°F, sunrise 0546
Waterway Information	River, project depth 9 ft, width about 1,600 ft, current 4–5 mph est., river gage 15.6 ft and rising

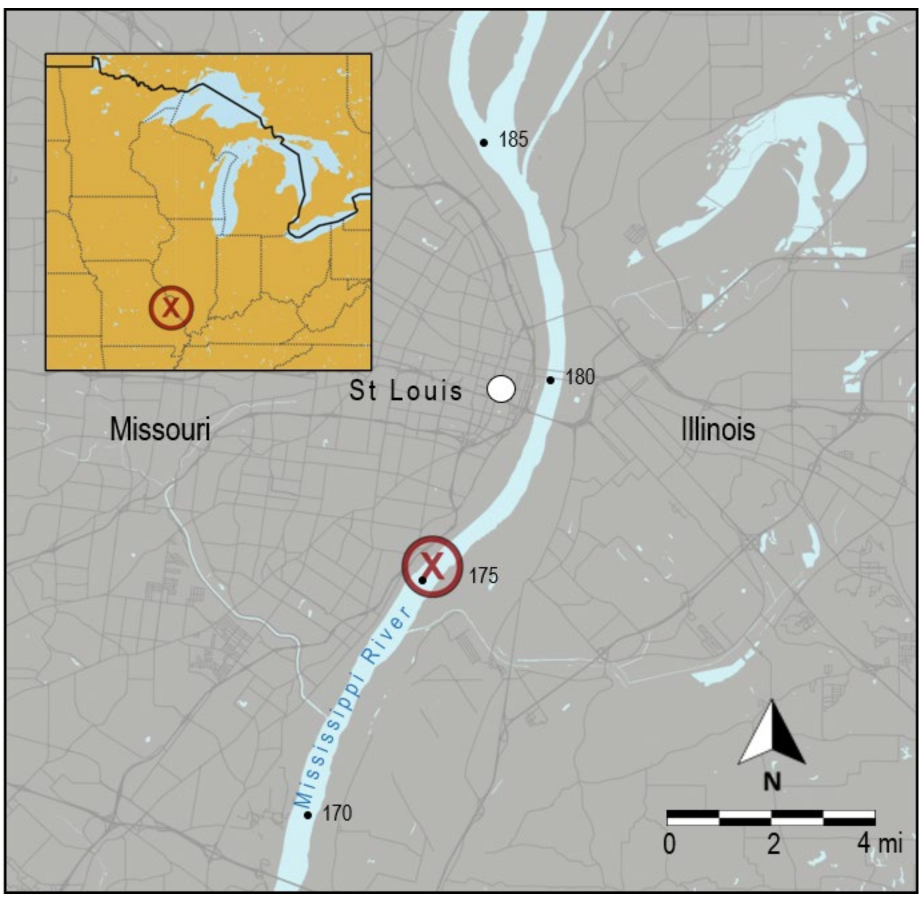

Figure 2. Area where the fire in the engine room of the *Mary Lynn* occurred, as indicated by a red *X*. (Background source: Google Maps)

1. Factual Information

1.1 Background

Built in 1957, the *Mary Lynn* was a 141-foot-long towing vessel powered by two mechanically controlled, 16-cylinder EMD 645-D3A roots-blown (supercharged) diesel engines. Each 3,800-hp engine was connected to a set of reduction gears and pneumatically operated clutches. Hermann Sand and Gravel operated the *Mary Lynn*, which was leased from Missouri River Towing.

Constructed of welded steel, the *Mary Lynn* had three decks above the main deck, including the wheelhouse. The upper level of the engine room was located aft of the galley and accommodation spaces on the main deck. The lower level of the engine room was below the main deck and contained the main engines, auxiliary machinery, and the fire pump. The engine room's upper level had several windows located along the port and starboard exterior main deck.

1.2 Event Sequence

About 0315 on May 18, the *Mary Lynn* tied up at the Gasconade Street fleet near mile 175 of the Upper Mississippi River in St. Louis after dropping off barges about 3 miles downriver. The vessel's crew planned to take on fuel, lube oil, and potable water from a delivery tug and barge about 0600.

The chief engineer woke up about 0300, in advance of his 0500 watch, to prepare for the fuel, lube oil, and potable water transfer. He went to the engine room, conducted a visual inspection of the space, and then began the weekly task of removing residual water from the four fuel storage tanks (no. 2 port and starboard and no. 3 port and starboard) using a dewatering filtration system.

About 0330, while the chief engineer was still operating the dewatering filtration system, the fuel delivery tug and barge arrived, about 2.5 hours earlier than expected. The chief engineer shut off the dewatering system pump and closed the fuel storage suction and return valves for the tank he was dewatering at the time, leaving all fuel return line valves closed. The chief engineer later told investigators that he had thought the no. 2 port and starboard fuel storage tank fuel return line valves were open, but he did not physically check their positions. The chief engineer then shifted his focus to preparing for the fueling operation, completing the bulk cargo transfer checklist (used for fuel) at 0335.

About 0500, the transfer of 25,550 gallons of ultra-low-sulfur diesel fuel to the *Mary Lynn* was completed. The fuel delivery barge and tug departed the *Mary Lynn* at

0537, and, about 0540, the captain arrived in the wheelhouse to relieve the pilot for his scheduled watch.

The chief engineer changed the disposable fuel filters (not a part of the main engines) for the fuel transfer pumps and the fuel suction cartridge filters on the fuel supply line for both main engines (the chief engineer said the changeout was usually done based on engine running hours). Once the changeout of the fuel filters was complete, he informed the captain that the engines were ready for use.

About 0617, after facing up and connecting to two barges, the tow got under way to pick up more barges about 3 miles up river. Just after getting under way, the captain noticed the rpm on the starboard engine was not increasing, so he radioed the deckhand and requested he inform the chief engineer of the problem. At the starboard main engine, the chief engineer observed only 5 pounds per square inch (psi) of fuel pressure supplying the injectors from the engine-mounted fuel pump. According to the chief engineer, fuel pressure was normally about 18 psi when the engine was idle and about 28 psi when the engine was under load. The chief engineer asked the captain to return to the fleet and tie up so he could investigate the problem.

About 0626, the *Mary Lynn* tied up again at the Gasconade Street fleeting area. The chief engineer shut down the starboard engine and opened and inspected the fuel suction cartridge filters. He discovered that they had been "sucked dry." He stated that he thought this was caused by improperly sealed O-rings on the fuel suction cartridge filter housing covers, so he replaced the O-rings. He checked the fuel transfer pump, which was normally always on and circulating fuel between selected fuel storage tanks and the fuel day tank when the main engines were running. He found the pump was off and had been off since before the fuel transfer earlier that morning (it was common practice to have the fuel transfer pumps powered off when taking on fuel). The chief engineer opened the no. 3 fuel storage tank suction valve and started the fuel transfer pump. He also filled the fuel filter canisters with fuel, closed the canister covers, and restarted the starboard main engine. He throttled it to about 600 rpm, and, after seeing the engine "had good fuel pressure," he informed the captain that the problem had been resolved and that they could depart. During the troubleshooting efforts, one of the *Mary Lynn*'s two generators, supplying electrical power to the vessel, continued running. The port main engine also remained running at idle and, according to the chief engineer, was operating normally.

At 0639, the captain maneuvered the *Mary Lynn* tow off the fleet and proceeded upriver. The captain said he had the engines at "nearly full" ahead; the tow was making a speed of about 2.5 to 3 mph into the current. The chief engineer, who was working between the main engines in the engine room, closer to the starboard engine, recalled hearing a "pow." He looked over to see a sight glass (referred to as a bowl in the EMD parts manual) blow off the spin-on fuel filter assembly on the forward end of the port main engine. He described seeing “a straight line that was spraying out” from where the sight glass bowl had blown off, and that the fuel “went straight up and it was all fire,” noting that he had “never seen anything go up that fast.” Based on onboard image recorder system footage from a nearby vessel, the engine room windows blew out about the same time flames became visible. The chief engineer stated that he tried to get to the fuel supply valve at the top of the port main engine to shut it down, but it was too hot and smoky for him to reach. With the rapidly increasing smoke and heat, the chief engineer evacuated the engine room via the aft engine room stairs and the portside door one deck above. He said that when he got to the upper deck of the engine room to exit, the whole area was in flames.

At 0652:46, the captain heard a call on the VHF radio stating, “Hey *Mary Lynn*’s on fire.” Shortly after, the chief engineer announced the fire over the handheld radio, and the vessel’s centralized fire-detection system alarmed in the wheelhouse. The captain looked aft of the wheelhouse and saw flames and black smoke shooting up from the deck. He then activated the general alarm to muster the crew to emergency stations. All crew responded and were accounted for.

Figure 3. The *Mary Lynn* at 0652:40 when the first open flame, circled in yellow, was visible on the second deck port side exhaust stack (*left*). The *Mary Lynn* at 0652:45 (*right*). (Source: ARTCO)

Both engines continued to run after the chief engineer evacuated the engine room. Since the *Mary Lynn* was still under way, the chief engineer waited for the captain’s order to pull the emergency remote fuel shutoffs, which closed valves supplying fuel to the main engines and generators. The emergency fuel shutoff pull station was located on the starboard-side main deck, outside of the engine room. The chief engineer remained on the portside main deck and could see open flame and black smoke coming out of the broken engine room windows. Recognizing that he would likely lose power, the captain steered the tow to starboard to keep away from a fleeting area that was ahead of the tow, and just after he did so, at 0655, the *Mary Lynn* lost main engine and generator power. At the captain’s instruction, the chief engineer went to the starboard side and pulled the main emergency fuel shutoff. Firefighting stations were located on the port and starboard sides of the outer main deck; however, the vessel had no power to operate the electrically driven fire pump. The engine room was not equipped with a fixed fire-extinguishing system, nor was there any regulation requiring it.

About 0655, Good Samaritan towing vessels began to assist the *Mary Lynn.* At 0657, the *Crimson Glory* arrived with charged fire hoses, and the crew sprayed water into the *Mary Lynn*'s blown-out portside engine room windows and the second deck engine room ventilation intakes. Additional towing vessels assisted with firefighting efforts or held the *Mary Lynn* and its barges in place. Based on onboard image recording footage, about 0705, smoke from the engine room began to dissipate. Crewmembers from the *Mary Lynn* and Good Samaritan vessels taped plastic coverings over the blown-out engine room windows and intake fans to limit the supply of air to the engine room. With no mechanical means to isolate the engine room ventilation, they placed tarps over the engine room ventilation openings on the second deck.

At 0715, a fire boat from the St. Louis Fire Department arrived, and firefighters boarded the *Mary Lynn*. At 0810, the St. Louis Fire Department declared the fire extinguished. Good Samaritan towing vessels pushed the *Mary Lynn* tow to a fleeting area, where it was secured at 0834.

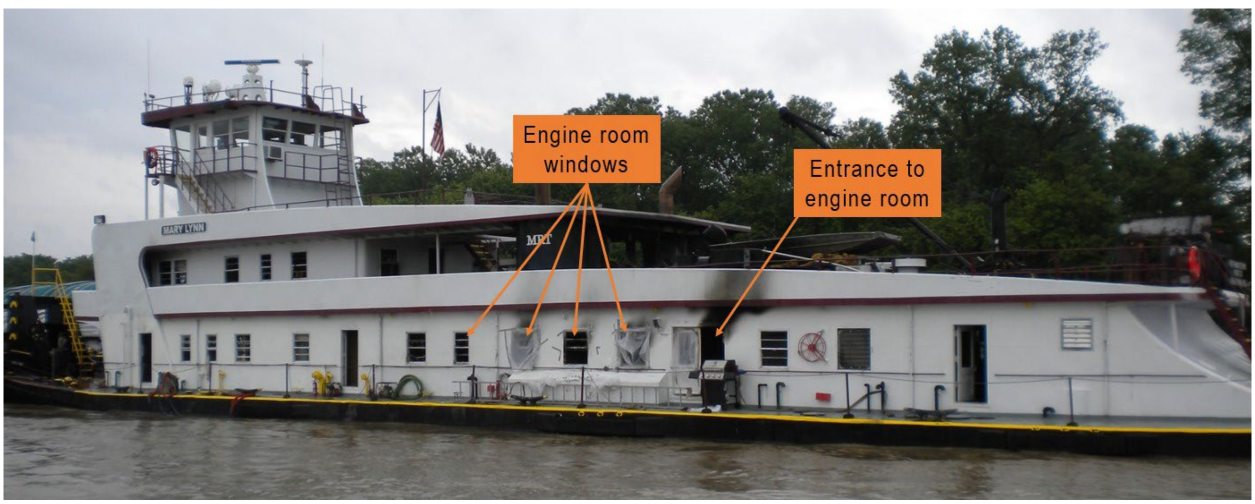

Figure 4. The *Mary Lynn*'s port side, postcasualty, with some of the plastic window coverings remaining over the engine room windows. (Source: US Coast Guard)

1.3 Additional Information

1.3.1 Personnel

The crew of the *Mary Lynn* were tested for alcohol and other drugs, all with negative results.

The chief engineer of the *Mary Lynn* was not a credentialed marine engineer and was not required to be. He had about 32 years of experience in the operation and maintenance of EMD-645-type engines. He had worked with Hermann Sand and Gravel for about 6 months, all aboard the *Mary Lynn*, and at the time of the casualty, he was about 2 weeks into his rotation on board. The captain of the *Mary Lynn* stated that the chief engineer was competent, knowledgeable, and had a high work ethic.

The chief engineer worked a 6-hours-on/6-hours-off watch rotation from 0500-1100 and 1700–2300 and rotated with a "deckaneer" (a deckhand who performed engineering duties), who worked 1100–1700 and 2300–0500 watches. The day before the casualty, on May 17, the chief engineer said that he slept from about midnight to 0500 (his longest continuous sleep before the casualty) and was on watch from 0500 to 1100. He slept about an hour after completing his watch and then was awake, but not on duty, from about 1200 to 1700. After completing his watch from 1700 to 2300 on May 17, the chief engineer went to sleep after having a meal. He was awake again about 0300 and was in the engine room shortly after to prepare to take on fuel. The chief engineer told investigators that he did not feel tired at the time he was awake and working in the engine room.

1.3.2 Damage

The *Mary Lynn* sustained heat, smoke, and water damage to the engine room, with the most intense heat, soot, and charring damage at the forward port side of the engine room, at the overhead directly above the port main engine and on the forward inboard side of the port main engine. Adjacent machinery spaces below the main deck sustained little to no heat, smoke, or water damage. The galley, forward of the main engine room on the main deck, sustained heat, smoke, and water damage, while all other accommodation areas had minor smoke damage. The starboard main engine and both generators showed no signs of damage from the fire.

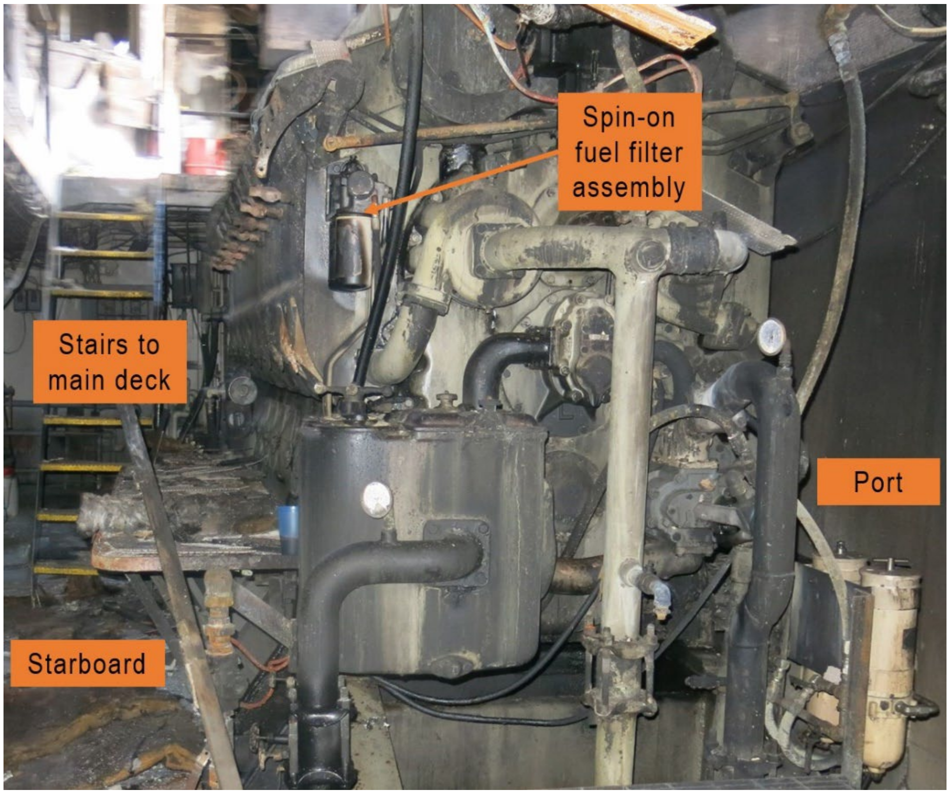

Figure 5. The front of the *Mary Lynn*'s port main engine, looking aft, from the forward lower engine room, postfire.

1.3.3 Main Engine Spin-on Fuel Filter System

Each engine had an engine-driven fuel pump (positive displacement), mounted on the forward end of the engine, that pulled fuel through two fuel suction cartridge filters, then discharged fuel through the spin-on fuel filters at 25-30 psi to the engine's cylinder injectors. Each engine's spin-on fuel filter assembly had two sight glass bowls on the front right side of the main engine. The sight glass bowls provided (1) visual indication of fuel supply to the engine and (2) the condition of the spin-on filters. Fuel returning from the engine's injectors passed through the fuel return sight glass bowl before returning to the fuel day tank. Under normal operation, the fuel return sight glass bowl would be full of fuel. If a spin-on fuel filter became clogged or dirty and the supply fuel pressure exceeded 60 psi, a bypass relief valve would open, directing fuel to the normally empty fuel supply bypass sight glass bowl, a cue to the operator that the spin-on filters needed replacement. According to the chief engineer, the disposable spin-on filters were normally replaced based on engine running hours, before any visual indication in the bypass sight glass bowl. The EMD 645 operation and maintenance manual had a warning that "a pressure of greater than 60 psi might fracture the fuel sight glasses" and to "beware of possible fire hazards due to fuel spillage."

During the postcasualty examination of the *Mary Lynn*, the chief engineer showed investigators the area of the port main engine spin-on fuel filter assembly where he heard a pop and saw the fuel spray from the engine's forward end. The fuel supply bypass sight glass bowl was found in pieces, and the fuel return sight glass bowl was still intact. The chief engineer recalled the last change of the port main engine's spin-on fuel filters was about 4 days before the casualty, and the engine had been running since then without any problems. He described that after replacing the spin-on fuel filters, he would unscrew the thumb screw of the clevis assembly (which the chief engineer described as a c-clamp) and then remove and clean both sight glass bowls. Once cleaned, he would check the gaskets on each sight glass bowl fitting before placing them back. He would then replace the clevis and tighten the thumb screw on the assembly. The chief engineer said that although the sight glass bowls were thick, he always tightened them by hand only. He noted that some people tightened the clevis thumb screws with pliers or wrenches, which he believed could fracture (crack) the glass.

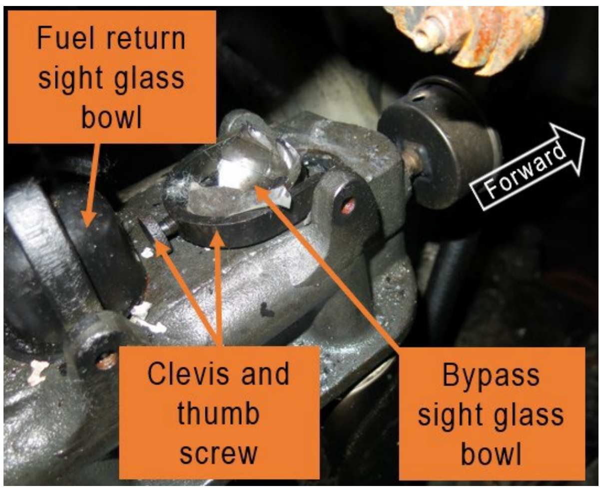

Figure 6. Top of the port main engine fuel filter assembly after the fire, with broken fuel supply bypass sight glass bowl and intact fuel return sight glass bowl.

1.3.4 Main Engine Exhaust Insulation

The port main engine exhaust manifold was lagged with insulation, but the section of exhaust header between the engine block and the horizontal portions of the exhaust manifold were not shrouded, insulated, or lagged. Additionally, the cylinder test valves, located on each side of the engine at each individual cylinder, had no insulation. Regulations require that piping and machinery components that exceed certain temperatures be insulated.[2] The last logged cylinder exhaust gas temperatures for the port main engine were recorded on March 31, while the engine was operating at a similar load as on the morning of the fire, and were above 500°F.

The chief engineer saw the first visible flame near the spin-on fuel filter assembly on the inboard side of the port main engine. He said he thought the fuel ignition may

[2] Title 46 *Code of Federal Regulations* (*CFR*) 143.220 (b) states that piping and machinery components that exceed 220° (428°F), including fittings, flanges, valves, exhaust manifolds, and turbochargers must be insulated. Measures must be in place to prevent flammable or combustible liquid piping leaks from coming into contact with these components.

have been a result of fuel contact with a cylinder test valve near the fuel header on the side of the engine, since he thought it was the hottest "uncovered" (uninsulated) part of the exhaust system.

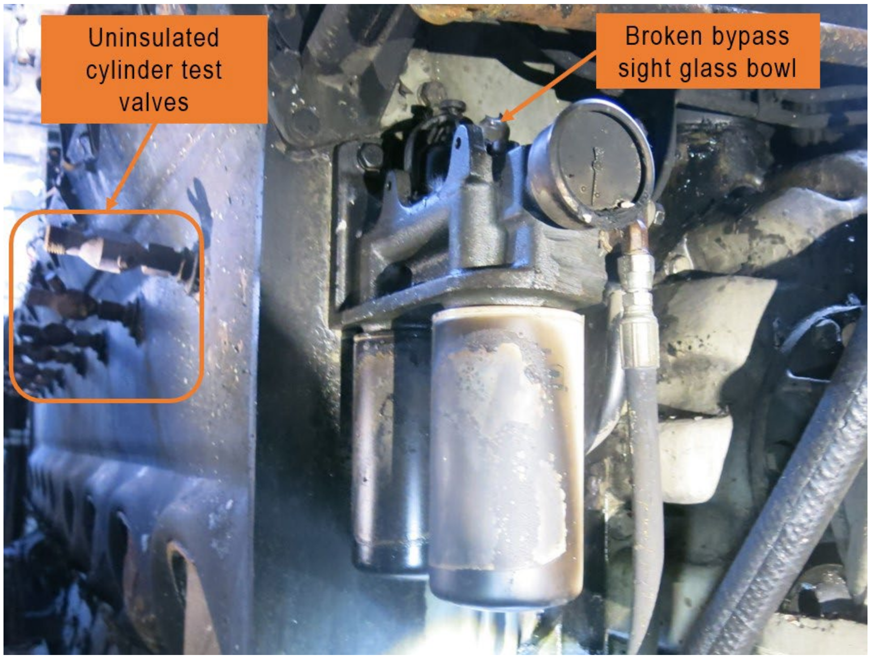

Figure 7. Inboard side of the port main engine showing the uninsulated cylinder test valves and their proximity to the broken sight glass bowl.

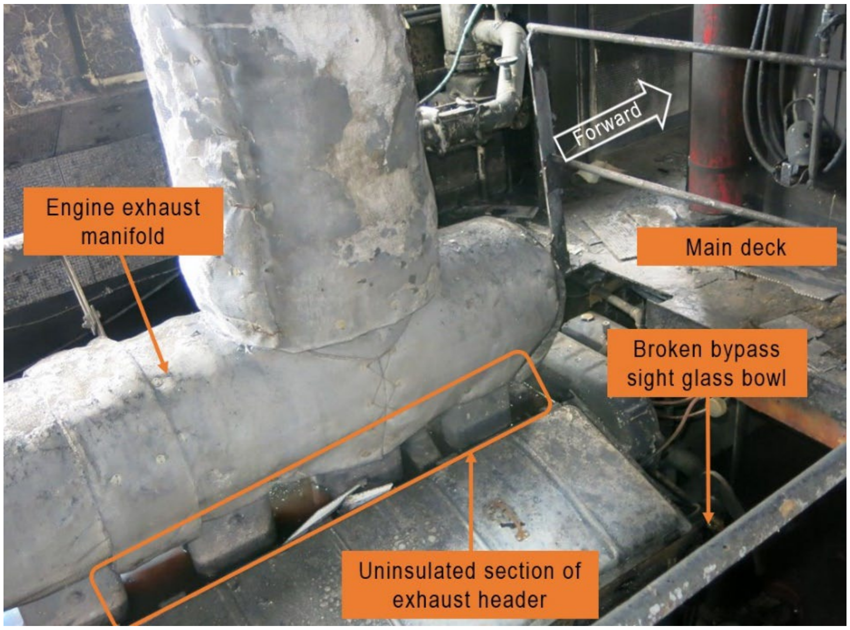

Figure 8. Front inboard side of the port main engine showing the uninsulated section of the exhaust header.

1.3.5 Fuel Piping System

The *Mary Lynn* had four fuel storage tanks: the no. 2 port and starboard tanks, each with a 12,189-gallon capacity, and the no. 3 port and starboard tanks, each with a 13,893-gallon capacity. Each fuel storage tank had an atmospheric vent located on the main deck. Two fuel transfer pumps located in the forward machinery room (forward of the main engine room) were used to transfer fuel from the storage tanks through a set of suction filters to a fuel day tank. The estimated 1,000-gallon-capacity fuel day tank, located in the forward starboard section of the upper engine room above the main engines, created a positive head (pressure) for the engine's fuel supply system. The day tank did not have a designated atmospheric vent; rather, it vented through its overflow line, exiting the tank's top and running downward to one or more of the fuel storage tanks via the fuel return header. If at least one fuel storage tank return valve was open, the day tank would be in communication with one or more of the storage tank vents by way of the day tank's overflow line, fuel return header, and the storage tank.

The fuel was delivered via the fuel supply header to the individual cylinder injectors within the main engines. Unconsumed hot fuel returned to the fuel day tank via a fuel return line through the spin-on fuel filter assembly. The chief engineer told investigators this return line did not have a pressure relief valve installed.

The vessel's standard operating procedure while under way was to continuously operate one of the two fuel transfer pumps in order to circulate fuel from the storage tanks through the day tank and back to the storage tanks via the day tank overflow line, fuel return header, and opened return valve. This practice replaced the warmer fuel in the day tank with cooler fuel from the storage tanks.

The chief engineer confirmed to investigators that on the day of the fire, all four fuel system return valves from the main engines and generators were closed and one suction valve from fuel storage no. 3 starboard tank was open. He said he "didn't put hands" (check the position) on the return valves for the no. 2 fuel storage tanks after operating the dewatering filtration system, noting that he thought the valves were open. According to the president of Hermann Sand and Gravel, who had experience operating the *Mary Lynn*, it was common practice to have return valves for both no. 2 fuel storage tanks in the same position (open or closed), and to have both return valves for the no. 3 storage tanks in the opposite position of the no. 2 fuel storage tank return valves (open or closed).

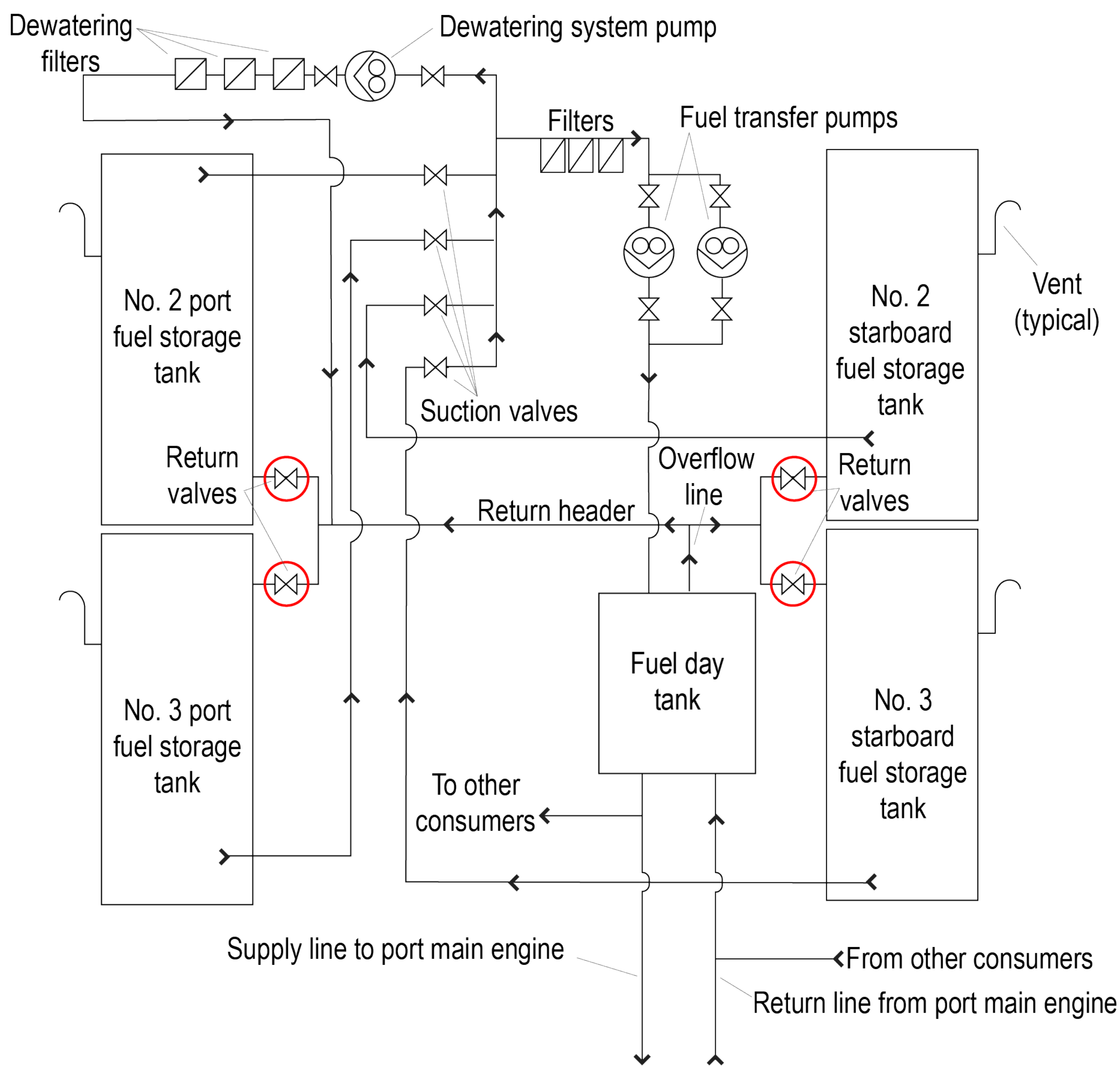

Figure 9. Fuel piping diagram for the *Mary Lynn*. Fuel return valves, circled in red, were inadvertently left closed when a fuel transfer pump was started and the no. 3 starboard suction valve was opened.

2. Analysis

2.1 Fuel System Overpressure and Resulting Fire

On the morning of the casualty, the chief engineer awoke and began preparations for taking on fuel, lube oil, and potable water. The fuel delivery tug and barge arrived about 2.5 hours earlier than expected, while he was dewatering the fuel storage tanks. He secured the return and suction valves for the tank he was dewatering and went on to prepare for the transfer of fuel, lube oil, and potable water. Although he thought that the two no. 2 fuel storage tank return valves were open, the chief engineer said he did not physically verify their position, and thus, he inadvertently left all return valves to the fuel storage tanks from the fuel day tank overflow line closed.

Almost immediately after the *Mary Lynn* got under way on May 18, the starboard main engine failed to meet the ordered rpm, and the captain brought the *Mary Lynn* back to the fleeting area to troubleshoot the issue. The chief engineer found that the fuel suction cartridge filter housings for the starboard main engine were "sucked dry," an outcome that he attributed to a damaged O-ring. While the chief engineer was troubleshooting the fuel pressure issue with the starboard main engine, he opened the no. 3 fuel storage tank suction valves and started one of the fuel transfer pumps, which had been turned off during fueling and had not been restarted before getting under way, as was the vessel's standard procedure. After the chief engineer started the fuel transfer pump, the fuel day tank level began to rise. Because the fuel day tank did not have its own independent atmospheric vent, tank venting was dependent on the four fuel storage tanks' vents via the overflow line, return header, and opened fuel return valves. Since the chief engineer had not opened any of the four storage tanks' return valves during or after the fueling process, the day tank essentially became unvented while the engines were running and consuming fuel. Once the day tank filled to capacity, the operating positive displacement transfer pump began overpressurizing the day tank, the supply lines from the day tank to the engine-driven fuel pump, and the return lines from the engine-driven pump to the day tank (entire main engine fuel system). The day tank and return line pressure would have also risen based on the pressure the positive displacement engine-driven pump could produce and the rate the engine was consuming fuel—with the engine-driven fuel pump directing excess fuel not consumed (not injected into cylinders) back to the day tank.

The resulting pressure increase caused the weakest part in the system to fail first, which, in this case, was the bypass sight glass bowl that tied into the return line (as witnessed by the chief engineer). The two sight glass bowls on the spin-on fuel filters were known to be sources of failure and could potentially contain hairline cracks from overtightening. Once the system reached a high enough pressure (likely exceeding

60 psi), and with no other means to relieve the pressure, the fuel supply bypass sight glass bowl on the port main engine spin-on fuel filter assembly broke. The breakage and separation of the sight glass bowl caused hot, pressurized, and atomized fuel to spray into the engine room.

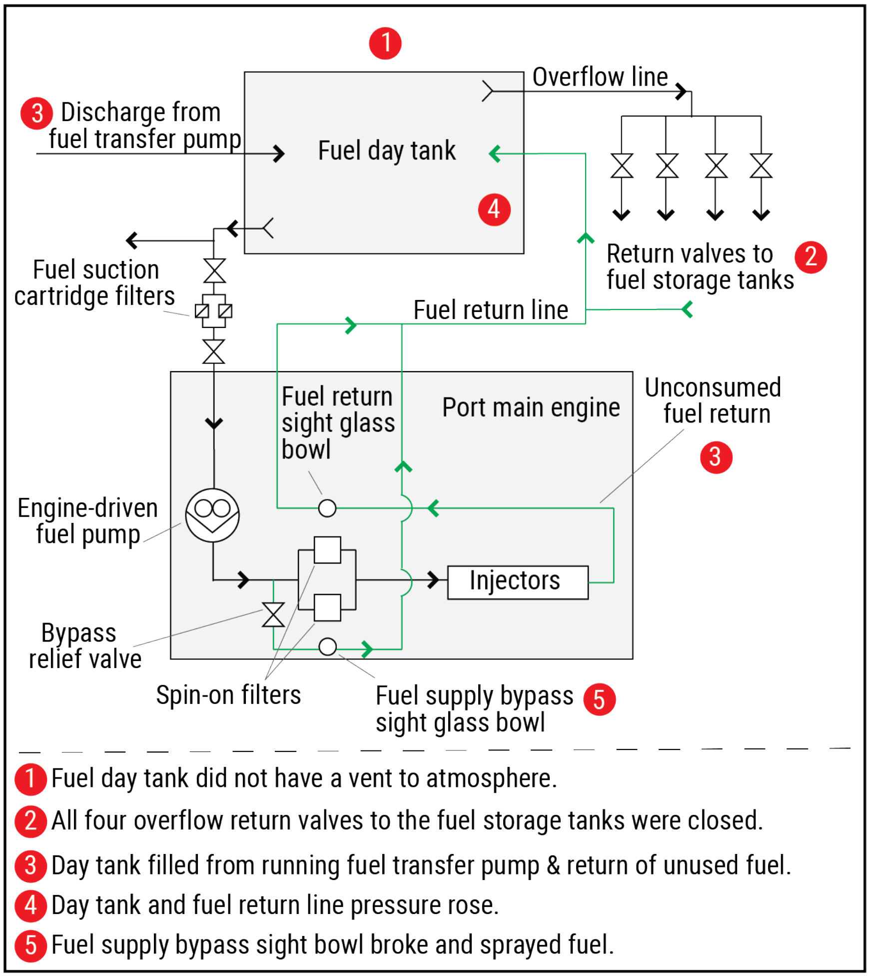

Figure 10. Simple main engine fuel supply/return system diagram for the *Mary Lynn* and sequence of events leading to the casualty.

For towing vessels, regulations require that, for vessels built after January 2000, "each integral fuel tank must have a vent that connects to the highest point of the tank, discharges on a weather deck through a bend of 180 degrees, and is fitted with a… flame screen."[3] The rules allow that vents from "two or more fuel tanks may combine in a system that discharges on a weather deck." As described in the regulation, the vents would combine (tie-in) above the fuel level in the tanks, not under head pressure beneath the fuel tank level, as was the case aboard the *Mary Lynn*. The fuel tank venting regulations did not apply to the *Mary Lynn*, since the vessel was built before 2000. The

[3] 46 *CFR* section 143.265

design of the *Mary Lynn*'s system allowed for the potential pressurization of the day tank to exceed atmospheric pressure if a crewmember secured valves on other tanks. Had the *Mary Lynn's* day tank been fitted with its own vent line, even with the fuel return lines inadvertently left closed, the overpressurization of the return line would have not occurred.

The fuel used in the engine at the time of the fire was marine diesel fuel, a highly combustible liquid with an average autoignition temperature of 428°F. To prevent combustible liquids, such as marine diesel fuel, from contacting piping and machinery components that exceed temperatures of 428°F, regulations require that such components be insulated. Logs showed that cylinder exhaust gas temperatures for the port main engine operating at a similar load as on the morning of the fire were above 500°F. However, after the fire, investigators found a section of exhaust header between the port main engine block and horizontal portions of the exhaust manifold with no thermal protection. The nearby cylinder test valves were also uninsulated. Based on the postcasualty examination of the vessel by investigators, the fire likely originated at or near the forward port main engine—either on the inboard side or directly above it—where these uninsulated components were located.

2.2 Fatigue

The chief engineer had about 32 years of experience working on towing vessels and with EMD engines. While he told investigators that he did not feel tired at the time he was awake and working in the engine room, he reported receiving less than 5 hours of sleep in the 24 hours preceding the fire, consisting of a 1-hour nap the previous afternoon and 3.5–3.75 hours of sleep before waking earlier than his scheduled 0500 watch to prepare for fueling. His longest continuous sleep—roughly 5 hours—was on May 17 (the day before the fire) from about midnight to 0500. Given the engineer's accumulated sleep debt over the previous 24 hours and waking early during an off-duty time when he would normally be asleep, the chief engineer was likely affected by acute fatigue.[4]

Compounding his fatigue was the time at which the fuel preparation tasks were completed on the morning of the fire. The chief engineer woke up about 0300, during a circadian low period outside of his regular work/sleep schedule. The circadian rhythm dips and rises at different times of the day, and, according to research, an individual's

[4] The American Waterways Operators. 2018. *Developing a Fatigue Risk Management Plan: A Guide for Towing Vessel Operations*. https://www.americanwaterways.com/sites/default/files/Fatique%20Risk%20Mgmt%20Guide%202018.pdf

strongest sleep drive generally occurs between 0300-0700.[5] The performance effects of fatigue during these circadian low periods are exacerbated when a person is already sleep deprived. Effects of fatigue can include a reduction in vigilance, concentration, memory, as well as reduced performance on complex or sequential taskings requiring high levels of attention. The nature of the chief engineer's task of preparing the boat to take on fuel required him to recall and remember sequential steps in a process while maintaining an accurate mental model of the fuel system's configuration. When this process was interrupted by the fuel barge arriving earlier than expected, it disrupted the sequential nature of the task. The noted effects of fatigue likely impacted the chief engineer's attention, memory, and performance of this complex task when returning from the interruption.

2.3 Firefighting and Response

The *Mary Lynn* was not fitted with a fixed fire-extinguishing system in the engine room, nor was it required to be. About 2–3 minutes after the fuel ignited, the *Mary Lynn* lost power, leaving the crew with no firefighting capability. However, a nearby Good Samaritan vessel supplied firefighting water within 4–5 minutes after the fuel ignited. Only 16 minutes after the fire started, crewmembers of the *Mary Lynn* and the Good Samaritan vessels secured plastic and tarps over the engine room windows, ventilation, and supply fans to isolate the space and prevent oxygen from entering and fueling the fire. This rapid firefighting response, along with efforts by multiple vessels to hold the *Mary Lynn* in place, prevented the fire's spread and limited damage to the vessel.

[5] National Academies of Sciences, Engineering, and Medicine. 2016. *Enhancing Sleep Efficiency on Vessels in the Tug/Towboat/Barge Industry*. Washington, DC: The National Academies Press. https://doi.org/10.17226/21933.

3. Conclusions

3.1 Probable Cause

The National Transportation Safety Board determines that the probable cause of the engine room fire on board the towing vessel *Mary Lynn* was the overpressurization of the fuel day tank (which did not have an independent vent) and a main engine fuel return system when the fatigued chief engineer inadvertently left the day tank overflow valves to the storage tanks closed, which ultimately led to ignition of spraying diesel fuel from a main engine's fuel system onto an uninsulated engine component.

3.2 Lessons Learned: Tank Ventilation

Subchapter M regulations for towing vessels require vessels built after 2000 to have vents for each fuel tank. Regulations for vessels ranging from small passenger vessels to cargo ships require that fuel tanks be independently vented from the highest point of the tank to atmosphere on a weather deck. Tank ventilation is important to ensure a valve line up error does not lead to the overpressurization of or vacuum in a fuel tank. Operators should be aware of their fuel tank ventilation system arrangements. On vessels without independent fuel day tank ventilation, it is critical to ensure proper valve position during transfer and operation of the fuel system.

Vessel	*Mary Lynn*
Type	Towing/Barge (Towing vessel)
Flag	United States
Port of registry	Hermann, Missouri
Year built	1957
Official number (US)	273407
IMO number	N/A
Classification society	N/A
Length (overall)	141.0 ft (43.0 m)
Beam	35.0 ft (10.7 m)
Draft (casualty)	8.5 ft (2.6 m)
Tonnage	503 GRT
Engine power; manufacturer	2 x 3,800 hp (2,834 kW); EMD 16-645-D3A diesel geared drive

NTSB investigators worked closely with our counterparts from Coast Guard Sector Upper Mississippi River throughout this investigation.

National Transportation Safety Board
Records Management Division, CIO-40
490 L'Enfant Plaza, SW
Washington, DC 20594
(800) 877-6799 or (202) 314-6551