January 13, 2026 MIR-26-02

Diesel Generator Engine Failure aboard Self-unloading Barge *Pathfinder*

On December 30, 2024, about 1609, the articulated tug and barge *Dorothy Ann/Pathfinder*, with a crew of 16, was anchored in Lake Erie, near Cleveland, Ohio, when a fire broke out in the generator space of the barge *Pathfinder* (see figure 1 and figure 2).[1] The crew sealed the space and released the vessel's fixed gas fire extinguishing system, putting out the fire. There were no injuries, and no pollution was reported. Damages were estimated at $2.6 million.

Figure 1. *Dorothy Ann/Pathfinder* underway in June 2024. (Source: Carson Last, Marinetraffic.com)

[1] (a) In this report, all times are eastern standard 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. DCA25FM013).

Casualty Summary	
NTSB casualty category	Machinery Damage
Location	Lake Erie, near Cleveland, Ohio 41°31.65' N, 81°43.23' W
Date	December 30, 2024
Time	1609 eastern standard time (coordinated universal time –5 hrs)
Persons on board	13 (*Dorothy Ann*), 3 (*Pathfinder*)
Injuries	None
Property damage	$2.6 million est.
Environmental damage	None
Weather	Visibility 10 mi, partly cloudy skies, winds west-southwest 20 mph, gusts 29 mph, air temperature 47°F, sunset 1707, evening twilight 1739
Waterway information	Lake; depth about 45 ft

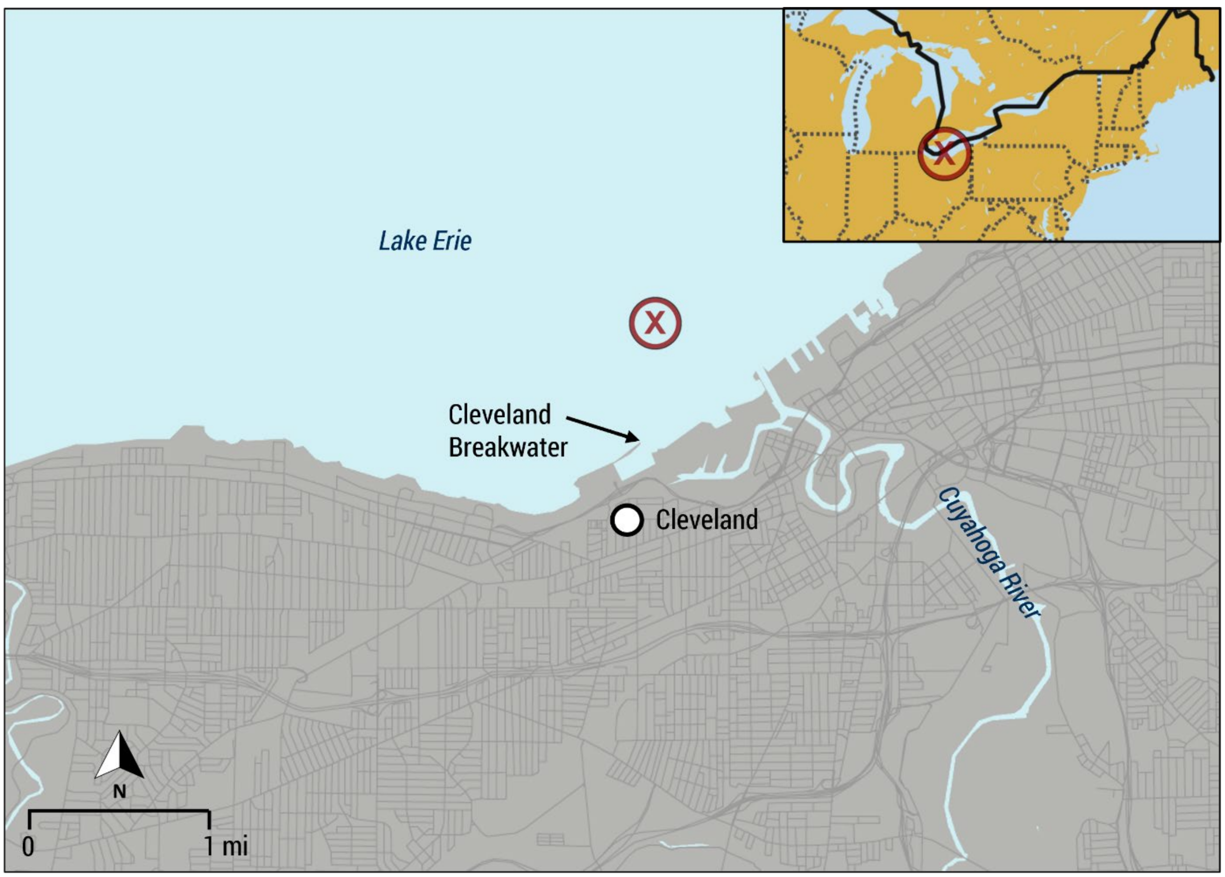

Figure 2. Area where the *Pathfinder* diesel generator engine failure occurred, as indicated by a circled *X*. (Background source: Google Maps)

1 Factual Information

1.1 Background

The 119.2-foot-long welded steel tug *Dorothy Ann* was built in 1999. The 580.3-foot-long welded steel self-unloading cargo barge *Pathfinder* was built in 1952. Both vessels were owned and operated by the Interlake Steamship Co. The *Dorothy Ann* was coupled to the barge *Pathfinder*, and they were operated together as an articulated tug and barge (ATB) in the ore and stone trades on the Great Lakes.

The *Pathfinder* had no propulsion capability but was equipped with a 1,000-hp (745.7-kilowatt [kW]) electrically driven bow thruster to assist with maneuvering. A 402-hp (300-kW) Caterpillar 3406 auxiliary service diesel engine-driven generator typically provided electrical power for the barge during transits or when loading cargo from shoreside facilities (see figure 3). When the bow thruster, ballast pumps, or unloading equipment (such as conveyor and boom) were operational, a 2,447-hp (1,825-kW) Caterpillar 3516B diesel engine-driven generator, referred to as the "unloading generator," provided electrical power. The unloading generator was located on the starboard side of the barge's main deck, aft of the auxiliary motor control center (MCC), with supply fan ducting in the overhead on the starboard side. The engine was positioned on the barge, with the turbochargers facing the forward direction, between the back of the engine and the generator.

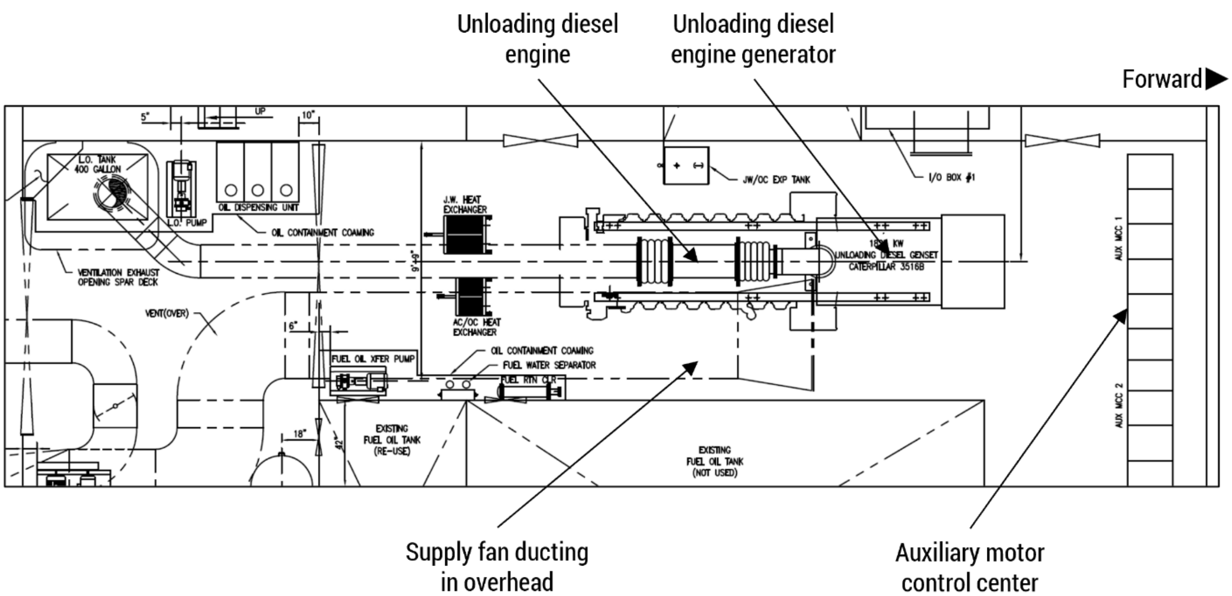

Figure 3. Unloading generator space on barge *Pathfinder*. (Background source: Interlake Steamship Co.)

1.2 Event Sequence

On December 29, 2024, about 1708, the ATB *Dorothy Ann/Pathfinder* departed Marblehead, Ohio, after loading stone. Later that evening, the vessel arrived at the Cleveland Bulk Terminal, in Cleveland, Ohio, where additional equipment was loaded aboard the vessel. About 1430 the next day, the *Dorothy Ann/Pathfinder* departed the terminal and transited onto Lake Erie, bound for a stone dock on the Cuyahoga River in Cleveland.

About 1518, the crew anchored the ATB about a mile north of the Cleveland Breakwater, inside the Cleveland Breakwater, to wait for traffic and current in the Cuyahoga River to subside. During maneuvering and while anchored, the unloading generator was running, providing electrical power to the barge. According to the chief engineer, while the unloading generator was running, the duty engineers (who were on-call for 24-hour shifts on the tug) and other crewmembers would typically make periodic rounds and walk through the space to observe and monitor the engine and operating equipment on the barge. A conveyorman would take written readings of engine's operating parameters when it was being used for unloading the vessel.[2]

About 1607, while the ATB was anchored, the first mate, who was on watch in the pilothouse of the *Dorothy Ann*, was notified by a call from a watchman on a handheld radio that the barge had lost electrical power. The first mate called the duty engineer in the tug's engine control room and then the chief engineer and captain.

About 1609, several crewmembers noticed black smoke coming out from the open doors of the unloading generator space and ventilation ducts on the barge. There was no fire detection system aboard the barge, nor was any required. At the time, the bow thruster was idling.

The first mate sounded the general alarm. The crew mustered on the stern of the tug and began donning firefighting gear; all crewmembers were accounted for.

Crewmembers boarded the barge, shut all doors and ventilation dampers to the unloading generator space, started the tug's fire pump, and began boundary cooling on the exterior bulkheads and deck above the unloading generator. The chief engineer closed the remote fuel and lube oil valves. The chief engineer was not

[2] A *conveyorman* operates and controls the vessel's conveyor system, opening and closing gates at the bottom of cargo holds to allow material to drop onto the conveyor belt, and the extendable boom, which swings out over the dock while unloading cargo.

sure of the operating status of the supply fan for the unloading generator space. He believed it was either running at slow speed or not running before the time of the fire.

The first mate and another crewmember, wearing self-contained breathing apparatus, entered the unloading generator space from the port side with two portable fire extinguishers and reported very heavy smoke. They retreated from the space, securing the door as they exited. The chief engineer announced that he was preparing to release the fixed carbon dioxide fire extinguishing system; he released carbon dioxide into the unloading generator space about 1630.

The captain notified the US Coast Guard and company of the fire. Crewmembers set watches and used an infrared thermometer to monitor bulkhead temperatures, which declined through the night. About 0730 the following morning, crewmembers entered the unloading generator space and verified the fire had been extinguished. Later that morning, the crew transited the ATB to a dock in Cleveland.

1.3 Additional Information

1.3.1 Damage

On January 1, 2025, the operating company's fleet electrical systems technician and fleet diesel systems technician, and investigators from the City of Cleveland Fire Investigation Unit (FIU) examined the unloading generator space. National Transportation Safety Board (NTSB) and Coast Guard investigators examined the space on January 3.

NTSB and Coast Guard investigators noted block damage of the unloading diesel generator engine in the area of the no. 9 connecting rod, where internal components had forcefully exited the engine. The exterior of the engine forward of the damaged block showed signs of heat and smoke damage on the starboard side. The unloading generator had smoke and heat damage on the exterior surfaces, and after removing panels, investigators observed damage to internal components such as wiring insulation and electronic measuring devices. The front panels of the auxiliary MCC showed heat and smoke damage with several melted breakers. The overheads and bulkheads above and forward of the no. 9 connecting rod were covered in soot.

The company electrical systems technician reported that the auxiliary MCC had extensive fire damage, which was most pronounced in the area forward of the generator (see figure 4). Several circuit breakers were completely melted with only their openings left in the panel. The electrician removed the panels and inspected the generator's internal components. The fiberglass busbar support was severely burned and partially collapsed. The generator's winding (stator) leads attached to the busbar experienced extreme heat with the insulation burned off, but the remainder of the insulation on the generator's stator leads appeared to be normal (see figure 5). The stator turns on the field and rotor (that could be observed without disassembly) also appeared normal with no signs of heat, and the lacquer color was normal.

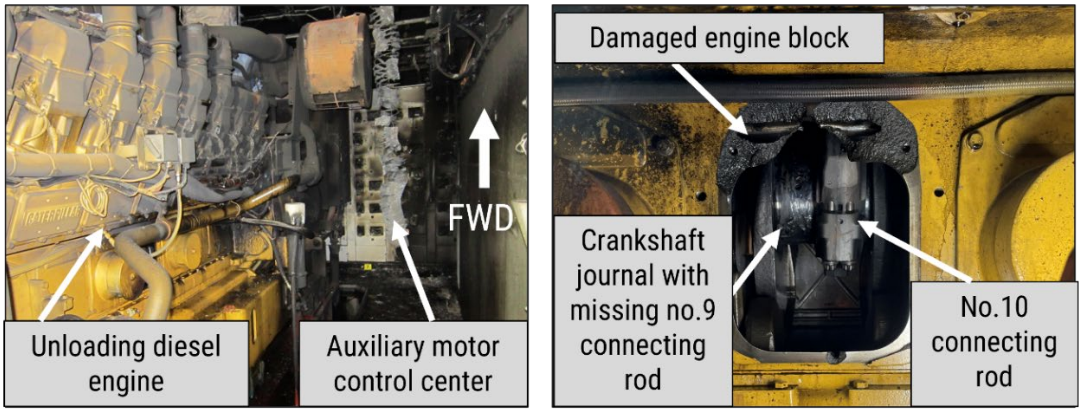

Figure 4. *Left to right*: Unloading diesel engine and auxiliary MCC after the fire and damaged engine block in the area of the no. 9 connecting rod.

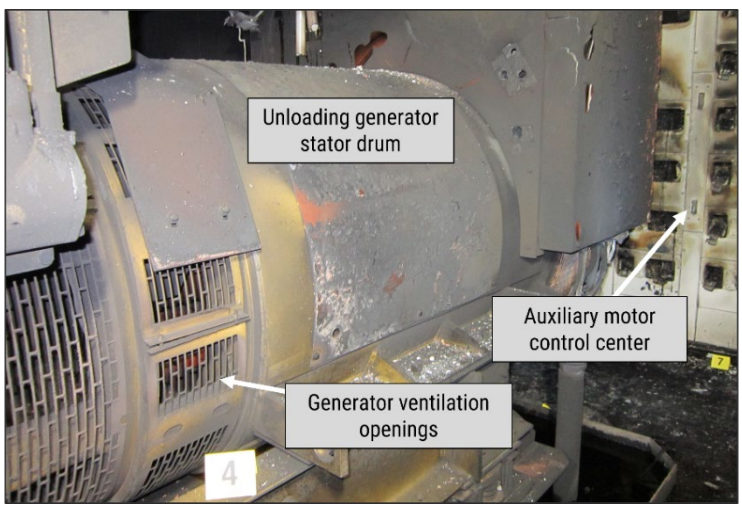

Figure 5. Damaged exterior of the unloading generator after the fire. (Background source: Coast Guard)

The City of Cleveland FIU produced a report that indicated the most severe fire damage by the engine was about 5 to 10 feet to starboard and forward of the area of the damaged engine block where internal components had forcefully exited the engine block (in the area of the no. 9 connecting rod), and the auxiliary switchboard sustained fire damage "extending to several cabinets and consuming some components." The report identified the area of origin to be "between the generator and auxiliary switchboard due to observing extensive fire damage in the area."

According to the report, because the FIU could not conduct an internal examination of the generator or switchboard, the unit's investigators could not definitively determine whether the fire started in the generator or the switchboard.

1.3.2 Engine Room Machinery Data and Alarms

Investigators reviewed the data logs and alarm history from the vessel's engine room machinery automation system. There were no alarms associated with the diesel engine, unloading generator, or electrical system on the day of the failure. The engine's speed was recorded at 1,800 rpm (varying 1–2 rpm) and lube oil pressure, provided by a positive-displacement, engine-driven gear pump, was recorded at 58 pounds per square inch (psi) (varying about 1 psi) from midnight on December 30 until about 1605 (see figure 6).[3] At 1605:28, the lube oil pressure dropped to 53 psi (see figure 6). Nineteen seconds later, the lube oil pressure dropped to 50 psi and then 47 psi until 1607:44. Throughout this time of reduced lube oil pressure, the engine speed remained about 1,800 rpm, the fuel oil pressure to the engine remained constant, the jacket water temperature increased 3°F, and the right bank exhaust temperature increased from about 750°F to over 900°F.[4] At 1609:02, the engine speed increased to 1,810 rpm for one second, and the lube oil pressure remained at 47 psi. Over the next 8 seconds, the engine speed reduced to about 1,000 rpm, and the lube oil pressure dropped to 32 psi. The alarm history showed low frequency and low voltage alarms during this time. At 1609:22, lube oil pressure dropped to 24.5 psi and then to zero at 1609:42. The engine speed dropped to zero at 1609:54.

[3] There were several instances where the automation system intermittently sensed the engine speed at 0 rpm and then restored to 1,800 rpm (as seen on figure 6).

[4] The left bank exhaust temperatures were not recording correctly in the engine automation system.

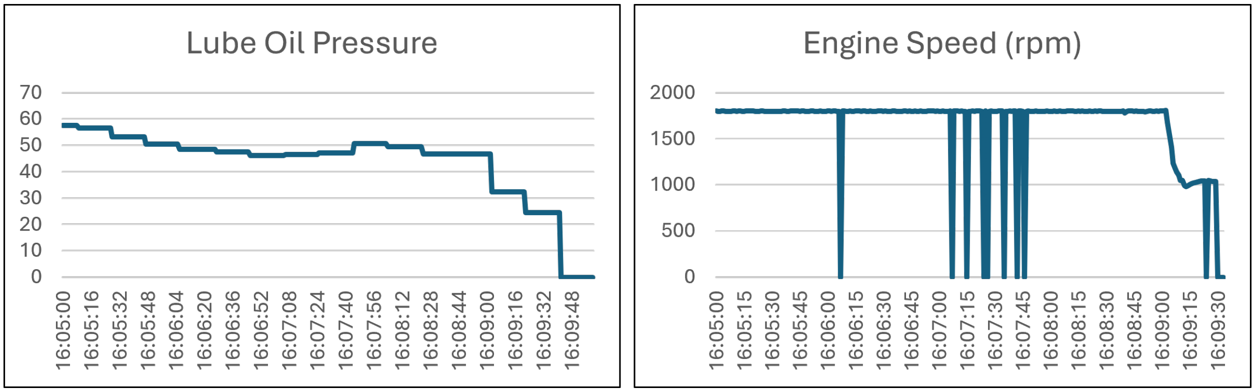

Figure 6. *Left to right*: Graph of unloading diesel engine lube oil pressure from 1605 to 1609 and graph of unloading diesel engine speed (rpm) from 1605 to1609.

Technicians also downloaded data from the diesel generator engine's electronic control monitor (ECM). There were several diagnostic and event codes logged, but the ECM was not equipped to identify exact times for alarms and operating parameters such as speed, engine load, and exhaust temperatures.

1.3.3 Maintenance Logs for Unloading Engine

At the time of the casualty, the engine had 26,482 running hours on it. In January 2024, during the winter layup period, a top end service overhaul was completed.[5] Company engineers indicated that a 10,000–12,000-hour top end service overhaul maintenance was scheduled for the unloading engine in the upcoming winter layup period, which included bearing inspections. The engine block had been replaced and engine rebuilt in July 2022 after a crankcase failure resulting from the failure of the no. 12 connecting rod, due to an issue with a lack of lube oil pressure.

The vessel's crew kept maintenance logs for the unloading engine. Lube oil samples were sent ashore monthly for analysis, and routine 500- and 1,000-hour maintenance tasks were conducted. At the time of the casualty, there were no alerts contained within the lube oil analysis results, nor were there any overdue maintenance items.

The operating company also contracted third-party specialists to conduct vibration machinery service and thermography on the vessel's machinery. The most recent vibration analysis on the *Pathfinder* unloading generator engine was conducted in May 2024 and was normal, with no warnings or faults. The most recent

[5] A *top-end service overhaul* consists of the removal, inspection, and reworking of the cylinder head components (including fuel injectors, cylinder valves, and heads) without a full teardown.

thermography report from July 2024 had no warnings or critical alerts on any of the electrical switchboards on the *Pathfinder*.

The barge was not equipped with any electrical switchboard monitoring systems or automation alarms, and the chief engineer was not aware of any electrical issues on the barge. After the fire, in March 2025, the generator's main breaker was inspected by electric service technicians. The results from the physical and mechanical inspections were all "Okay" or "N/A." The report indicated that an undervoltage coil was replaced.

1.3.4 Postcasualty Engine and Generator Disassembly

In the months after the casualty, technicians from the operating company removed the damaged engine and generator from the barge and disassembled and inspected the internal components. The engine's main bearings showed debris damage on the bearing surfaces, particularly in the nos. 5, 6, and 7 bearings (see figure 7). All cylinder heads were removed with no damage observed. The crankshaft was removed, and appeared to be intact with no cracks, with damage on the journals in the area of the no. 9 connecting rod and adjacent journal surfaces.

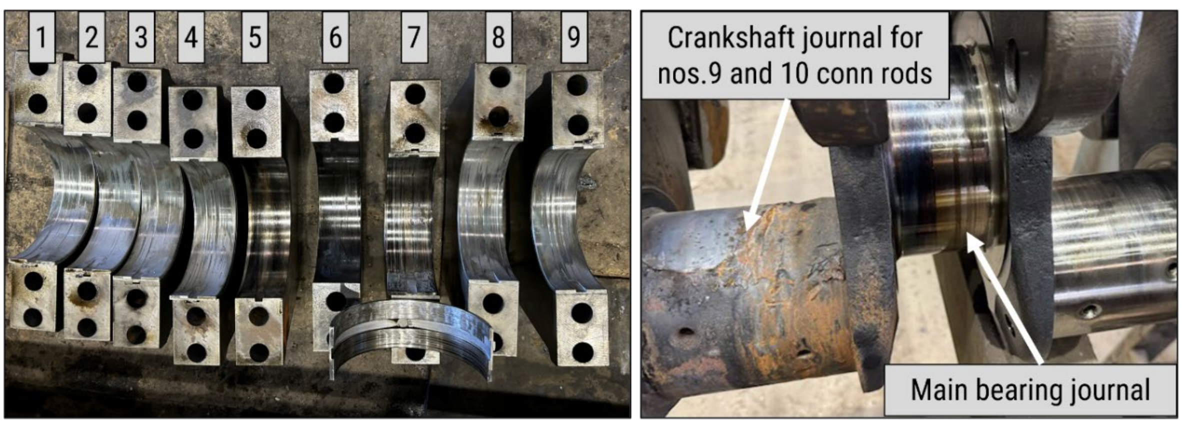

Figure 7. *Left to right*: Removed main bearings from the unloading engine of the *Pathfinder* after the fire and damaged crankshaft in the area of the nos. 9 and 10 connecting rods.

Company technicians removed the generator from the *Pathfinder* and inspected the damage. They reported incinerated insulation on the stator leads with evidence of burning and provided an explanation of the failure sequence based on the postcasualty condition of the internal generator components (see figure 8). Their report stated that "a phase to phase short occurred on the generator side of the bus bar (before the breaker), which caused an arc and fire as well as extreme 'block loading.'"[6]

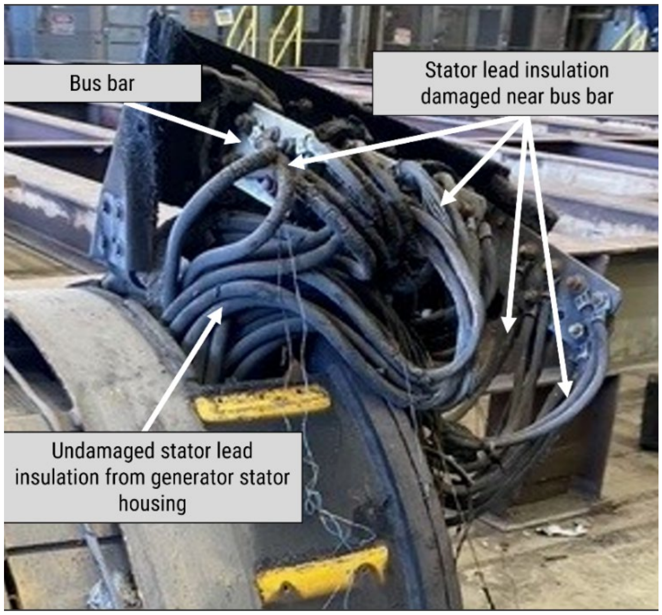

Figure 8. Disassembled generator from *Pathfinder* showing insulation damage on stator leads. (Background source: Interlake Steamship Co.)

The company technicians' report further stated that the short caused a sudden increase in current and drop in magnetic field, and the generator's voltage regulator, sensing this, increased the output to maintain the magnetic flux around the rotor. The magnetic field became so strong that it acted as a brake on the rotor, and because the rotor was connected to the engine crankshaft, the engine speed decreased. To correct this decrease in engine speed, the ECM increased fuel to the diesel engine to keep it running at speed, but the magnetic field continued to counter this. The report stated that these counteracting forces "created extreme torsional loads and crankshaft deflections, allowing the crank shaft journal to penetrate the thin oil film barrier between the journal and bearings." The report concluded that the "catastrophic diesel engine failure" was caused when the main bearing began to rotate (spin) in its saddle, "misaligning its lube oil holes and thereby starving the main bearing journal and the no. 9 connecting rod bearing journal of lubricating oil."

The damaged engine block and generator were replaced aboard the *Pathfinder* in May 2025.

[6] A *block load* is a sudden, significant, and unexpected electrical load to a generator. The generator must instantly draw a large amount of mechanical power from its engine to meet the new demand, which can cause significant stress on the system and potentially lead to equipment damage or failure.

2 Analysis

On December 30, 2024, while the ATB *Dorothy Ann/Pathfinder* was anchored in Lake Erie, the diesel generator engine on the *Pathfinder* suffered a catastrophic failure, which resulted in a fire in the barge's unloading electrical generator space. The crew sealed the space and released the vessel's fixed gas fire extinguishing system, putting out the fire.

The most severe fire damage was about 5–10 feet from the damaged engine block near the no. 9 connecting rod, where internal components had forcefully exited the engine. In the 4 minutes leading up to the discovery of the fire at 1609, the engine control room machinery automation system recorded a decrease of lube oil pressure while the engine was running at rated speed (1,800 rpm). The engine stopped at 1609:30. This loss of pressure (from 58–47 psi) was not severe enough to activate the low-pressure lube oil alarm, so the watchstanding crew was unaware of it. A loss of lube oil pressure would have allowed excessive movement outside of the clearances between engine components, resulting in a loss of oil film between the rotating components. Without an oil film, the friction of rotating components would have generated excessive heat, causing components, such as the no. 9 connecting rod and the crankshaft, to seize together at the journal and fail. Given the extensive fire damage in this area, the fire originated on the starboard side of the unloading generator engine when the engine block ruptured in the area of the no. 9 connecting rod and hot, atomized lube oil vented through the damaged side cover and ignited off hot components internal to the engine.

Investigators sought to determine why additional fire and smoke damage extended forward and upward in the direction of the generator attached to the damaged engine block and the auxiliary MCC. Because the generator was outfitted with open cooling vents, fire and heat from the unloading generator space likely entered the interior of the generator housing, causing additional damage to internal components. Additionally, the outlet of the space's supply fan was located in the overhead on the starboard side of the engine. The chief engineer was not sure if the fan was operating at the time of the engine failure but thought it could have been running at low speed (until power was lost) with its damper open before the fire started. If it was running, the supply fan would have directed the fire and smoke toward the generator and MCC. Further, the turbochargers, which were located at the forward end of the engine, drew air forward through the space. The direction of the combined air flow from the supply fan and turbocharger would have caused heat damage to MCC components.

Because the engine speed did not decrease in the time leading up to the engine failure but lube oil pressure (which was produced by the engine-driven lube oil pump) did, the loss of lube oil pressure would have likely been through an internal engine component. After the casualty, technicians from the operating company disassembled the damaged engine and generator and inspected the internal components. The postcasualty main bearing inspection identified surfaces that showed signs of debris damage, which could have occurred prior to the engine failure or during the event. Debris in the system would have caused scratching or scoring of the inner layer of the bearings (which typically had an aluminum-based alloy layer) as the debris circulated through the rotating components. As the debris wore away the bearing surfaces of the main bearings and connecting rod bearings, the clearances between the components would have begun to increase between the journals, crankshaft, and bearings. These increased clearances would have allowed more lube oil to flow out the sides of the bearings, ultimately resulting in a loss of oil film between the rotating components and generating excessive heat. However, since the origin of the debris is unknown, investigators could not definitively determine whether the debris damage occurred before or during the engine failure.

The company technicians attributed the engine failure to an electrical short on the generator side of the busbar that led to block loading of the attached generator. As the technicians' report stated, block loading could have placed an excessive load on the diesel engine and ultimately caused the engine's main bearing shells to rotate in their saddles. This would have allowed the lube oil film to fail, leading to friction between rotating components, and resulted in components, such as the no. 9 connecting rod and crankshaft, seizing together. As the engine continued to run at rated speed with the crankshaft rotating, the seized no. 9 connecting rod would have broken away from the crankshaft. Investigators found parts from the disconnected connecting rod and other internal components alongside the engine in the unloading generator space. These components would have ruptured the engine block in the area where the no. 9 connecting rod attached to the crankshaft.

The technicians' postcasualty examination of the damaged generator found damaged insulation on the stator leads within the generator housing. The leads showed burned insulation close to the busbar; however, the remainder of the cables' insulation was unburned throughout the generator housing. The localized insulation damage was likely electrical in nature, rather than caused by fire, which lends credence to the conclusions in the technicians' report. However, investigators were unable to confirm the company technicians' analysis. There were no recording or automation devices within the electrical switchboard or engine room machinery automation system that could have identified an electrical fault at any time before the engine failure. The ECM for the unloading generator engine was not equipped to identify exact times for alarms and operating parameters such as speed, engine load, and exhaust temperatures. The chief engineer was not aware of any electrical grounds or other operational issues with the barge’s electrical system. A forensic failure analysis by third-party technicians was not conducted to determine the root cause of the failure. Therefore, although the unloading generator could have experienced a block load beyond its design capability, leading to catastrophic damage to its diesel engine, investigators were unable to determine the exact cause of the generator’s engine failure.

3 Conclusions

3.1 Probable Cause

The National Transportation Safety Board determines that the probable cause of the diesel generator engine failure and resulting fire aboard the self-unloading barge *Pathfinder* was a loss of lube oil to one of the engine's connecting rods, possibly due to its electrical generator experiencing a sudden block load beyond its design capability resulting from an electrical short in the generator.

3.2 Lessons Learned

Containing Fires in Machinery Spaces

Machinery spaces contain multiple fuel sources as well as mechanical ventilation, making the spaces especially vulnerable to rapidly spreading fires. After a diesel generator engine failed aboard the self-unloading barge *Pathfinder*, the crew effectively contained the spread of a fire by removing fuel and oxygen sources. Vessel crews should familiarize themselves and train frequently on machinery, fuel oil, lube oil, isolation valves, and ventilation shutoff systems to quickly act to contain and suppress fires in machinery spaces before they can spread to other spaces and/or cause a loss of propulsion and electrical power.

Vessel Particulars

Vessel	*Dorothy Ann*	*Pathfinder*
NTSB vessel group	Towing/Barge (Towing vessel)	Towing/Barge (Self-unloading barge)
Owner/operator	The Interlake Steamship Co. (Commercial)	The Interlake Steamship Co. (Commercial)
Flag	United States	United States
Port of registry	Cleveland, Ohio	Cleveland, Ohio
Year built	1999	1952
Official number	1081409 (US)	264738 (US)
IMO number	8955732	5166768
Classification society	American Bureau of Shipping	American Bureau of Shipping
Length (overall)	119.2 ft (36.3 m)	580.3 ft (176.9 m)
Breadth (max.)	24.0 ft (7.3 m)	70.0 ft (21.3 m)
Draft (casualty)	20.0 ft (6.1m) (design depth)	22.5 ft (6.9 m)
Tonnage	1,090 GT ITC	10,720 GRT
Engine power; manufacturer	2 × 3,600 hp (2,685 kW); EMD20-645-E7B diesel engines	N/A

NTSB investigators worked closely with our counterparts from **Coast Guard Marine Safety Unit Cleveland** throughout this investigation.

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