

Fire aboard Bulk Carrier *Cuyahoga*

On March 15, 2024, about 1315 local time, the bulk carrier *Cuyahoga* was undergoing maintenance while docked in Ashtabula, Ohio, when a fire broke out in a cargo hold where hot work was being conducted (see figure 1 and figure 2).¹ The crew and maintenance personnel on the vessel were unable to extinguish the fire and evacuated to shore. The Ashtabula Fire Department, with assistance from the ship's crew, extinguished the fire. There were no injuries, and no pollution was reported. The vessel was declared a constructive total loss estimated at \$11 million.²



Figure 1. *Cuyahoga* after the fire, on March 20, 2024.

¹ In this report, all times are eastern daylight time, and all miles are statute miles.

² Visit [ntsb.gov](https://www.ntsb.gov) to find additional information in the [public docket](#) for this NTSB investigation (case no. DCA24FM027). Use the [CAROL Query](#) to search investigations.

Casualty Summary

NTSB casualty category	Fire/Explosion
Location	Ashtabula Harbor, Lake Erie, Ashtabula, Ohio 41°54.47' N, 080°47.65' W
Date	March 15, 2024
Time	1315 eastern daylight time (coordinated universal time -4 hrs)
Persons on board	40 (15 crewmembers; 25 maintenance personnel)
Injuries	None
Property damage	\$11 million est.
Environmental damage	None
Weather	Overcast, visibility 9 mi, light airs, air temperature 52°F, water temperature 46°F
Waterway information	Channel; width 240 ft, depth 29 ft at casualty site



Figure 2. Area where the *Cuyahoga* caught fire, as indicated by a circled X. (Background source: Google Maps)

1 Factual Information

1.1 Background

The 605-foot-long Canada-flagged bulk carrier *Cuyahoga* was built in 1943 by American Shipbuilding Company in Lorain, Ohio, and converted into a self-unloading bulk carrier in 1974. The vessel was owned by Lower Lakes Ltd and operated by Lower Lakes Towing Ltd.

Within each of the vessel's four cargo holds, hydraulically operated gates allowed cargo to pass (gravity feed) onto two conveyor belts located in a tunnel beneath each cargo hold. The conveyor belts then moved the product to the forward part of the ship, where the elevator—a series of buckets on a rail system—lifts the product onto the ship's 250-foot unloading boom/conveyor belt to transfer the product ashore (see figure 3).

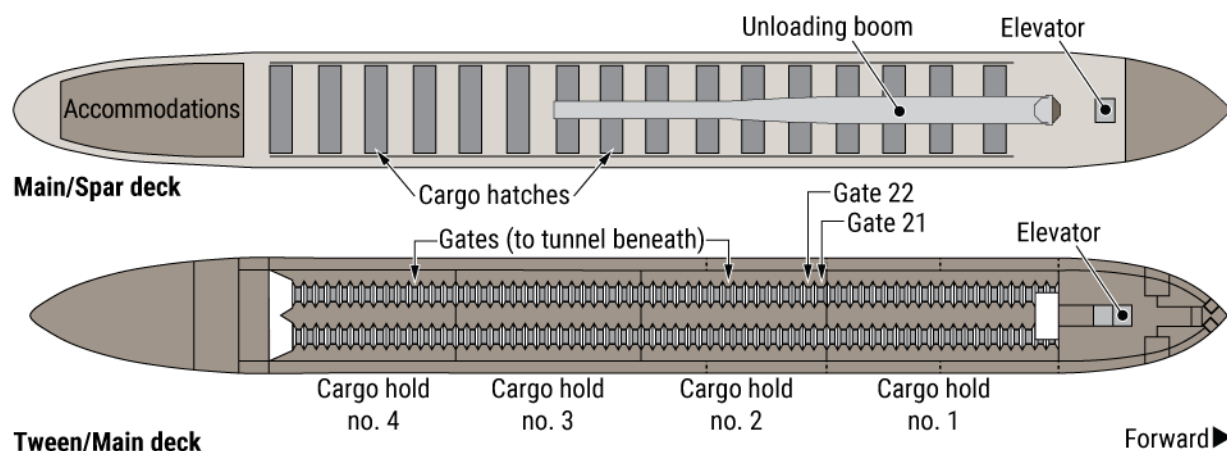


Figure 3. Layout of *Cuyahoga* decks, showing cargo hatches, unloading boom, elevator, gates, and cargo holds.

1.2 Event Sequence

Beginning in January 2024, the *Cuyahoga* was moored port side to the Kinder Morgan Pinney Dock in Ashtabula, Ohio, for winter layup. As part of the ship's winter layup preparations, the crew conducted an internal washdown of the ship's four cargo holds to remove any residual cargo (the cargo holds had previously held furnace coke, pot ash, and nut coke). During winter layup, the vessel's firefighting equipment was stowed in the aft fire locker, and the lifesaving equipment was stowed in the portside passenger room.

While the vessel was in winter layup, hot work was scheduled to be performed in various cargo holds and tunnels. The hot work included removing areas of steel wastage and replacing those areas with new metal inserts or components. Lower Lakes Towing contracted Conneaut Creek Ship Repair, Inc. to assist with the hot work, and Conneaut contracted South Marine Systems, Inc. to perform the hot work.

On March 14, the master, chief engineer, and 13 other crewmembers returned to the vessel, which was scheduled to depart on March 17, for its scheduled 5-year drydock in Erie, Pennsylvania.

The following day, on March 15, about 0800, the crew began preparing the vessel for its scheduled departure. As part of their preparations, they moved the vessel's fire extinguishers from the aft storage locker back to their assigned fire stations (the fire hoses remained in a locked storage locker). About the same time, two Lower Lakes Towing employees (a fire watch and cutter) began conducting hot work on gate channels.³ The gate channels were on the port side of the cargo tunnel below cargo hold no. 2, by gate no. 22, about 10 feet from the forward bulkhead (see figure 3). The work included removing the existing I-beam from the channel with a cutting torch, staging a new beam, and welding the new beam in place.

Three employees from South Marine Systems, (a welder, fire watch, and fitter) entered cargo hold no. 2 to install a replacement ladder on the forward bulkhead and remove safety chains in the middle and aft sections of the hold. The South Marine Systems welder was tasked with grinding the epoxy paint off the forward bulkhead to prepare the surface for welding the ladder brackets and new ladder to the bulkhead utilizing a flux core welding unit. To perform this work, the welder stood on raised wooden planking (scaffolding) that extended from the center of the cargo hold to the port side and about 4 feet above the bottom of the cargo hold. The fitter was tasked with using a grinder and cutting torch to remove the safety chains. While hot work was being conducted, the fire watch monitored the work and had two 2.5-gallon water-canister fire extinguishers on hand in case of fire. There were no workers, nor a fire watch, posted on the opposite side of the bulkhead the ladder was being welded to, in cargo hold no. 1.

³ The gate channels directed cargo from the cargo hold down toward the gate and onto the conveyor belt.

The Lower Lakes Towing employees completed their hot work in the portside cargo tunnel at 0930 and, in accordance with Occupational Safety and Health Administration (OSHA) requirements and the company's established procedures, observed the area for 30 minutes to ensure that a fire did not ignite.⁴ They then proceeded to stage the replacement beam.

Around 1130, hot work stopped in cargo hold no. 2, and all three South Marine Systems employees remained to observe the areas of hot work for the required 30 minutes. Meanwhile, the two Lower Lakes Towing employees returned to the cargo tunnel to continue staging the replacement beam. About 1200, the Lower Lakes Towing employees completed their work and departed the tunnel. About the same time, the three South Marine Systems employees departed the cargo hold for lunch, satisfied that the areas of hot work had cooled down.

About 1230, the two Lower Lakes Towing employees returned to the cargo tunnel and resumed their work, aligning a gate and installing gears (no hot work was conducted). The South Marine Systems employees returned to cargo hold no. 2 about 1300 to continue their work. However, the voltmeter for the flux core welding unit indicated that there was no power to the equipment. According to the welder, one of the connectors for the welding unit on the main deck may not have been properly connected. As a result, no further hot work was conducted in the cargo hold.

About 1315, the fire watch, who was located near the center of cargo hold no. 2, saw a flame on the forward bulkhead near the ladder and yelled, "Fire!" The fire watch told investigators that the base of the fire was 4 to 5 feet up the bulkhead, near the wooden planking (see figure 4). At the same time, the welder, who was facing away from the cargo hold's forward bulkhead, felt heat on his back. He turned toward the forward bulkhead and saw flames on the bulkhead near the ladder. The fitter also stated that he observed smoke and a fire by the forward ladder. According to the fitter, the fire was about 5 feet above the bottom of the cargo hold and quickly growing up the bulkhead above the location of the wooden planking.

⁴ OSHA provides standards for safely conducting hot work and requires a fire watch to remain in the hot work area for at least 30 minutes after completion of the hot work. See [Title 29 Code of Federal Regulations 1915.504](#).

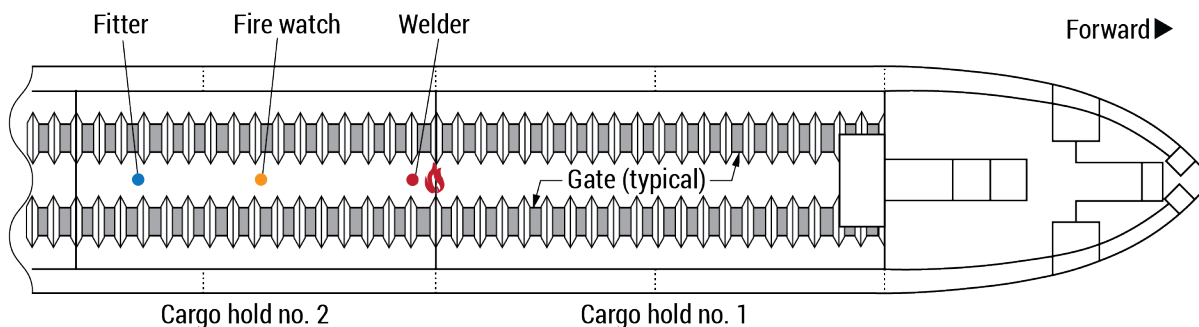


Figure 4. Layout of the cargo hold no. 2 with approximate locations of fitter, fire watch, and welder (not to scale).

The fire watch attempted to extinguish the fire with the two on-hand water canister fire extinguishers; however, the fire continued to grow. All three South Marine Systems employees evacuated the hold by using the aft ladder. After being notified of the fire, the two Lower Lakes Towing employees evacuated the tunnel.

The master was in his cabin, located at the bow of the vessel, when he heard someone yelling, "Fire!" As he exited his cabin, he observed flames and black smoke coming out of the open hatches of cargo hold no. 2. The master, along with the crewmembers and contractors, tried to extinguish the fire in cargo hold no. 2 using 10 fire extinguishers (water and dry chemical) but were unsuccessful. The fire hoses were still locked in a storage locker, so not able for immediate use. The fire spread within cargo hold no. 2 and then up through the open hold hatches to the rubber conveyor belt on the unloading boom located above the cargo holds. Realizing that the fire was too large to extinguish and was expanding, the master ordered all personnel and crewmembers on board to evacuate the vessel.



Figure 5. *Cuyahoga* during the fire. (Source: Ashtabula Fire Department)

About 1320, the Ashtabula Fire Department received several notifications of the vessel fire from bystanders. Fire trucks arrived at the vessel about 1330, and firefighters were informed that everyone on board had been evacuated. Firefighters used three engine trucks and a ladder truck to apply water to initially fight the fire on the main deck from the dock. As the firefighting efforts continued, the firefighters worked with the vessel's crew to ensure that the amount of water added to the vessel to extinguish the fire did not affect its stability. Firefighters then boarded the vessel to apply water and foam directly into the cargo holds that were on fire. The fire was declared extinguished about 2200, and firefighters then monitored the area of the fire to prevent reignition.

1.3 Additional Information

1.3.1 Damage

After the fire, investigators from the US Coast Guard, the National Transportation Safety Board, and the Ashtabula Fire Marshall examined the *Cuyahoga*. The vessel sustained damage to the main deck, with warping and deformation around cargo hold no. 2. The unloading boom conveyor belt was consumed by fire, and the metal framing of the boom was deformed. Investigators found extensive fire damage to cargo hold nos. 1 and 2, as well as to the conveyor

tunnel belts. The vessel was declared a constructive total loss estimated at \$11 million.

In cargo hold no. 2, investigators found an area of “clean burning” at the bottom of the access ladder, along with heavy soot on areas in alignment with the vertical stiffeners located on the other side (cargo hold no. 1) of the bulkhead (see figure 6).⁵ Additionally, in cargo hold no. 2, investigators found the remains of the welding machine, as well as other wooden planks located within the cargo hold.

During the postcasualty examination of the interior of the vessel, investigators identified a white residue in cargo hold no. 1 which was similar in appearance to pot ash, and a black residue in cargo hold no. 3 which was similar in appearance to nut coke. Samples were collected from the two residues and sent to a laboratory to identify the content and to determine if residues from previous cargos were present, however the material in the samples could not be identified.



Figure 6. Photo of the fire damage to the forward bulkhead of cargo hold no. 2, showing the location circled in red where welder, fitter, and fire watch saw the initial fire. (Background Source: Ashtabula Fire Department).

⁵ *Clean burn* refers to fire patterns on a noncombustible surface where soot deposits have been burned away by direct flame contact or intense radiant heat, leaving a "clean" area bordered by sooty stains. A clean burn helps fire investigators determine areas of maximum fire intensity, which may be near the fire's point of origin, as well as the direction in which the fire spread.

1.3.2 Cargo Hold Epoxy Coating

The owner of the *Cuyahoga* informed investigators that Polybird 705 epoxy was applied to the cargo holds in 1990 and then in 2019 Amerthane 490 epoxy coating was applied. According to the Bureau of Alcohol, Tobacco, Firearms and Explosives, Fire Research Laboratory, epoxy coating has an ignition temperature between 600°F to 1,100°F and experiments on epoxy samples from the vessel determined that it becomes highly susceptible to catching fire if it meets an ignition source such as direct contact with a flame or flux core welding. The maximum temperature potentially generated during the welding to attach the ladder was around 6,000°F. However, experiments also identified that molten slag from welding landing on the epoxy did not produce smoldering or flaming combustion on the epoxy coating.

The South Marine Systems welder, fitter, and fire watch told investigators that they were not aware of any concerns with the epoxy when exposed to high temperatures. In a letter dated July 6, 2023, from Lower Lakes Towing to Conneaut Creek Ship Repair about the planned work, the vessel operator shared information about the epoxy, noting that “paint needs to be stripped from the steel in way of repairs and adequate fire watch should be posted at all times during hot works.” The South Marine Systems employees stated that they removed the epoxy around the areas where the ladder would be attached.

The South Marine Systems fire watch told investigators that, earlier on the day of the casualty, during cutting operations with an acetylene torch, he had observed the epoxy paint catching fire. He saw this happening on the interior of the slope of the gate to the tunnel below cargo hold no. 2. However, the fire he had witnessed was small and was extinguished with a water canister fire extinguisher. A Lower Lakes Towing employee who was in the cargo tunnel under cargo hold no. 2 informed investigators that before being notified of the fire, he did not see any fire or smoke but did hear a sound similar to small stones or dirt falling onto the gates. Then, as they were evacuating the tunnel, he observed drippings and sparks dropping down into gate 21 (see figure 3).

2 Analysis

While the self-unloading bulk carrier *Cuyahoga* was docked in Ashtabula Harbor in Ashtabula, Ohio, a fire started in cargo hold no. 2. The fire rapidly spread and was eventually extinguished by shoreside fire department personnel after maintenance personnel and crewmembers evacuated the vessel.

Maintenance personnel and crewmembers told investigators that they saw the bulkhead's coating in cargo hold no. 2 on fire, and data collected by investigators during the postcasualty examination of the fire area confirmed the coating had caught fire. The vessel owner informed investigators that all of the cargo holds had been painted with an epoxy coating. According to the Alcohol, Tobacco, Firearms and Explosives, Fire Research Laboratory, the epoxy coating applied to the interior of the vessel's cargo holds had an ignition temperature between 600°F to 1,100°F and could ignite when exposed to direct flame or to the heat generated during welding. Therefore, the fuel source for the fire was the epoxy coating on the vessel's cargo holds.

Personnel in cargo hold no. 2 reported first seeing the fire about 5 feet above the base of the cargo hold forward bulkhead. There were no reports from the workers of any signs of fire or smoke in the unloading tunnels below the cargo hold, and investigators found no fire damage patterns indicating a fire was initiated in the tunnels and moved into the cargo hold. Additionally, a postcasualty examination of cargo hold no. 2 found clean burning in the same area where the fire was first seen by the fire watch. Clean burning is consistent with high temperature fires associated with the epoxy coating on the bulkhead that have a longer period of time to burn and consume the source of fuel. Given the location of the clean burn, it is likely that the fire's origin was on the forward bulkhead of cargo hold no. 2.

The personnel conducting hot work in cargo hold no. 2 did not see any signs of a fire on the forward bulkhead while carrying out their work. After hot work was completed at 1130, the three personnel remained in the cargo hold for about 30 minutes and did not observe any signs of fire before departing the hold. The first indication that there was a fire was at 1315—about 105 minutes after hot work had been completed—when the fire was first seen on the forward bulkhead of cargo hold no. 2. In addition, none of workers in the hold or in the cargo tunnel on the *Cuyahoga* were conducting hot work at the time the fire started. Prior to the discovery of the fire on the forward bulkhead within cargo hold no. 2, there was no identifiable heat source that contributed to the ignition of the epoxy coating.

Based on the time since hot work had been completed—over an hour and a half later—and the fact that no one saw smoke or flame before the start of the fire on the forward bulkhead, it is possible that a smoldering fire occurred, which ultimately then led to the ignition of the epoxy coating (fuel source) in cargo hold no. 2. A

smoldering fire is formed when combustible materials ignite, but the combustion proceeds slowly and steadily on the material's surface with little heat and no smoke or flame. A smoldering fire is not easily detected and, depending on its surroundings, can last for hours after the initial ignition. Given that hot work had been ongoing in the area and was completed for an extended period without any indication of a fire, and that there were no other apparent ignition sources nearby, it is possible a spark from the earlier hot work (welding) started a smoldering fire.

A smoldering fire can quickly grow into a flaming fire with no warning, especially when fueled by nearby combustibles. During the postcasualty investigation, residue—possibly from a previous cargo (furnace coke, pot ash, and nut coke)—was identified within cargo hold no. 1 and no. 3. Further testing of the residue could not determine its composition. However, if the residue from a previous cargo was present in significant concentration on the forward bulkhead of cargo hold no. 2, this combustible material may have served as a fuel source for a smoldering fire. Since the fire began above the wooden planking where a ladder was being installed (ladder mounting legs/brackets being welded to the bulkhead), the wooden planking is another possible source of fuel for a smoldering fire. Although the cargo residue and the wooden planking are potential combustible materials that would support a smoldering fire, the exact source could not be determined.

3 Conclusions

3.1 Probable Cause

The National Transportation Safety Board determines that the probable cause of the fire on the bulk carrier *Cuyahoga* was the ignition of the epoxy coating on the forward bulkhead within cargo hold no. 2, possibly from a smoldering fire from an undetermined source associated with earlier hot work in the hold.

3.2 Lessons Learned

Combustible Materials and Smoldering Fires

The NTSB has investigated multiple fires caused by a smoldering fire that occurred following the completion of hot work. A smoldering fire is formed when combustible material ignites, but the combustion proceeds slowly and steadily on the material's surface with little heat and no smoke or flame. A smoldering fire is not easily detected, and depending upon its surroundings, it can last for hours after the initial ignition. A smoldering fire can long outlast the time a fire watch observes an area following hot work. Additionally, it can quickly grow into a flaming fire, with no warning. Therefore, it is critical to evaluate work areas for fire hazards and ensure that combustibles are relocated or protected from hot work.

Vessel Particulars

Vessel	<i>Cuyahoga</i>
Type	Cargo, dry bulk (Bulk carrier)
Owner/Operator	Lower Lakes Towing Ltd (Commercial)
Flag	Canada
Port of registry	Port Dover, Ontario, Canada
Year built	1943
Official number	N/A
IMO number	5166392
Classification society	Lloyd's Register
Length (overall)	604.9 ft (184.4 m)
Breadth (max.)	60.0 ft (18.3 m)
Draft (casualty)	24.8 ft (7.6 m)
Tonnage	10,532 GRT
Engine power; manufacturer	1 x 3,084 hp (2,300 kW); Caterpillar 3608 diesel engines

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

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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 DCA24FM027. 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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