



National Transportation Safety Board

Marine Accident Brief

Fire aboard Cargo Ship *Chipolbrok Moon*

Accident type	Fire/Explosion	No. DCA18FM025
Vessel name	<i>Chipolbrok Moon</i>	
Location	Industrial Terminal West, Greens Bayou, Port of Houston, Texas 29°44.94'N; 95°10.07'W	
Date	May 23, 2018	
Time	0010 central daylight time (coordinated universal time – 5 hours)	
Injuries	None	
Property damage	\$12 million est.	
Environmental damage	None	
Weather	Partly cloudy, light east winds, air temperature 73°F	
Waterway information	Greens Bayou is located at about mile 43 on the north side of the Houston Ship Channel, which extends from Galveston across Galveston Bay to the city of Houston.	

On May 23, 2018, at 0010 local time, a fire was detected in a cargo hold on board the cargo ship *Chipolbrok Moon* while moored at the Industrial Terminal West in Greens Bayou in the Port of Houston, Texas. Some of the vessel's 24 crewmembers had completed hotwork in that space about 25 minutes before the alarm sounded. The crew manually activated the fixed CO₂ fire-extinguishing system in the affected space, and the fire was extinguished. Several wind-turbine components being carried as cargo were damaged in the fire. No pollution or injuries were reported. Damage to the vessel was estimated at \$12 million.

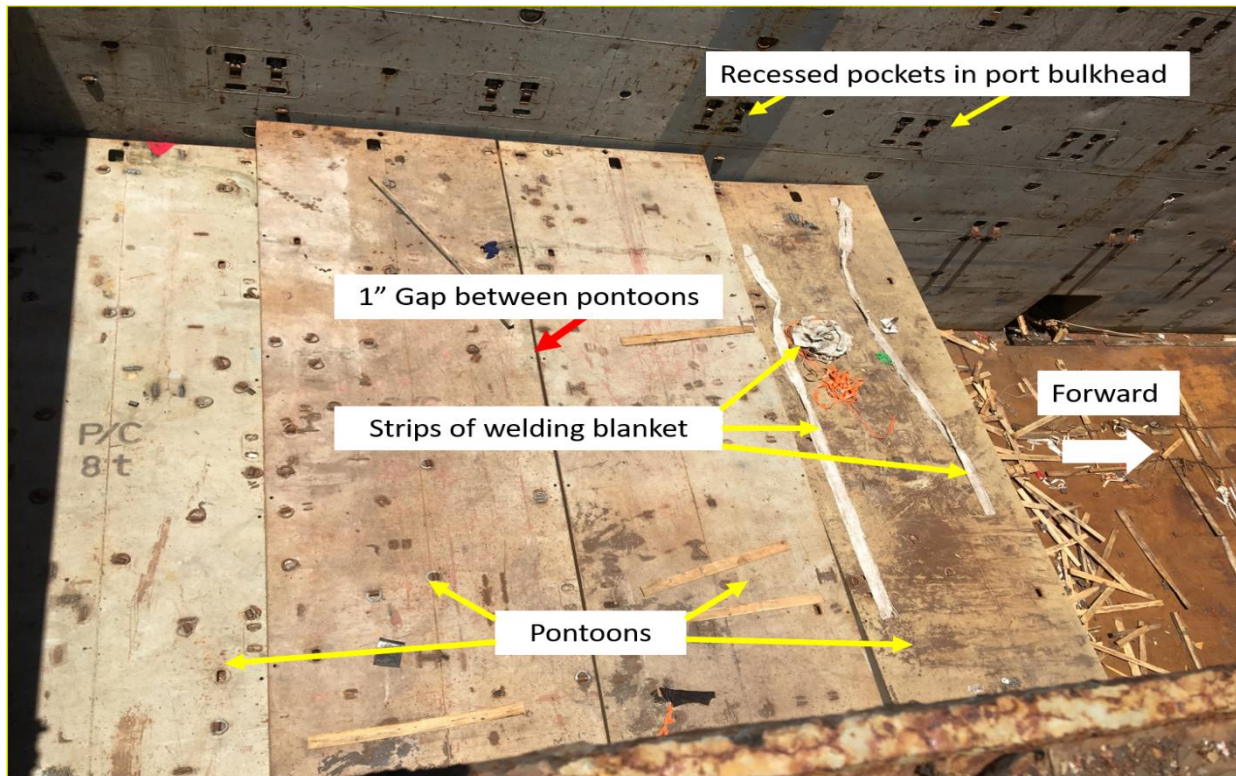


Cargo vessel *Chipolbrok Moon* docked in Houston after the accident.

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Background

The *Chipolbrok Moon*, a multipurpose cargo ship, was built in Shanghai, China, in April 1994. The vessel's cargo holds could be configured with removable steel decking pieces (referred to as pontoons) to accommodate cargo of different sizes. The pontoons each measured 34 feet long by 10 feet wide and about 2 feet high. Retractable feet at predetermined heights on either side of the cargo holds could be pulled out from their recessed pockets in the bulkheads to engage the pontoons and lock them into place. When assembled, the pontoons would form decks (referred to as "tween decks") to support cargo, with athwartship gaps (typically about 1 inch) between each pontoon.



***Chipolbrok Moon* pontoon decks in cargo hold. A gap between the pontoons is identified by a red arrow.**

On April 18, 2018, *Chipolbrok Moon* departed Dafeng, China, loaded with turbine blades, transmission hubs, and nacelle units for 3.45-megawatt wind turbine assemblies.¹ Each transmission hub unit was shipped with three fiberglass spinner shields attached to the top of the hub and wrapped in a blanket kit, covered in plastic. The purpose of the blanket kit was to keep dust from getting onto the spinner shields. All the wind-turbine components were to be offloaded in Houston.

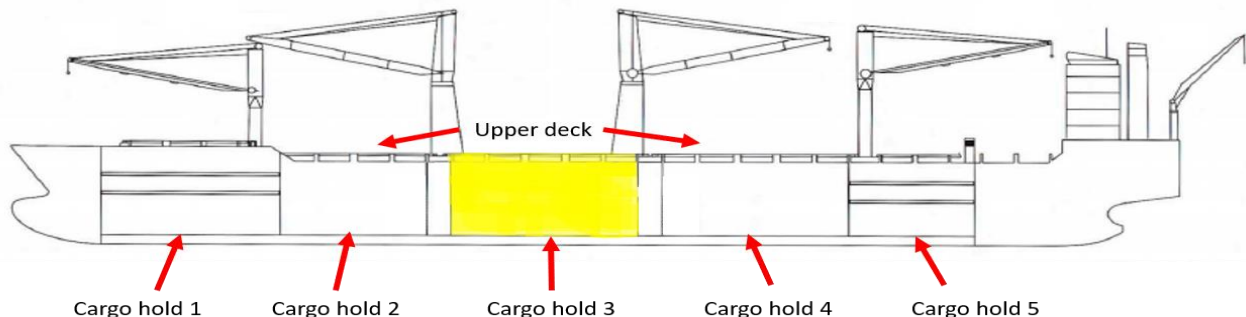
To accommodate the cargo, the pontoon decks in port cargo hold no. 3 were set up to form the lower tween deck at a height of 12.8 feet off the tank top. The port lower tween deck was loaded with four nacelle units, which were rectangular-shaped and filled about 90 percent of the deck. Another set of pontoons were positioned 15.1 feet above the lower tween deck to form the

¹ A *nacelle* is a housing that contains all of the generating components in a wind turbine, including the generator, gearbox, drive train, and brake assembly.

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upper tween deck. Four nacelle units were stored on this deck below the hatch covers in port cargo hold no. 3. A longitudinal bulkhead separated the port cargo holds from starboard holds, and there were two openings in the lower hold between the port and starboard holds. Four transmission hubs, along with several pieces of cylindrical steel bars, and other piping systems on a skid were loaded at the bottom of the cargo hold, on the tank top.

Because of the unique dimensions of the equipment, several 20-millimeter (about ¾-inch) steel tabs, referred to as “sea fasteners,” were welded to the pontoon decks and tank tops in the cargo holds as stoppers to anchor the units for sea before the vessel left China.



Portside profile of *Chipolbrok Moon* with cargo holds identified.

Accident Events

About 1500 on Monday, May 21, the *Chipolbrok Moon* arrived at Industrial Terminal West in Houston. After the ocean voyage and prior to offloading the cargo, the steel sea fastener tabs used to secure the turbine components needed to be removed by cutting, using an oxygen/acetylene torch.² The following afternoon, a marine chemist tested the atmosphere in cargo holds no. 2 port, no. 3 port and starboard, and no. 4 starboard for oxygen content and presence of flammable vapors to determine if it was safe to conduct hotwork.

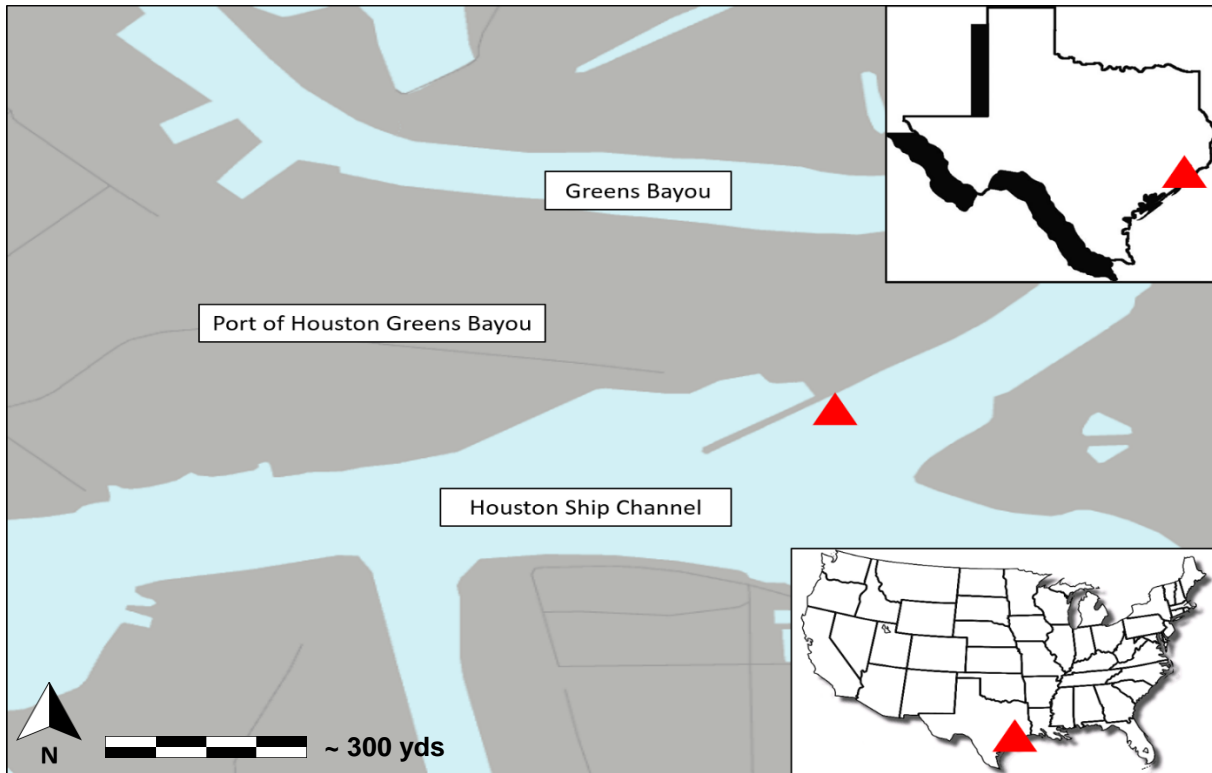
After testing the cargo holds, the marine chemist issued a certificate deeming the cargo holds were “safe for workers and safe for hotwork” and noted that the scope of work was to “high cut” sea fasteners (avoiding cutting directly on the decks). He also noted that fire watches were to be posted in the upper and lower holds throughout, hotwork was to be conducted 1 foot off untested spaces and hollow structures, hotwork areas needed to be at least 35 feet (12 meters) away from flammable and combustible materials, and the crew was to maintain gaps separating “tween deck pontoons covered with dunnage/fire blanket during hotwork.”

The second officer completed a hotwork permit, which the captain and the chief mate signed. The permit indicated that the crew had addressed all 12 of the listed requirements, including, among other items, that the work area be clear of combustible materials and tested for

² *Oxy-fuel cutting* is a process that uses fuel gases and oxygen to cut metals. Pure oxygen, instead of air, is used to increase the flame temperature to allow localized melting of the workpiece material (e.g., steel). An oxygen/acetylene flame burns at about 3,773 Kelvin (3,500°C; 6,332°F). In oxy-fuel cutting, a torch is used to heat metal to its kindling temperature. A stream of oxygen is then trained on the metal, burning it into a metal oxide that flows out of the kerf as slag.

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oxygen, firefighting equipment be ready for use, and a work permit had been submitted to a local authority.

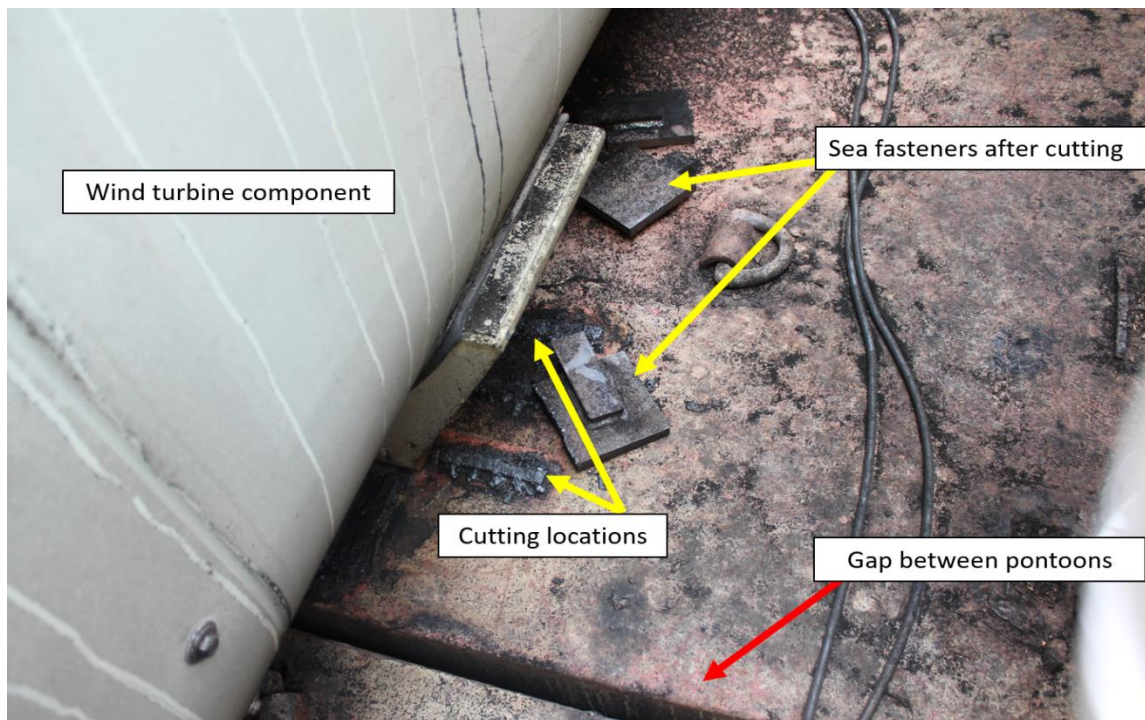


Location of *Chipolbrok Moon* in the Port of Houston, Texas, when the fire broke out. (Background by Google Maps)

Later that evening, at 1940, an enclosed space entry permit was completed, and about 1950, the ship's fitter (welder) began cutting away the welded steel tabs in portside cargo hold no. 3 on the pontoon upper tween deck. An oiler and a deck officer were assigned as fire watches, and a dry powder fire extinguisher and garden hose were on hand. The crew had placed narrow strips (about 7 inches wide and 25 feet long) that had been cut from larger fiberglass welding blankets over the gaps in the pontoons. They had not placed blankets under the cargo skids due to the low clearance to the decks. The mechanical ventilation system in the cargo hold was not energized; there was no forced ventilation in the hold. The cargo hold had two recessed flood lights on the outboard bulkhead on the upper level and fluorescent lights in the access trunk and aft ladder. With the pontoons in place, no lighting illuminated the lower tween deck and lower hold decks. The fire watch said that the crewmembers were using flashlights to see in the cargo hold.

After removing the steel tabs on the upper tween deck level, the fitter and the fire watch moved to the lower hold (tank top) to cut away the tabs from the deck that had been installed to secure the cargo. When those steel tabs were removed, they proceeded to the lower tween deck and cut the tabs off from that deck. The fitter, oiler, and second mate stated that they waited for about 25 minutes in the port cargo hold after completing hotwork and then proceeded to the starboard cargo hold via the openings in the longitudinal bulkhead. A few minutes after entering the starboard hold, the oiler smelled smoke, and about the same time, the fire alarm sounded.

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Steel sea fasteners cut from deck in the portside no. 3 hold aboard *Chipolbrok Moon*, identified with yellow arrows. The gap between pontoons is identified with a red arrow. (Photo by Harris County Fire Marshal)

The smoke detection system sensed a concentration of smoke in the cargo hold and set off the fire alarm that sounded throughout the ship. The captain heard the alarm, reported to the bridge, and looked at the smoke detection system panel, which indicated an alarm in cargo hold no. 3. He mustered the crew, directed the access manholes to be closed, and directed the third mate to release 60 bottles of CO₂ from the vessel's fixed fire-extinguishing system into cargo hold no. 3. After the CO₂ was discharged, the crew monitored the bulkhead temperatures in cargo hold no. 3 and verified that they were not rising. The crew continued monitoring for the next 8 hours.

After the accident, the captain called and emailed the company offices in Houston and China but did not make any other notifications to the port or the Coast Guard, nor did he make any radio broadcasts during or after the fire, even though the vessel's response plan required doing so. The vessel's response plan required quarterly training, but available records did not indicate that the crew had completed this training in the months before the fire.

Additional Information

About 8 hours after the fire broke out, the ship's agent notified the Coast Guard of the fire. The Coast Guard contacted the Harris County Fire Marshal's Office, and later that morning, the ship's crew and investigators inspected the cargo hold. The vessel had no structural damage, but several pieces of cargo sustained damage. One transmission hub located directly below a gap between the pontoons and beneath a hotwork area sustained the majority of damage to its internal and external components. Additionally, several nacelles and transmission hubs located in port cargo hold no. 3 were damaged by smoke and soot.

After the fire, the chief investigator from the Harris County Fire Marshal's Office inspected the damaged hub and identified smoke and fire damage consistent with sparks and slag falling onto

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the plastic and blanket kit covering the hubs from a gap in the pontoons from the deck above. The burn pattern indicated that the worst damage was to the area directly below the gap in the pontoons. Many other components were damaged by smoke, which entered the interior spaces of the hubs and nacelles during the fire. The hubs and nacelles were equipped with sensitive electronics, hydraulic systems, gears, and bearings.



Fire damage to transmission hub as seen from above (left) and side (right) after removal from port cargo hold no. 3 of the *Chipolbrok Moon*.

Investigators determined that the blanket kit material was polyethylene terephthalate (PET), the same plastic from which water bottles are made. The melting temperature range for PET is 250–255°C (482–491°F). Without the addition of fire-retardant material, PET will combust like any hydrocarbon fuel once liquified. Slag resulting from cutting with a torch can reach 6,000°F and the sparks generated from the torch can exceed 3,000°F. Hot welding sparks and byproducts can easily ignite combustible materials, particularly low temperature melting material like the PET fiber in the blanket.

As part of the operating company’s safety and quality management system, the company had a written instruction sheet titled “Instructions on Naked Fire Operation.” The purpose of the document was to “exterminate any potential fire and secure maintenance work for the safety operations of ships.” The document provided instructions to crewmembers about preparing and protecting work areas for hotwork. Regarding the use of fire-protection devices, the company required that “open areas next to the workshops where sparks may reach shall be covered; workshops shall be protected to isolate sparks and to insulate the radiation of heat.” Also, “before welding, preparations shall be made such as checking various places and positions . . . cleaning up all areas involved, removing combustibles or gases in vicinity, particularly for those on the reverse side of the objects to be welded, and providing ventilation if necessary.” Additionally, “when the ship lies alongside or is in waters regulated by the port authority, welding operations can only be undertaken with the approval of the port authority or in compliance with local regulations.”

The vessel owner provided SOLAS training records for the 4 months prior to the fire, which indicated that “firefighting equipment operation training” was conducted on February 27, April 7, April 29, and May 19, 2018. This training included instruction on portable fire extinguishers, fixed extinguishing system, fireman outfits, emergency-escape breathing devices,

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other equipment (such as the fire pump, fire hose, and fire axe), gas detectors, and anti-chemical clothes. The captain's evaluation of training effectiveness each time was classified as "succeed." The vessel owner also provided a training record from May 19, three days before the fire, which indicated that "hotwork instruction, firefighting equipments [sic] ready for use on spot, fire watch posted and instructed, and duty officer instructed and communication" had been satisfactorily completed.

Before permitting welding and hotwork in the port of Houston, the Port of Houston Authority required vessel owners to complete a "Welding and Hotwork Permit" and to notify Port of Houston Fire Department dispatcher by phone before starting any burning or welding. The *Chipolbrok Moon* crew did not submit this permit.

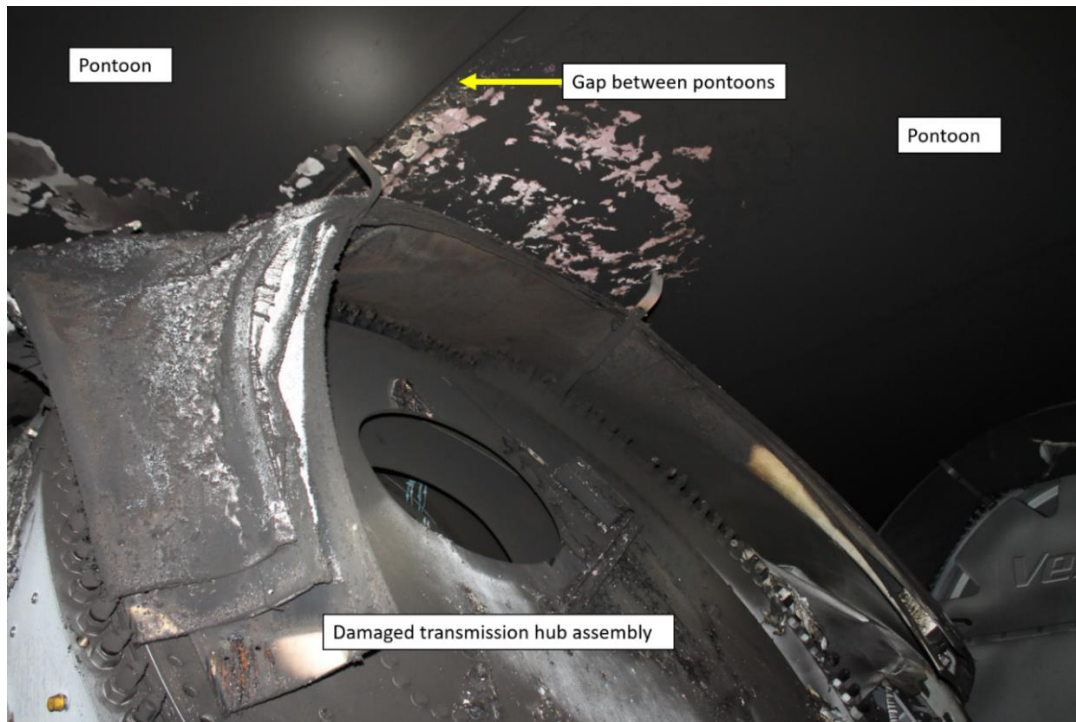
Postaccident alcohol testing was conducted on the involved crew about 1 hour after the fire broke out; all results were negative. Pertinent crewmembers were also drug tested; results were negative. In addition, work/rest histories for the crewmembers involved in the fire showed that they had about 16 hours of rest available per day. The fitter had 30 years of experience working aboard ships. The captain had been in the marine industry for 13 years. The accident voyage was his first trip as captain aboard the *Chipolbrok Moon*.

Analysis

The investigation revealed several issues that contributed to the fire aboard the *Chipolbrok Moon*, including preparation and execution of hotwork. Postaccident notifications were also an issue, which indicated that written procedures were not being followed.

The cargo of transmission hubs was located on the lower deck just below the pontoons making up the lower tween deck level. The crew was conducting hotwork near a gap between two pontoons on the deck above, and sparks/welding slag were able to fall from the work location through the unprotected gaps between the pontoons, igniting the turbine component's dust-protective transport plastic and blanket. The area above the transmission hubs and below the pontoon deck was difficult to access and hard to see given the lack of lighting in the hold. In addition, transmission hubs stored aboard the vessel were wrapped in a material that ignited relatively easily. The crew of the *Chipolbrok Moon* did not ensure adequate placement of fire blankets, particularly in areas that were difficult to access. Further, the modification of the fire blankets into narrow strips (about 7 inches wide) could have easily led to shifting, uncovering the gaps between the pontoons. In his permit, the marine chemist noted that hotwork areas needed to be at least 35 feet (12 meters) away from flammable and combustible materials. However, because of the loading configuration, the hubs were located less than a foot below the hotwork area on the lower tween deck in port cargo hold no. 3. Additional fire blankets should have been placed over the hubs.

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Fire damage to transmission hub in cargo hold no. 3 aboard *Chipolbrok Moon* directly below gap between pontoons. (Photo by Houston Fire Marshal)

Although the crew of the *Chipolbrok Moon* obtained a marine chemist certificate for the hotwork areas, the required permit and notification to the Port of Houston Port Authority had not been completed. Subsequently, days after the fire, a Port of Houston Welding and Hotwork permit was completed for hotwork commencing on May 25. During the fire, the captain did not notify the port or the Coast Guard. This lack of notification did not meet the vessel's response plan, which stated to immediately report hazardous conditions occurring on board.

The above shortcomings of the crew in following all components of the hotwork procedures demonstrate a lack of understanding of hotwork SMS procedures.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the fire aboard cargo vessel *Chipolbrok Moon* was the crew's lack of adherence to the company's safety management system and the marine chemist's instructions pertaining to hotwork precautions, which allowed sparks and slag to fall through unprotected gaps between the removable decking pontoons and ignite the dust-protective covering of the transmission hubs.

Fire Protection and Port Notification

Before conducting hotwork, it is critical to evaluate work areas for fire hazards to ensure that adequate protection is in place. In addition, notifying shoreside authorities both before conducting hotwork and in the event of a fire allows port authorities to properly prepare and respond more rapidly.

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Vessel Particulars

Vessel	<i>Chipolbrok Moon</i>
Owner/operator	Chipolbrok America Inc.
Port of registry	Hong Kong
Flag	Hong Kong
Type	Multipurpose cargo vessel
Year built	2004
Official number (US)	N/A
IMO number	9272216
Construction	Steel
Length	655 ft (199.8 m)
Draft	50 ft (15.5 m)
Beam/width	91 ft (27.8 m)
Gross and/or ITC tonnage	24,167 gross tons
Engine power; manufacturer	22,109 hp (16,250 kW); Sulzer 7RT-FLEX60C Marine Diesel
Persons on board	24

For more details about this accident, visit www.nts.gov and search for NTSB accident ID DCA18FM025.

Adopted: April 24, 2019

NTSB investigators worked closely with our counterparts from Coast Guard Sector Houston/Galveston throughout this investigation.

The NTSB has authority to investigate and establish the probable cause of any major marine casualty or any marine casualty involving both public and nonpublic vessels under Title 49 *United States Code*, 1131. This report is based on factual information either gathered by NTSB investigators or provided by the Coast Guard from its informal investigation of the accident.

The NTSB does not assign fault or blame for a marine casualty; rather, as specified by NTSB regulation, “[NTSB] investigations are fact-finding proceedings with no formal issues and no adverse parties . . . and are not conducted for the purpose of determining the rights or liabilities of any person.” Title 49 *Code of Federal Regulations*, 831.4.

Assignment of fault or legal liability is not relevant to the NTSB’s statutory mission to improve transportation safety by conducting investigations and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report. Title 49 *United States Code*, 1154(b).