

# NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering  
Materials Laboratory Division  
Washington, D.C. 20594



February 3, 2021

FIRE INVESTIGATION FACTUAL REPORT

Report No. 21-010

## A. ACCIDENT INFORMATION

Place : Pier 20, Blount Island, Jacksonville, Florida  
Date : June 4, 2020  
Vehicle : *Höegh Xiamen*  
NTSB No. : DCA20FM020  
Investigator : Marcel Muise

## B. ACCIDENT SUMMARY

About 1530 local time on June 4, 2020, the Norwegian-flagged roll-on/roll-off (Ro/Ro) *Höegh Xiamen* caught fire while moored at the Blount Island Terminal in Jacksonville, Florida.<sup>1</sup> The crew evacuated to the pier; however, the fire consumed the five highest cargo decks and the accommodations. No injuries were reported to the crew, though nine municipal firefighters were injured. The vessel was declared a total loss. Damages to the ship and cargo were estimated at \$40 million.

## C. COMPONENTS EXAMINED

The NTSB did not initially travel to the accident site and participated remotely in support of the US Coast Guard. The Fire Group considered the crew statements, the after-action reports from the Jacksonville Fire Department personnel, and photographs taken by the Coast Guard and the fire department, as well as closed-circuit television (CCTV) video from the port.

## D. DETAILS OF THE EXAMINATION

For a general description of the vessel type and operations, see the Nautical Operations Factors Group Factual Report. For details about the cargo and cargo loading operations, see the Hazardous Materials Group Factual Report.

The *Höegh Xiamen* had a fixed fire detection and suppression system serving the cargo decks and engine spaces. The fire detection system had been temporarily deactivated during cargo loading. The fire detection system went into alarm as soon as it was restored.<sup>2</sup> The cargo decks were separated into airtight fire zones that could be individually selected for

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<sup>1</sup> A roll-on/roll-off (Ro/Ro) cargo ship is designed to carry wheeled cargo such as cars, trucks, and semi-trailer trucks, which are driven onto and off the ship. Ro/Ro vessels have either a built-in or shore-based ramp that allows cargo to be efficiently rolled on and off the vessel while in port.

<sup>2</sup> See Table 4 in Nautical Operations Factors Factual report for fire alarms captured to the VDR.

fire suppression by the low-pressure carbon dioxide (CO<sub>2</sub>) system. The cargo decks were grouped into 5 fire zones (figure 1). The crew identified zone 3 containing decks 7 and 8 as the origin of the observed smoke. The crew also observed fire on the aft starboard side of deck 8 and dripping down onto deck 7.

### **Crew Interviews**

Crew interviews were conducted in Jacksonville, Florida, and NTSB investigators participated remotely. Due to the language barrier with the crew, a translator was available to help facilitate some of the interviews. The interviews were transcribed and are available in the accident docket. Summaries of the crew statements pertaining to the discovery and actions taken to respond to the fire are contained below. Some of the statements have been paraphrased for clarity.

#### *Chief engineer (Quan Jia Wang)*

About 1530 the chief engineer was chatting with the captain. At that time, the second mate came running up and alerted them that smoke was coming up from the cargo compartment. Before they all had a chance to react, the fire alarm system began to sound.

The chief engineer went to deck 11 to begin an inspection of the cargo decks and worked his way down to deck 7. He observed strong smoke on cargo deck 8 and noted that the lights were out. He asked the chief mate to turn on the lights but was told that the lights were already on. The chief engineer stated that while he was on deck 7, he could see (through the decking) a small fire on the aft starboard side of deck 8 and that he could also see the small fire dripping down onto deck 7.

The chief engineer then instructed crewmembers to connect firehoses and bring firefighting equipment to the stairwell at levels 7 and 8. The chief engineer waited there for firefighting teams 1 and 2 to arrive. As the crew were preparing to make entry and fight the fire, a sudden rush of thick smoke began to come out of the door. He reported this condition to the captain and was given the order to retreat to the upper deck muster station. He stated that at this point, he was no longer in charge of the initial response, and he began following instructions to close dampers.

A little while afterward, the captain told the crew to get off the vessel and muster on the dock. As the chief engineer was about to make his way down to the dock, the captain ordered him, along with the chief mate, to go back up and release the CO<sub>2</sub> into the deck 7/8 zone. The chief engineer said that he was unable to release the CO<sub>2</sub> from the CO<sub>2</sub> control room, so he proceeded to the firefighting station and released the CO<sub>2</sub> from there. He then went back to the CO<sub>2</sub> control room to check the pressure. He stated that he believed that the system had activated, and, following the captain's instructions, he evacuated.

#### *Second mate (Min Zhao)*

After loading had been completed, the second mate had completed a walkthrough of some of the cargo decks, including decks 7 and 8, and he did not observe any problems. The second mate then went to the bridge and began preparing documents for departure. While at the bridge he heard on the radio that there was smoke coming from deck 8. The second mate estimated that it had been more than 30 minutes between when he was last on deck 8 and when he heard the alert over the radio.

The second mate rushed to deck 7 immediately. He said that he found heavy smoke and could not see inside. He then went back up to the bridge and put on his firefighting outfit and went back down to the cargo decks with the able seaman. When he arrived back down at the cargo deck, he said that the first firefighting team was already there. The firefighting team tried to "take some action" but there was too much smoke to go inside. The captain then led them away and ordered them to muster at deck 12. The second mate said that around that time, the Jacksonville Fire Department began to arrive, so the Captain ordered the crew down to deck 5, where a firefighter arrived, and the second mate and the captain showed the firefighter up to deck 8. The crew opened the door to deck 8, and heavy smoke began to pour out, so they immediately closed it. They all then went back down to deck 5, at which point the fire department personnel asked them to disembark.

*Chief mate (Xiulei Zhang)*

The chief mate stated that when the cargo loading operation was completed, he instructed the boatswain to close the remaining internal ramps and watertight doors. The chief mate instructed the second mate to inspect cargo decks 5–11 while he inspected decks 1–4. After the chief mate completed his inspection, he went up to the weather deck to close the side ramp, then went to close the stern ramp and discovered there was a problem (frequently encountered by the crew) that prevented him from closing it at that time. Since it was raining, the chief mate and the boatswain decided to go inside and wait for the rain to subside. The chief mate said he went to the passageway from the elevator/staircase to the accommodation area to wait there. The chief mate stated that he then saw a little bit of smoke coming from the ventilation housing associated with decks 7 and 8. He could not see the smoke very clearly due to the rain, so he went closer to the ventilation damper, at which point he was convinced there really was smoke. The chief mate called out on the radio to alert the rest of the crew that there was smoke on decks 7–8. The chief mate stated that it was approximately 10–20 seconds after he made the alert call on the radio that the ship's smoke alarm system began to alert. The chief mate said that the captain contacted him on the radio to ask what happened and instructed him to go and check what was going on. The chief mate then used the radio to instruct the ordinary seaman and able seaman to go to decks 7 and 8 and see what was going on. The chief mate then went into the accommodation area and closed all the machinery ventilation controls inside the ventilation room. At this time, he saw other crew members coming out of their staterooms and get dressed in their firefighting equipment. The ordinary seaman reported back to the chief mate that they could not see anything inside deck 8 and that the lights were off. The chief mate then told the ordinary seaman that they should go down to deck 7 since it was in the same fire zone as deck 8. The ordinary seaman reported back to the chief mate that they could see some fire on deck 8 from deck 7.

The chief mate said that initially, he had only seen the one vent associated with decks 7 and 8 producing smoke when he used the radio to alert the rest of the crew. He estimated that a few minutes after the initial smoke was discovered, he noticed that there were more (three or four) ventilation housings producing smoke.

The chief mate and the firefighting team arrived at the aft staircase, and he radioed the captain to request entry onto deck 8. The captain replied, granting him permission to proceed. The chief mate stated that as the fire team opened the door, heavy smoke poured out under pressure against the door, so the firefighting team closed the door immediately. The chief mate then ascended to the weather deck, where he saw a lot of ventilation housings producing smoke. He radioed the captain and told him what had happened on the entry attempt and what he saw on the weather deck. The chief mate suggested that they release the CO<sub>2</sub> at that time. He stated that he recommended the release of the CO<sub>2</sub> at least three times. The captain ordered the chief mate and the firefighting team to head to the muster station.

The chief mate stated that the captain instructed him to close all the natural ventilation fire dampers. The chief mate said that he delegated to the electrician to go to the ventilation room and close the remote-control dampers and that he told other crew who were at the muster station to spread out and close the manual dampers. The chief mate said that after all the crewmembers returned from securing the ventilation dampers, he reported back to the captain that the dampers were closed. The chief mate then said that the captain informed him that he had called the local fire department and that they would be arriving soon. When the Jacksonville Fire Department arrived, the captain ordered the chief mate to go down the stern ramp to talk to the firefighters who had just arrived. The chief mate gave the firefighters some information regarding the deck on which the fire was observed. The chief mate said that the firefighters told him to radio the captain and have him order the rest of the crew off the ship. The captain did not reply on the radio but showed up in person on deck 5 and met with the firefighters. The chief mate said that after the captain had spoken with the firefighters, he ordered him and the chief engineer to go topside and release the CO<sub>2</sub> system.

The chief mate stated that there was a lot of smoke in the passage from the stairway to the CO<sub>2</sub> room when he arrived with the chief engineer. The chief engineer entered the CO<sub>2</sub> room. While the chief mate was waiting outside the CO<sub>2</sub> room, the captain showed up, saying that it was too loud for effective communication and that the chief mate should go shut off the ship's fire alarm. The chief mate went and shut off the ship's fire alarm, and when he returned, the three of them went back down to deck 5. Once the crew were accounted for near the stern ramp, they all disembarked. The chief mate could not verify that the CO<sub>2</sub> was released because he went off to silence the ship's alarm while the captain was outside the CO<sub>2</sub> room and the chief engineer was inside the CO<sub>2</sub> room.

The chief mate was asked to clarify which vent he first saw smoke coming from and stated that it was on the starboard side aft the second from the last vent. He was also asked if after the ventilation dampers were closed he could still see smoke, and he responded that he could still see smoke.

*Captain (Shilian Zhang)*

The captain was in his office at approximately 1530 when he heard a warning over the radio from a crewmember about the fire. The captain stepped outside, and the first thing he saw was the chief officer running to his deck office to (presumably by the captain) resume (turn back on) the fire alarm system. The captain followed the chief officer and stated that once the fire detection system was reactivated, it went into alarm, so they were sure they had a fire in the cargo hold. The captain then ran back to the bridge and radioed the chief mate to go to the "spot" and help maintain contact with the radios. The captain then made an announcement over the ship's public address (PA) system that there was a fire on decks 7 and 8 and that everybody should go to the muster station. The captain stated that his first objective was to have the crew isolate the fire by closing the dampers to the affected fire zone and for him to contact the local fire rescue. The captain had some difficulty making the call for help, but he eventually was able to make contact through very high frequency (VHF) channel 14 and relay that the ship was on fire.

The captain stated that the chief mate then notified him that the dampers were closed and that they were ready to release the CO<sub>2</sub> system. He stated that at the same time, he could see in the distance the fire department coming. The captain then ordered the ship officer to have the crew fire team make entry onto the deck to check if they could fight the fire. The captain said that the fire team reported too much smoke and no light on the deck and that it was impossible to go inside out of concern for safety. The captain stated that he ordered the crew to come back and muster, since he saw the fire department was arriving. The captain felt that the fire department would have more experience than his men. The captain then left the bridge and headed towards the muster station. The captain stated that he could very clearly see the smoke from the vent getting stronger and stronger. He stated that it was from the port and starboard vents aft of the ship. At the muster station, the captain said that the chief mate told him all crew were accounted for.

The captain then ordered the chief mate to go down and meet with the fire department and tell them what was happening. The captain also ordered the second mate to bring the fire control plan to show the fire department. The captain stated that since the smoke kept growing, he decided that for the safety of his crew he would order them all to evacuate. The captain wanted to remain aboard the ship to see what he could do, but due to the noise and difficulties with the radio, he eventually went down to deck 5 to find out about the interaction of his crew with the fire department. The captain said that when he arrived on deck 5, he saw three firefighters there with their breathing apparatus on. The captain had difficulty communicating with them but managed to ask if he should release the CO<sub>2</sub> system. The fire department agreed, and the captain ordered the chief mate and chief engineer back on the ship to release the CO<sub>2</sub> as soon as possible. The captain told them that once they were ready to wait for his final order before releasing the CO<sub>2</sub>. The captain then tried to communicate with them over the radio but could not make contact, so he told the fire department to stand by as he ran back upstairs to give the command to release the CO<sub>2</sub>.

The captain found the chief mate and chief engineer at the entrance to the low-pressure CO<sub>2</sub> system room and ordered the chief engineer to release the system. The

captain said that the chief engineer was not able to release the CO<sub>2</sub> from the CO<sub>2</sub> system room due to some undescribed failure. The Captain said that the chief mate reminded them that they can release the CO<sub>2</sub> from the fire control room. The captain stated that the chief engineer was able to release the CO<sub>2</sub> system from fire control room. The captain stated that he heard sounds like CO<sub>2</sub> releasing. The captain and the chief mate and chief engineer all went back down to deck 5, and the captain told the fire department that they had released the CO<sub>2</sub> system for the affected fire zone.

#### *Electrician (Shaohu Liu)*

The electrician was on his break when he heard about the fire. He was given orders to close the ventilation dampers. He closed the manual dampers first and then the remote-controlled ones. He said there was no way to verify that the remote dampers closed. He then was asked to hook up a hose line. He eventually evacuated the ship with the rest of the crew.

### **Fire Fighting Response**

The Jacksonville Fire Department first arrived on scene with Engine 48 (E48) at 1603 local time. CCTV cameras observing the port captured this arrival and the arrival of other fire department apparatus during the response. When E48 arrived, smoke could be seen coming from the aft ventilation exhausts both on the port and starboard sides (figure 2). These ventilation exhausts corresponded to decks 10/11 and 9 on the port side and decks 10/11 and 7/8 on the starboard side. There was difficulty communicating between the fire department and the ship's crew due to a language barrier. The crew initially showed members of the fire department the stairway leading to the deck 8 cargo hold. The crew opened and immediately shut the door to the deck 8 cargo hold due to heavy smoke. The crew advised the fire department that they would release the CO<sub>2</sub> system into the affected zone, and the fire department agreed. After releasing the CO<sub>2</sub> system, the crew disembarked.

From that point on, the fire department took over the firefighting efforts. Statements<sup>3</sup> from the responding firefighters indicated that initially there were no reports of any heat or smoke in the entire stairwell. Firefighters also stated<sup>4</sup> that upon entry on the 8<sup>th</sup> deck they encountered two smoldering vehicles. The same firefighters also stated that after cooling the cars and putting the small fire out the heat seemed to increase substantially. They retreated from the deck as the heat continued to increase. Firefighters<sup>5</sup> from Ladder 7 had been assigned to the top deck with the purpose of finding hatches to possibly open for ventilation. The firefighters from Ladder 7 stated<sup>6</sup> that they checked the vents and found them to be open with smoke flowing freely out of the vents for deck 8 and 9. They said that they were ordered to open any doors to the housings around the vents. Once the doors on the port side had been opened an explosion occurred approximately one minute later.

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<sup>3</sup> JFRD Firefighter Statements, S37B

<sup>4</sup> JFRD Firefighter Statements, L9B

<sup>5</sup> JFRD Firefighter Statements, R35B

<sup>6</sup> JFRD Firefighter Statements, L7B

At 1846 local time, there was an overpressure event that resulted in the injury of multiple firefighters. From the perspective of the fire fighters in the stairwell, the overpressure event was described as a sudden rush of heated air that pushed them through the stairwell. From the exterior of the ship, firefighters witnessed a tall column of greyish white smoke projecting from the stern on the weather deck and debris flying. Based on firefighter statements there may have been a number of these events of varying magnitude. After the explosions the firefighting approach transitioned to a defensive cooling type approach (figures 3, 4). The fire was declared extinguished 8 days later.

### **Ventilation Examination**

The weather deck of the ship had the exhaust and supply outlets and inlets for ventilation of the decks. These outlets and inlets were located along the periphery of the ship from bow to stern (figure 5). The exhaust ventilation outlets were covered with a rectangular metal structure and the supply ventilation inlets were rectangular metal structures on top of cylindrical metal bases. These structures are both referred to here as ventilation doghouses. The condition of the ventilation doghouses on the weather deck was examined using photographs. The photographs of each of the doghouses were taken by the fire department and the Coast Guard during walkarounds of the weather deck. Not all angles or interior and exterior photographs were available for each doghouse, and therefore, this assessment is limited by the available photographic evidence.

Overall, the condition of the doghouses fell into three categories. They either had no signs of external sooting and mechanical damage; they exhibited external sooting and no mechanical damage; or they exhibited both external sooting and mechanical damage. The only ventilation doghouses that exhibited sooting were those associated with decks 7/8, 9, and 10/11. The only doghouses that exhibited mechanical damage consistent with an overpressure event were associated with decks 9 and 10/11. The doghouses for deck 10/11 exhibited greater levels of mechanical damage than those of deck 9. A doghouse for a deck 7 vent exhibited some mechanical damage, but it did not appear to have originated from the inside. The diagram in figure 5 contains these observations and their locations on the weather deck.

The following section will describe the ventilation doghouses highlighted in figure 5. The letter "E" or "S" after the vent number designates exhaust or supply, respectively. The description will begin from the stern and move along the port side to the bow, then back from the stern again and along the starboard side to the bow.

#### *10E and 9E (at the stern port side)*

Figures 6 and 7 show the doghouses for exhaust vents for decks 10/11 and 9. These doghouses exhibit external soot staining and portions of the doghouses have been forcefully separated. The mechanical damage is consistent with an overpressure event.

*7S (aft area port side)*

Figure 8 shows the doghouse for a supply vent for deck 7/8. There is no external soot staining visible, but the inside of the door (shown open) appears to have been soot stained.

*10S (aft area port side)*

Figure 9 shows the doghouse for a supply vent for deck 10/11. There is external sooting of the doghouse and the door appears to be missing. There is also debris on the deck at the base of the doghouse.

*10S (near midship port side)*

Figure 10 shows the doghouse for a supply vent for deck 10/11. There is external sooting and debris around the base. The interior of the doghouse door also exhibits heavy sooting. No mechanical damage was observed in the photos.

*7E (near accommodation space port side)*

Figure 11 shows the doghouse for an exhaust vent for deck 7/8. There is soot staining on the exterior of the doghouse. The inboard side of the doghouse is separated and pushed outward at the base. There is a sharp crease on the separated portion near the bottom. It is not clear if this is mechanical damage due to overpressure.

*10S (near accommodation space port side)*

Figure 12 shows the doghouse for a supply vent for deck 10/11. There is soot staining on the exterior and along the door jamb. There is no visible mechanical damage.

*10S (near the bridge port side)*

Figure 13 shows the doghouse for a supply vent for deck 10/11. There is soot staining on the exterior seen on the louvred side, which is directed inboard at this location.

*9E (at the bow port side)*

Figure 14 shows the doghouse for an exhaust vent for deck 9. There is soot along the upper portion of the doghouse, and the one side of the doghouse is separated and laying partially attached at the base. This mechanical damage appears consistent with an overpressure event.

*10E and 7E (at stern starboard side)*

Figures 15 and 16 show the doghouses for exhaust vents for decks 10/11 and 7. The doghouse for the deck 10/11 exhaust vent is almost completely separated from the deck. The doghouse separated along three sides along the base and rotated about the remaining



attached side ending up inverted on the deck. The mechanical damage to the doghouse is consistent with an overpressure event. The doghouse for the deck 7 exhaust vent exhibited some soot staining on the upper aft side.

*10S (aft area starboard side)*

Figure 17 shows the doghouse for a supply vent for deck 10/11. There is soot staining on the exterior of the doghouse. There is no visible mechanical damage.

*10S (midship starboard side)*

Figure 18 shows the doghouse for a supply vent for deck 10/11. There is soot staining on the exterior of the doghouse. There is no visible mechanical damage.

*10S (near accommodation space starboard side)*

Figure 19 shows the doghouse for a supply vent for deck 10/11. There is soot staining on the exterior of the doghouse. There is no visible mechanical damage.

*10S (near accommodation space starboard side)*

Figure 20 shows the doghouse for a supply vent for deck 10/11. There is soot staining on the exterior of the doghouse. There is no visible mechanical damage.

*10E (at the bow starboard side)*

Figures 21 and 22 show the doghouse for an exhaust vent for deck 10/11. There is some light soot staining on the bulkhead of the stairwell entrance adjacent to where the ventilation doghouse had been. The doghouse was completely separated from the deck and landed on the dock. The mechanical damage to the doghouse is consistent with an overpressure event.

## **Port CCTV Video Examination**

Video from port security CCTV cameras was provided by the Coast Guard for examination. The footage was provided in separate clips, most of which did not contain timestamp information. Events described based on these videos are made in reference to events noted in the crew interviews and fire department logs that can be seen in the video clips.

The ship's crew stated that they had trouble closing the stern ramp and that they abandoned their effort temporarily to wait out the rain. In the port CCTV video, the crew can

be seen leaving after attempting to close the ramp, and the following observations are made in reference to this time (figure 23). Approximately two minutes after the crew left the ramp, a reflection of smoke coming off the starboard stern can be seen on the wet pavement (figure 24). Approximately 7 minutes after the crew had left, a reflection on the wet pavement begins developing, indicating that smoke was now also coming from the port side of the stern (figure 25). Approximately 11 minutes after the crew left, the reflection of the smoke indicates two distinct, thick columns of smoke rising from both the port and starboard sides of the stern (figure 26). Approximately 16 minutes after the crew left, the CCTV camera panned upward, and the smoke could be clearly seen coming from the two aft most ventilation doghouses on both the port (10E, 9E) and starboard sides (10E, 7E) (figure 27).

The Jacksonville Fire Department arrived on scene at 1603 local time with E48. E48 can be seen on the port CCTV camera video pulling up to the ship in figure 28. Heavy smoke can be seen coming from the vents on the stern on both the port and starboard sides. Smoke can also be seen around midship but without a clear origin. As some of the firefighters from E48 begin walking up the ramp, a large puff of black smoke can be seen exiting a vent from the port side stern of the ship (figure 29). This puff of black smoke came out more forcefully than the smoke that had been already coming out. After the puff, the flow of smoke continued as it had before. In figure 30, members of the crew as well as some firefighters can be seen on the top of the ramp at deck level 5. From a different video angle, approximately 11 minutes after the arrival of E48, the ship can be seen with the majority of the smoke coming from the stern and a smaller quantity coming from a little aft of midship (figure 31). At this time, the smoke has a dark black appearance. Approximately 43 minutes after the arrival of E48, the smoke transitions to a grey-white color (figure 32). Approximately 50 minutes after the arrival of E48, the smoke has taken on a mostly white appearance (figure 33). When E48 first arrived (figure 28), the white paint on the starboard side of the ship did not exhibit any discoloration. Approximately 14 minutes after the arrival of E48, thermal discoloration can be seen on the white paint on the starboard side (figure 34). This discoloration appears to be associated with fire zones containing decks 7/8 and 10/11. Approximately 42 minutes after the arrival of E48, the thermal discoloration to the paint on the starboard side of the ship has darkened and still appears to be associated with the zones containing decks 7/8 and 10/11 (figure 35).

## **Overall Fire Damage**

The ship burned for 8 days before the fire was declared extinguished. The ship was declared a constructive total loss. The fire caused thermal damage on the interior of cargo decks 7 to 11 and thermal damage to the deck and accommodation spaces on deck 12. This thermal damage extended from the stern to the bow. The Hazardous Materials Factual Report contains a description of the cargo. On the ship's exterior, the paint was discolored, charred, or burned off and rusted in areas where the fire had been burning adjacent to the ship's skin (figure 36). Photos taken by the Jacksonville Fire Department depict some of the overall damage from the perspective of the deck 12 weather deck (figures 37–43).

Joseph Panagiotou  
Fire Protection Engineer

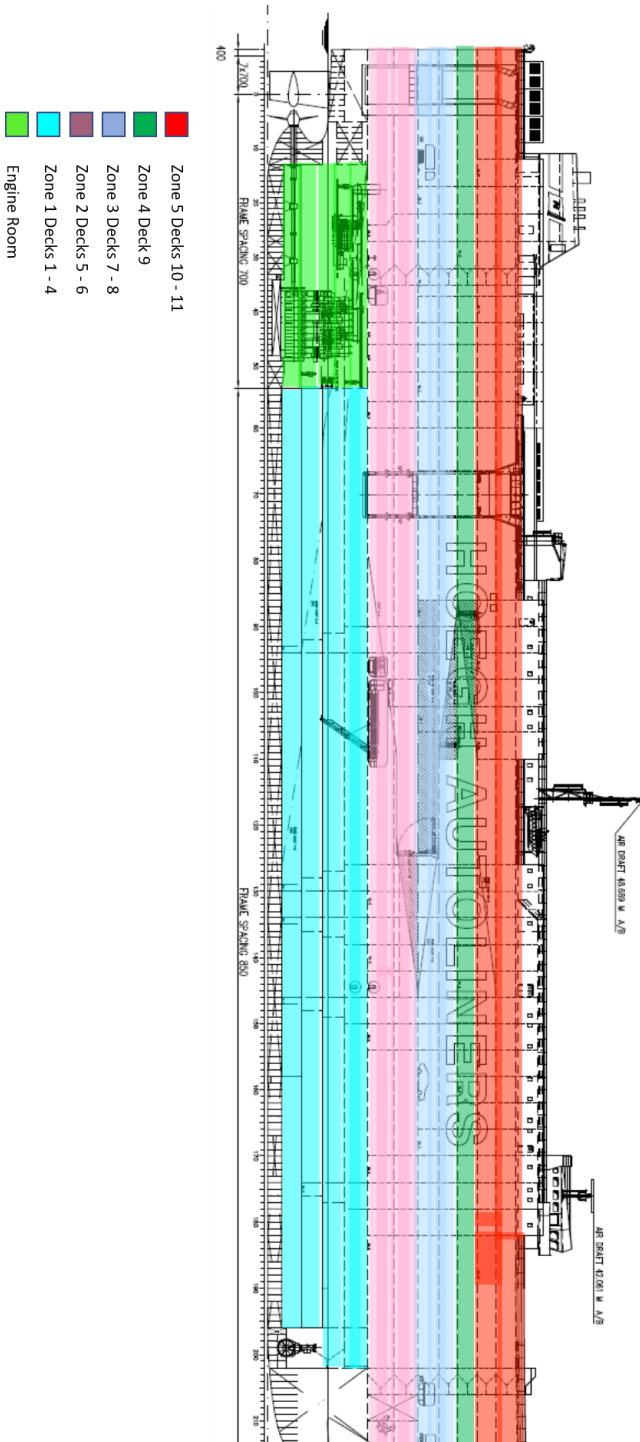


Figure 1. Fire zones for CO<sub>2</sub> fire suppression system

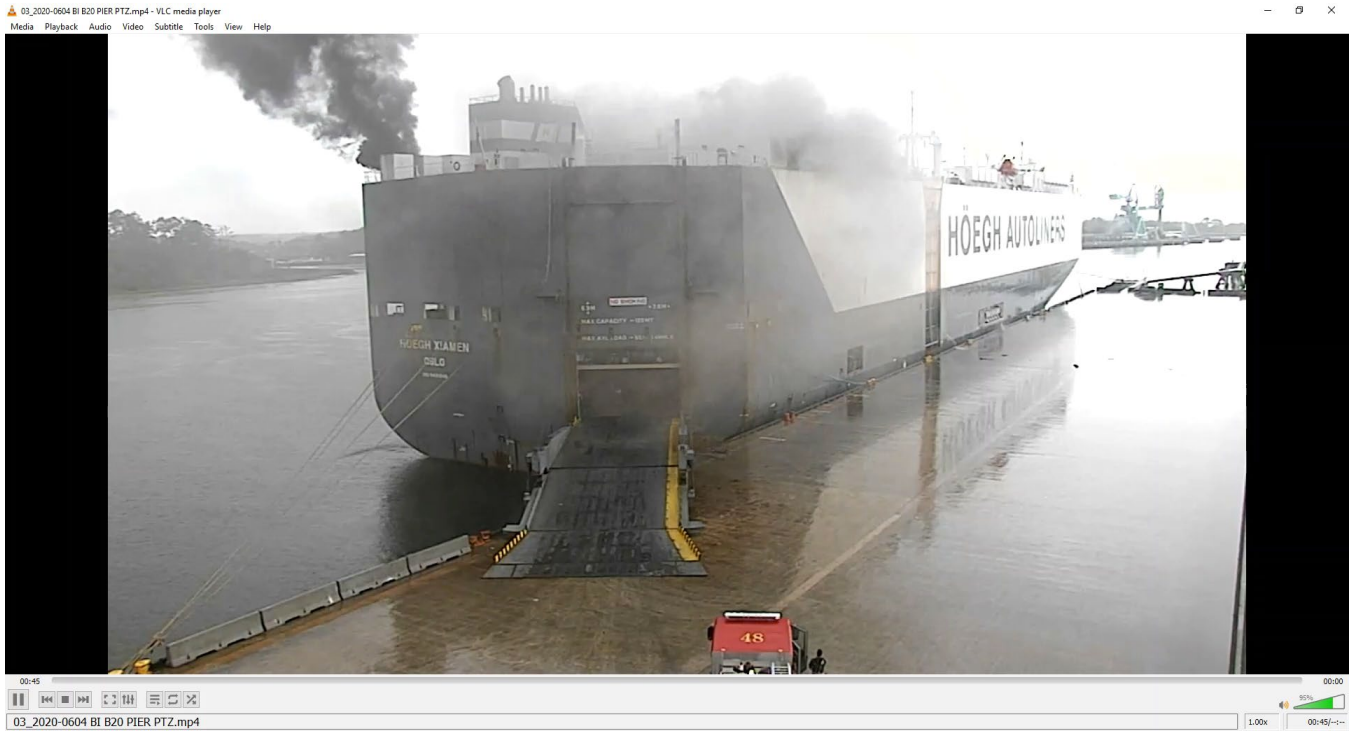


Figure 2. Arrival of Jacksonville Fire Department truck E48.



Figure 3. Exterior cooling tactic



Figure 4. Exterior cooling tactic



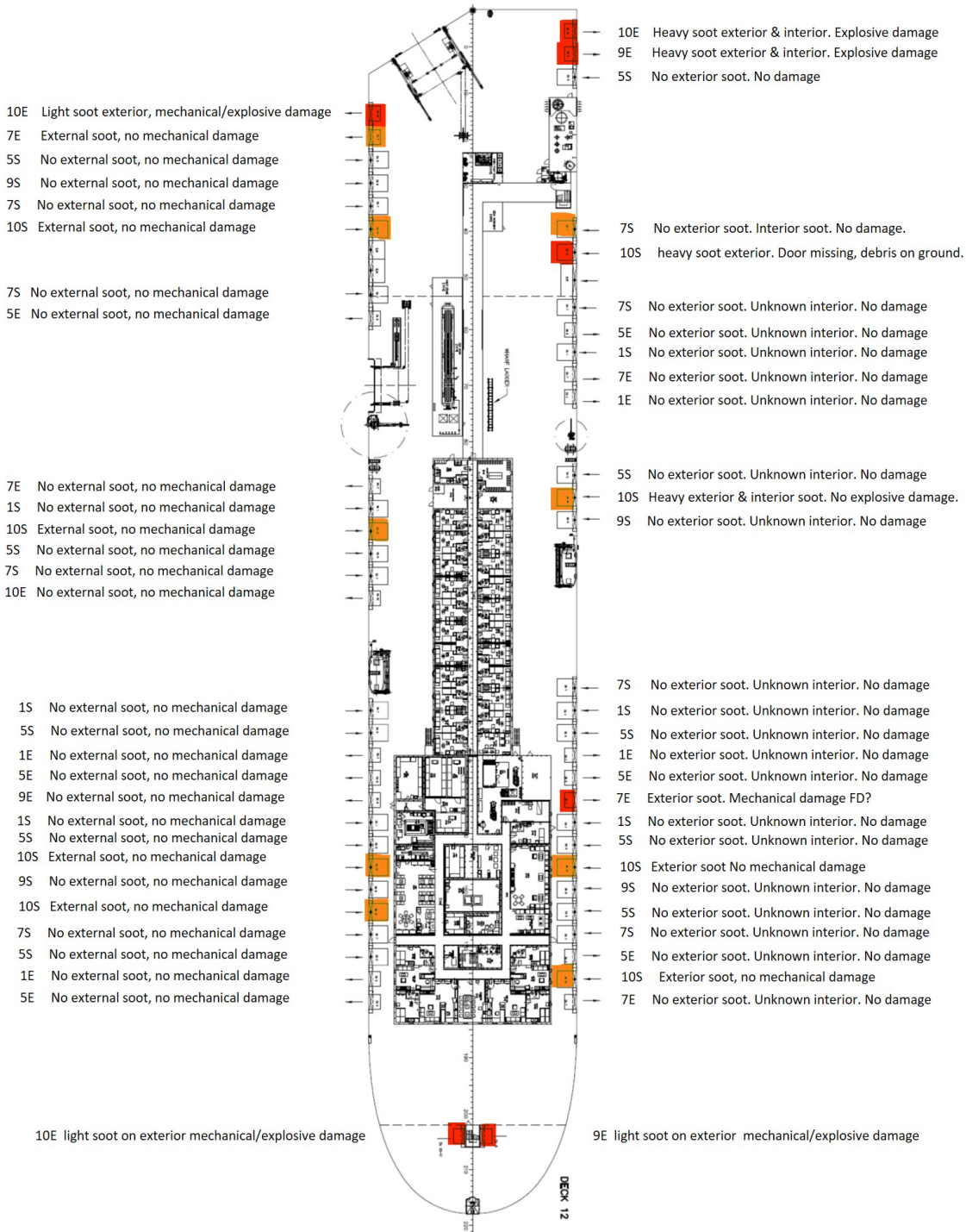


Figure 5. Diagram of vent arrangement on deck 12. Red highlighted vents exhibited soot staining and mechanical damage. Orange highlighted vents exhibited soot staining only.





Figure 6. Vents 10E and 9E on the port side of the stern. Both exhibit soot staining and damage due to overpressure.



Figure 7. Vents 10E and 9E on the port side of the stern. Both exhibit soot staining and damage due to overpressure.



Figure 8. Vent 7S on the port side exhibiting soot on the interior of the open door.



Figure 9. Vent 10S on the port side exhibiting soot and thermal discoloration. The doghouse door is missing, and there is debris around the base.



Figure 10. Two photos of vent 10S on the port side. Left: Exhibiting soot and thermal discoloration on the exterior. Right: Internal soot and thermal damage.



Figure 11. Vent 7E on the port side exhibiting external soot staining and the inboard doghouse wall displaced outward from the bottom.



Figure 12. Vent 10S on the port side exhibiting soot staining on the exterior door seam.



Figure 13. Vent 10S on the port side exhibiting heavy soot staining on the exterior.



Figure 14. Vent 9E on the port side of the bow exhibiting soot staining near the top and mechanical damage consistent with overpressure on the outboard side.



Figure 15. Vents 10E and 7E on the starboard side of the stern. Vent 10E exhibits mechanical damage due to overpressure. Vent 7E exhibits light soot staining on the upper corner.

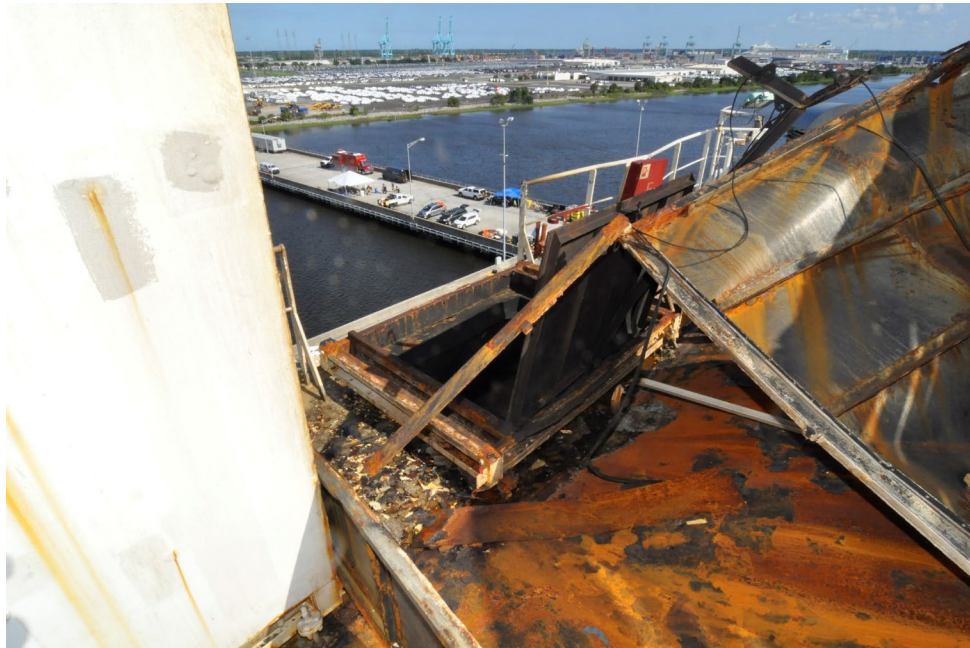


Figure 16. Vent 10E on the starboard side of the stern separated from the deck.



Figure 17. Vent 10E on the starboard side exhibiting external soot staining.



Figure 18. Vent 10S on the starboard side exhibiting soot staining on the exterior.



Figure 19. Vent 10S on the starboard side exhibiting soot staining on the exterior.



Figure 20. Vent 10S on the starboard side exhibiting soot staining on the exterior.



Figure 21. Vent 10E on the starboard side of the bow. The upper portion of the doghouse is completely separated from the base and missing. This mechanical damage is consistent with an overpressure event. There is soot staining on the bulkhead adjacent to where the doghouse had been.





Figure 22. Ventilation doghouse from vent 10E on the starboard side of the bow found on dock.

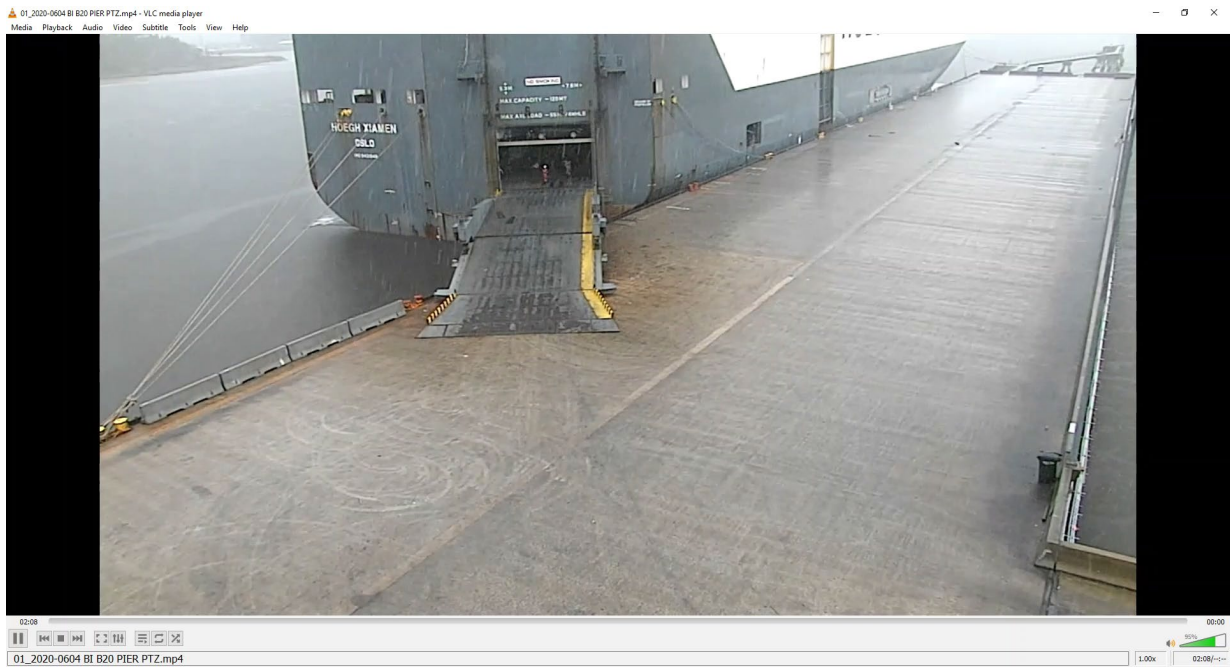


Figure 23. Ship's crewmembers about to leave stern ramp after failing to stow the ramp.

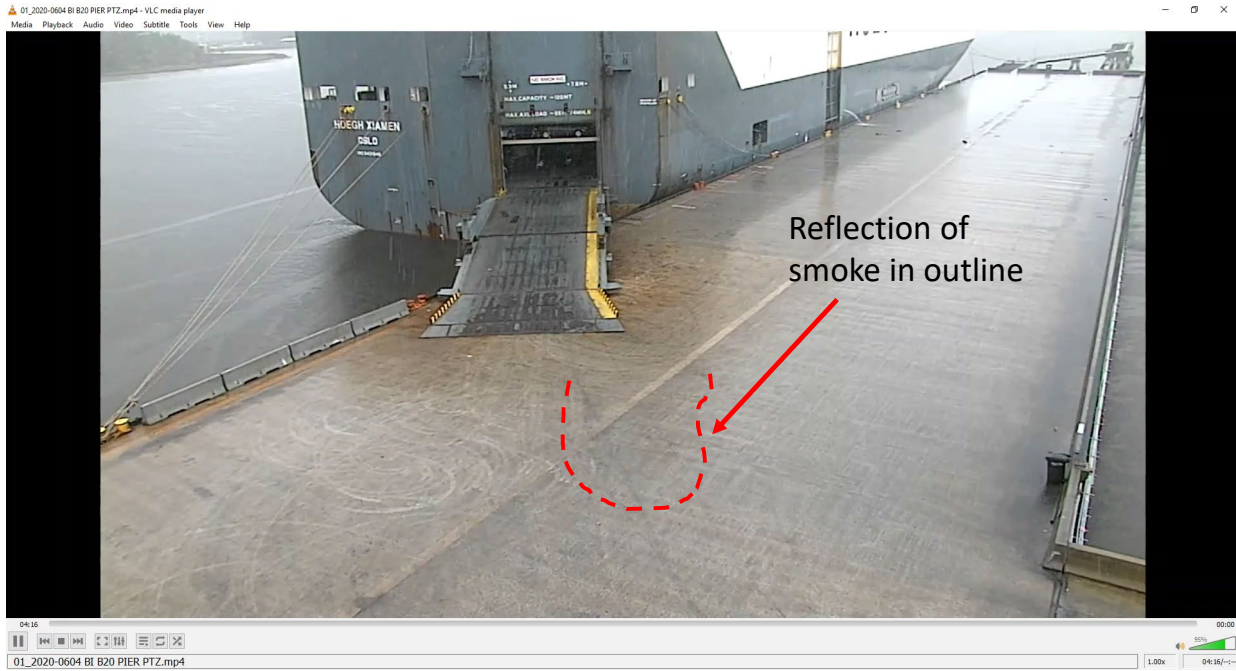


Figure 24. Two minutes after the crew leaves, there is the first sign of smoke seen as a reflection on the wet pavement. The reflection of the smoke is outlined.

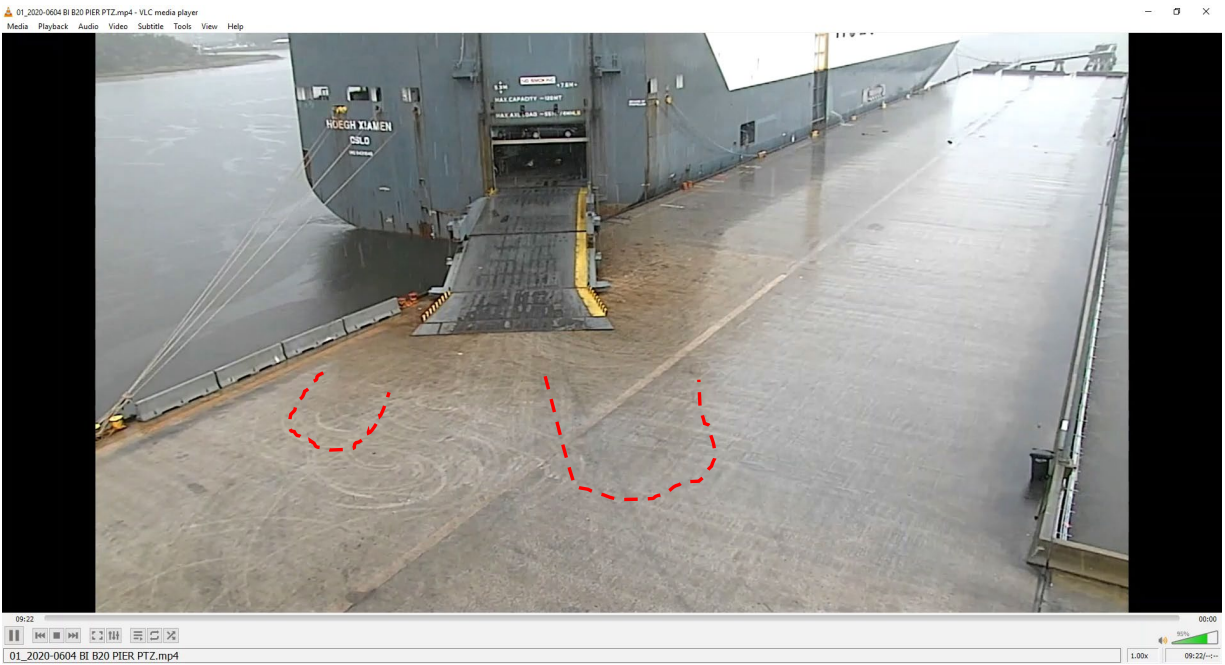


Figure 25. Seven minutes after the crew leaves, smoke starts to be seen on the port side. The reflections of the smoke are outlined.

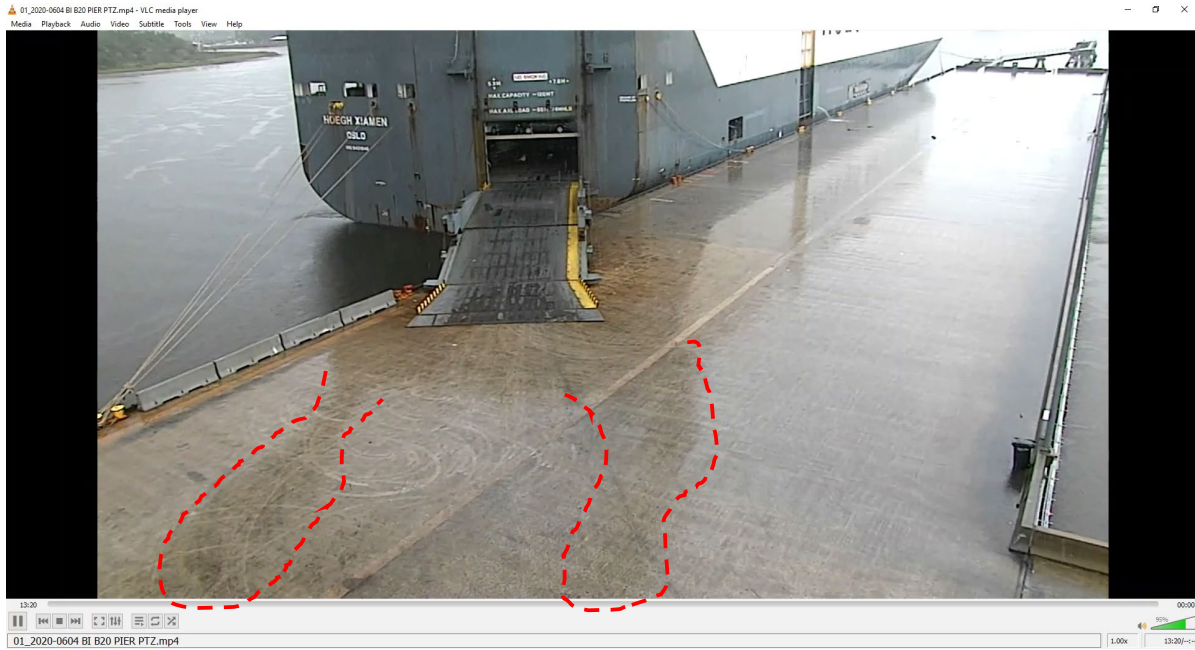


Figure 26. Eleven minutes after the crew leaves, heavy smoke can be seen from both the port and starboard sides of the stern.



Figure 27. Sixteen minutes after the crew leaves, and the camera has panned upward. Smoke can be seen coming from vents on both the port and starboard sides of the stern.

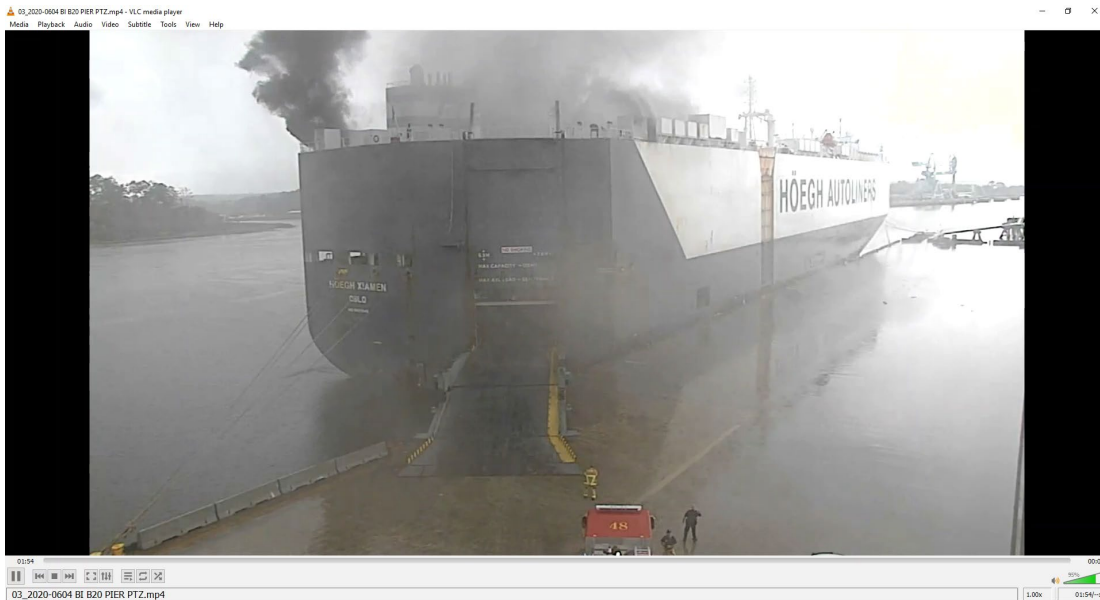


Figure 28. Jacksonville Fire Department truck E48 has just arrived on scene.

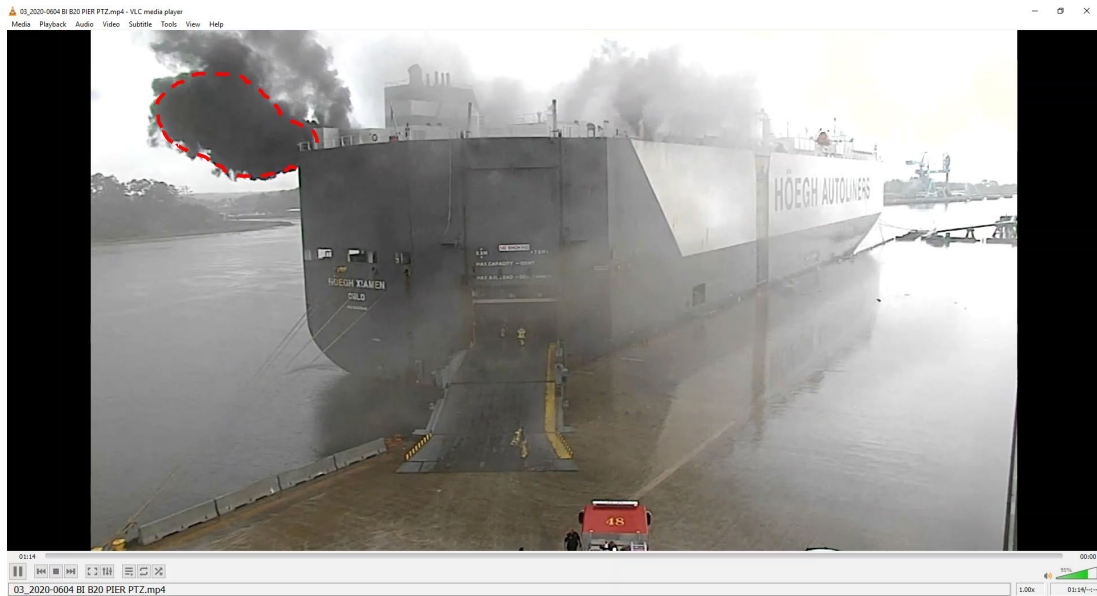


Figure 29. Fire department personnel walk up the stern ramp while a big puff of black smoke (outlined in red) exits from a stern port side vent.

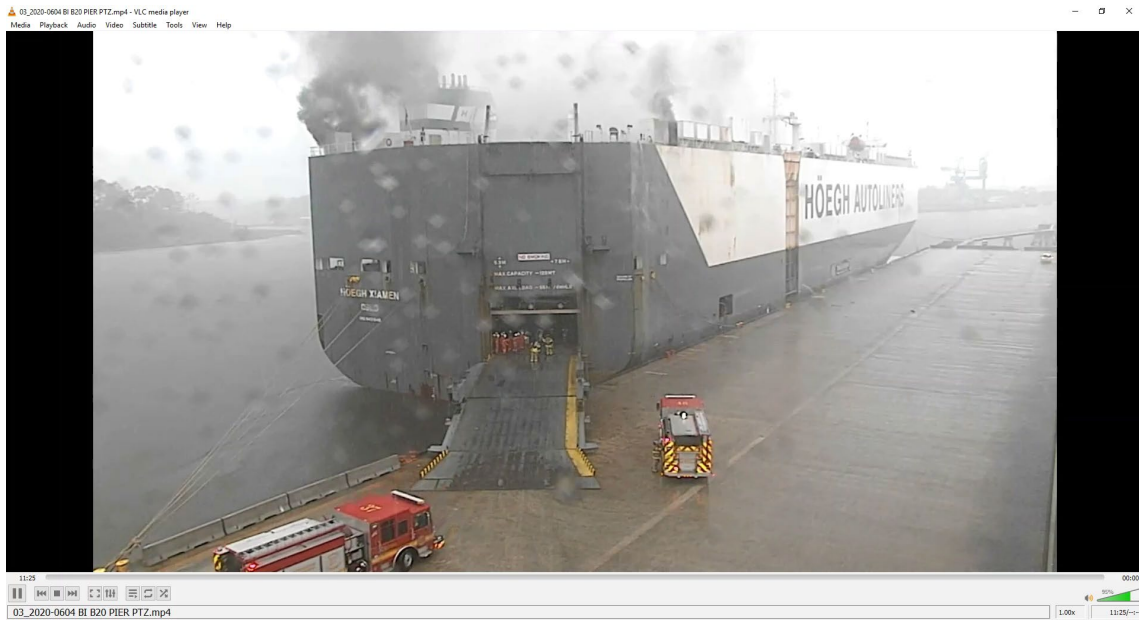


Figure 30. The ship's crew on the deck 5 ramp with some fire department personnel.



Figure 31. Approximately eleven minutes after truck E48 arrival. A thick column of black smoke can be seen emanating from the stern.



Figure 32. Approximately 43 minutes after truck E48 arrival. The smoke color changes to grey-white.



Figure 33. Approximately 50 minutes after truck E48 arrival. The smoke has become mostly white.



Figure 34. Thermal discoloration (circled in red) of the paint approximately 14 minutes after E48's arrival.

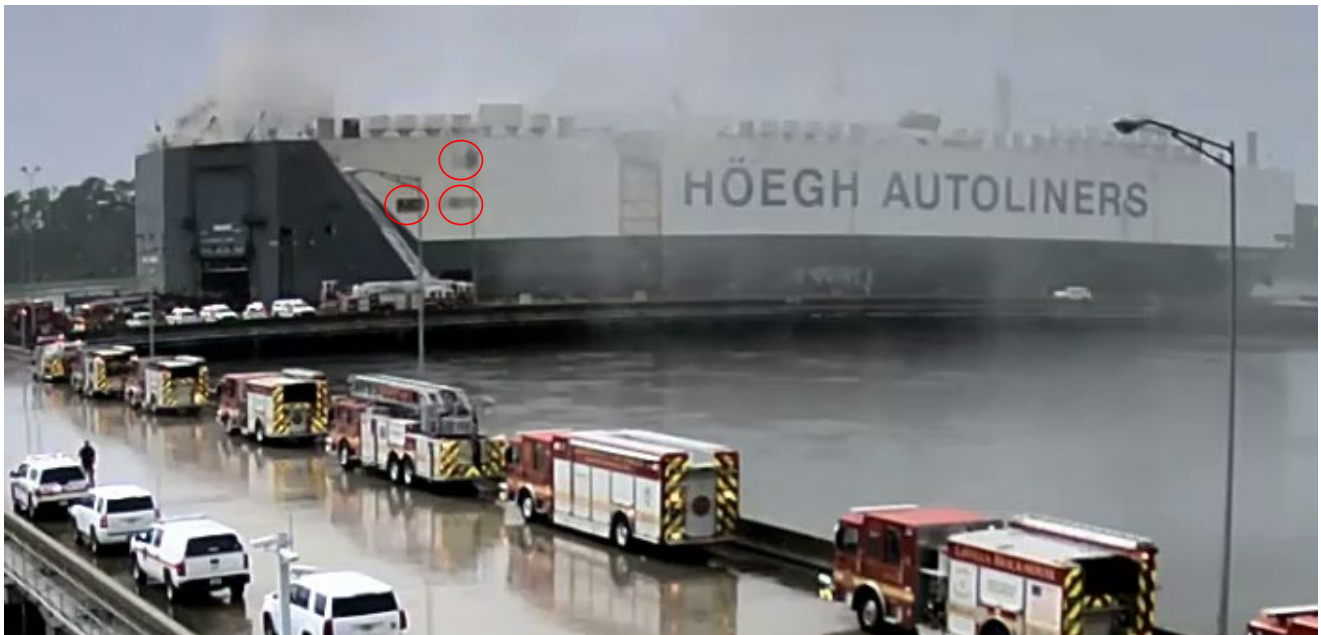


Figure 35. Thermal discoloration (circled in red) of the paint approximately 42 minutes after E48's arrival.



Figure 36. Thermal damage on the exterior skin of the ship denoting areas where the fire had been in proximity to the skin.





Figure 37. View from the port side toward the stern ramp. The surface of deck 12 is exhibiting deformation and charring/loss of paint.

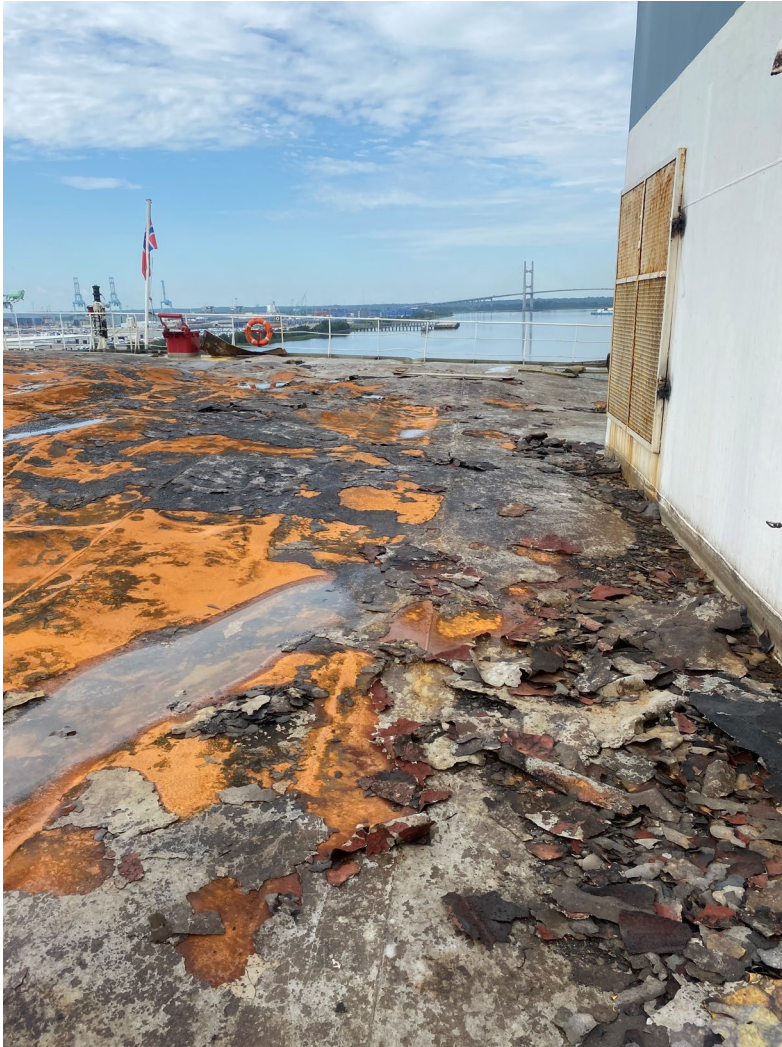


Figure 38. View of the port side stern of the ship. Thermal damage to the deck surface.



Figure 39. View of the starboard side near the accommodation space. There are soot stains coming from the accommodation space windows and thermal damage to the deck surface.



Figure 40. View of the starboard side near the accommodation space, including thermal damage to the deck surface.



Figure 41. View of the area below the bridge, including thermal damage to the deck surface and smoke stains above the window of the space below the bridge.



Figure 42. Thermal damage to the deck at the bow.



Figure 43. Thermal damage on the deck and smoke and thermal damage above the windows of the accommodation space on the port side.