UNITED STATES COAST GUARD

REPORT OF THE INVESTIGATION

INTO THE

FIRE ON BOARD THE OFFSHORE SUPPLY VESSEL HARVEY ENERGY (O.N. 1243697) IN PORT FOURCHON, LOUISIANA ON APRIL 28, 2023

MISLE ACTIVITY NUMBER: 7681968

U.S. Department of Homeland Security
United States Coast Guard

Commandant
United States Coast Guard

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16732/IIA #7681968
02 Sep 2025

FIRE ABOARD THE OFFSHORE SUPPLY VESSEL HARVEY ENERGY (O.N. 1243697) RESULTING IN TWO INJURIES WHILE MOORED IN PORT FOURCHON, LOUISIANA ON APRIL 28, 2023

ACTION BY THE COMMANDANT

The record and the report of the investigation completed for the subject casualty have been reviewed. The record and the report, including the findings of fact, analysis, conclusions, and recommendation, are approved subject to the following comments. This marine casualty investigation is closed.

ACTION ON RECOMMENDATION

Recommendation 1: Recommend Commandant reassess the vessel's current vent heights and locations. The current height of the engine purge and crankcase vents is approximately 2' off the deck and located under the vessel's air castle. While this configuration is in compliance with The International Code of Safety for Ships Using Gases or Other Low-Flashpoint Fuels (IGF Code), the current height of the vents and position of the vents do not allow for proper venting of gases and allows for the accumulation of flammable methane gas in that area. This could lead to additional fires onboard the HARVEY ENERGY, and on other vessels with the same design. Changing the vent heights and/or location would allow the gases to more freely vent into the atmosphere, greatly reducing the possibility of methane accumulation onboard the vessel.

Action: I do not concur with this recommendation. Based on a review of the Report of Investigation, I note that the casualty was caused by a combination of failures of equipment and noncompliance with operational restrictions, including introduction of an open flame in a hazardous area. In addition, as noted in this recommendation, the vent height arrangement complied with the requirements of the IGF Code. Therefore, there is insufficient justification to mandate an alteration to the HARVEY ENERGY's vent heights or pursue a regulatory change to vent heights in excess of current requirements. While unfortunate, this casualty is a reminder of the importance of complying with all applicable design and operational requirements that are in place to protect the crew, the vessel, and the Marine Transportation System.

[redacted]

R. C. COMPHER
Captain, U.S. Coast Guard
Director of Inspection & Compliance (CG-5PC)

U.S. Department of Homeland Security

United States Coast Guard

Commander
Eighth Coast Guard District

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16732

MAY 12 2025

FIRE ONBOARD THE OFFSHORE SUPPLY VESSEL HARVEY ENERGY (O.N. 1243697) IN PORT FOURCHON, LOUISIANA ON APRIL 28, 2023.

ENDORSEMENT BY THE COMMANDER, EIGHTH COAST GUARD DISTRICT

The record and the report of the investigation convened for the subject casualty have been reviewed. The record and the report, including the findings of fact, analysis, conclusions, and recommendations are approved. It is recommended that this marine casualty investigation be closed.

COMMENTS ON THE REPORT

The investigation and report contain valuable information which can be used to address the factors that contributed to this marine casualty and prevent similar incidents from occurring in the future.

ENDORSEMENT ON RECOMMENDATION

Safety Recommendation 1: Location of Engine Purge and Crankcase Vents. Recommend Commandant reassess the vessel's current vent heights and locations. The current height of the engine purge and crankcase vents is approximately 2' off the deck and located under the vessel's air castle. While this configuration is in compliance with The International Code of Safety for Ships Using Gases or Other Low-Flashpoint Fuels (IGF Code), the current height of the vents and position of the vents do not allow for proper venting of gases and allows for the accumulation of flammable methane gas in that area. This could lead to additional fires onboard the HARVEY ENERGY, and on other vessels with the same design. Changing the vent heights and/or location would allow the gases to more freely vent into the atmosphere, greatly reducing the possibility of methane accumulation onboard the vessel.

Endorsement: I concur with this recommendation. I fully support the recommendation for the Commandant to reassess the current vent heights and locations onboard the HARVEY ENERGY. While the existing configuration complies with the International Code of Safety for Ships Using Gases or Other Low-Flashpoint Fuels (IGF Code), the current positioning of the engine purge and crankcase vents which are approximately two feet off the deck and located beneath the vessel's air castle do not provide optimal gas venting.

This configuration creates a significant risk by allowing the accumulation of flammable methane gas in enclosed spaces, increasing the likelihood of onboard fires. The proposed adjustment to vent heights and/or locations in regulations would facilitate more effective dispersion of gases into the atmosphere, drastically reducing the chance of methane buildup and enhancing overall vessel safety. Prioritizing this reassessment is a proactive measure that will not only improve the safety of the HARVEY ENERGY but also benefit other vessels with similar designs. The implementation of these modifications would represent a critical step toward minimizing fire hazards and ensuring safer operations for crews and vessels alike.

[redacted]

J. E. FOTHERGILL
Commander, U.S. Coast Guard
Chief of Prevention, Acting
Eighth Coast Guard District
By Direction

U.S. Department of Homeland Security
United States Coast Guard

Commanding Officer
United States Coast Guard
Marine Safety Unit Houma

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16732
April 4, 2025

FIRE ON BOARD THE OFFSHORE SUPPLY VESSEL HARVEY ENERGY (O.N. 1243697) IN PORT FOURCHON, LOUISIANA ON APRIL 28, 2023

ENDORSEMENT BY THE OFFICER IN CHARGE, MARINE INSPECTION

The record and the report of the investigation convened for the subject casualty have been reviewed. The record and the report, including the findings of fact, analysis, conclusions, and recommendations are approved subject to the following comments. It is recommended that this marine casualty investigation be closed.

ENDORSEMENT ON RECOMMENDATIONS

Safety Recommendation 1. *Location of Engine Purge and Crankcase Vents.* Recommend Commandant reassess the vessel's current vent heights and locations. The current height of the engine purge and crankcase vents is approximately 2' off the deck and located under the vessel's air castle. While this configuration is in compliance with The International Code of Safety for Ships Using Gases or Other Low-Flashpoint Fuels (IGF Code), the current height of the vents and position of the vents do not allow for proper venting of gases and allows for the accumulation of flammable methane gas in that area. This could lead to additional fires onboard the HARVEY ENERGY, and on other vessels with the same design. Changing the vent heights and/or location would allow the gases to more freely vent into the atmosphere, greatly reducing the possibility of methane accumulation onboard the vessel.

Endorsement: Concur; although the vessel's ventilation configuration met regulatory requirements, this incident demonstrates that the current regulations do not adequately address and prevent the buildup of flammable vapors. The U.S. Coast Guard should take this incident into consideration when reviewing proposed ventilation configurations for low-flashpoint fueled vessel.

Administrative Recommendation 1. Recommend this investigation be closed.

Endorsement: Concur; recommend this investigation be closed.

[redacted]

J. S. FRANZ
Captain, U.S. Coast Guard
Officer in Charge, Marine Inspection
Houma, Louisiana

U.S. Department of Homeland Security
United States Coast Guard

Commanding Officer
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16732
09 Aug 2023

MEMORANDUM

From: [redacted]

To: [redacted] LCDR
Chief, Investigations Division

Subj: FORMAL MARINE CASUALTY INVESTIGATION CONCERNING FIRE ON BOARD HARVEY ENERGY ON 28 APRIL 2023

Ref: (a) Title 46 United States Code, Chapter 63
(b) Title 46 Code of Federal Regulations, Part 4
(c) Marine Safety Manual, Volume V; COMDTINST M1600010.A

1. Pursuant to the authority contained in reference (a) and (b), you are to convene a formal investigation for the marine casualty of the fire on board the Offshore Supply Vessel HARVEY ENERGY (O.N. 1243697) that occurred on April 28, 2023. In conducting your investigation, you shall follow as closely as possible the policy guidance and operational procedures for the Coast Guard Marine Investigations Programs.

2. I have assigned the following persons to conduct the investigation.

- CWO [redacted], USCG, Lead Investigating Officer
- LTJG [redacted], USCG, Assistant Investigating Officer

3. Upon completion of the investigation, you will issue a report to me with the collected evidence, the established facts, and conclusions and recommendations. The regulation, 46 C.F.R. § 4.07-1, shall be the aim in finalizing the report. Conclusions and recommendations concerning commendatory actions or misconduct that would warrant further inquiry shall be referred to me under separate correspondence for consideration and action as appropriate.

4. You will complete and submit your investigative report to me by November 24, 2023. If this deadline cannot be met, you shall submit a written explanation for the delay and notice of the expected completion date. You are highly encouraged to submit any interim recommendations intended to prevent similar casualties, if appropriate, at any point in your investigation.

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U.S. Department of Homeland Security
United States Coast Guard

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Marine Safety Unit Houma
United States Coast Guard

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16732
11 Mar 2025

FIRE ON BOARD THE OFFSHORE SUPPLY VESSEL HARVEY ENERGY (O.N. 1243697) IN PORT FOURCHON, LOUISIANA ON APRIL 28, 2023

EXECUTIVE SUMMARY

On April 28, 2023, at approximately 0600 hours, the offshore supply vessel HARVEY ENERGY, a dual-fueled vessel, was moored starboard side at the Harvey Gulf International Dock in Port Fourchon, LA. The vessel was utilizing the number (NR) 1 main engine using methane Liquid Natural Gas (LNG) as fuel. Seas were approximately 0-1 feet, wind speed was estimated between 10-12 knots, and clear skies. At 0600, Able Seaman (AB) 1 and Able Seaman (AB) 2 attended the daily planning meeting and were instructed to prep, prime, and paint the air castle upper deck. At approximately 0700, AB 1 and AB 2 started collecting the tools needed for the day's tasks and began work at approximately 0830. AB 1 was on the air castle main deck passing equipment and AB 2 was chipping and sanding paint on the air castle upper deck. During this time the NR 1 main engine purge line actuator electrical connection gland failed allowing methane to escape through the vent located 2 feet off the air castle main deck. At approximately 1445, AB 1 struck a lighter and ignited the methane gases engulfing both Able Seaman in flames. AB 2 jumped from the upper air castle deck to the air castle main deck and then both Able Seaman jumped from the air castle main deck to the bridge main deck below. A Deckhand conducting work on the stern saw a 30' x 20' translucent fireball in the vicinity of the air castle and ran to the house of the vessel and notified the other crewmembers of the fire. Once in the house, the Deckhand activated the fire alarm and donned firefighting gear. When the fire alarm was activated, it automatically switched the main engine from methane to diesel and triggered a purge cycle, which purged methane from the NR 1 main engine through the vent located on the air castle main deck which created a subsequent fire on the air castle. The Master of the vessel heard the fire alarm and announced "FIRE, FIRE, FIRE, all hands to muster stations" over the ships intercom system and notified emergency services. At this time, AB 2 ran down the exterior stairs to the main deck for help. The Deckhand proceeded to the bridge level and found AB 1 badly burnt and laying on the deck. Once on the air castle main deck, the Deckhand saw the Chief Engineer fighting the fire with a garden hose. After the fire was extinguished, the Chief Engineer and Deckhand remained and provided cooling water to the deck. The crew provided first aid to both Able Seaman until EMS arrived on scene and transported them to the hospital in New Orleans, LA.

Through its investigation, the Coast Guard determined the initiating event to be the material failure of the purge valve actuator electrical gland. Subsequent events included the erroneous discharge and accumulation of flammable methane vapors, the ignition of the flammable vapors, followed by a reflash fire. Causal factors contributing to this casualty were: 1) Performing hot work in an unsafe environment, 2) Unknown malfunction of the methane purge valve electrical connection, 3) Lack of markings on the deck to make personnel aware of hazardous locations, 4) Violation of company policy by using a disposable lighter in hazardous location, 5) No method of alerting the crew during an unwanted discharge of methane from vent piping, 6) Lack of personnel awareness regarding alternate fuels, 7) Ineffective construction of ventilation design and purge vents, and 8) Crews lack of knowledge pertaining to the fire alarm automation.

U.S. Department of Homeland Security
United States Coast Guard

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16732
11 Mar 2025

FIRE ON BOARD THE OFFSHORE SUPPLY VESSEL HARVEY ENERGY (O.N. 1243697) IN PORT FOURCHON, LOUISIANA ON APRIL 28, 2023

INVESTIGATING OFFICER'S REPORT

1. Preliminary Statement

1.1. This marine casualty investigation was conducted, and this report was submitted in accordance with Title 46, Code of Federal Regulations, Subpart 4.07, and under the authority of Title 46, United States Code, Chapter 63.

1.2. No organizations or individuals were designated a party-in-interest in accordance with 46 Code of Federal Regulations (CFR) Subsection 4.03-10.

1.3. The Coast Guard was the lead agency for all evidence collection activities involving this investigation. No other persons or organizations assisted in this investigation.

1.4. All times listed in this report are in Central Standard Time using a 24-hour format and are approximate.

2. Vessel Involved in the Incident

Figure 1. HARVEY ENERGY, date unknown. Source: Marine log.

Official Name:	HARVEY ENERGY
Identification Number:	O.N. 1243697
Flag:	United States
Vessel Class/Type/Sub-Type:	Offshore Supply Vessel
Build Year:	2013
Gross Tonnage:	4458 GT ITC
Length:	278.4 feet
Beam/Width:	27 feet
Draft/Depth:	11.75 feet
Main/Primary Propulsion:	Dual Fueled (Diesel, LNG), 7242 HP
Owner:	HARVEY ENERGY LLC New Orleans, LA, United States
Operator:	HARVEY GULF INTERNATIONAL MARINE, LLC New Orleans, LA, United States

3. Record of Deceased, Missing, and Injured

Relationship to Vessel	Sex	Age	Status
Able Seaman (AB) 1	Male	52	Injured
Able Seaman (AB) 2	Male	25	Injured

4. Findings of Fact

4.1. The Incident:

4.1.1. On April 28, 2023, The HARVEY ENERGY was moored portside to at the Harvey Gulf International Dock in Port Fourchon, LA.

4.1.2. The vessel was operating its main propulsion plant with methane liquified natural gas (LNG). The vessel had been operating on natural gas since 0000 on April 27, 2023.

4.1.3. The electrical gland on the methane purge valve malfunctioned causing the valve to chatter and intermittently release methane through the purge line. The valve did not have any maintenance associated with it and was installed during the original build process in 2013.

4.1.4. The valve controls methane discharge from the engine to the air castle deck when the engine transitions from methane to diesel fuel.

4.1.5. At approximately 0830, AB 1 and AB 2 on the HARVEY ENERGY began their assigned work of the day to remove paint and repaint the air castle's upper deck.

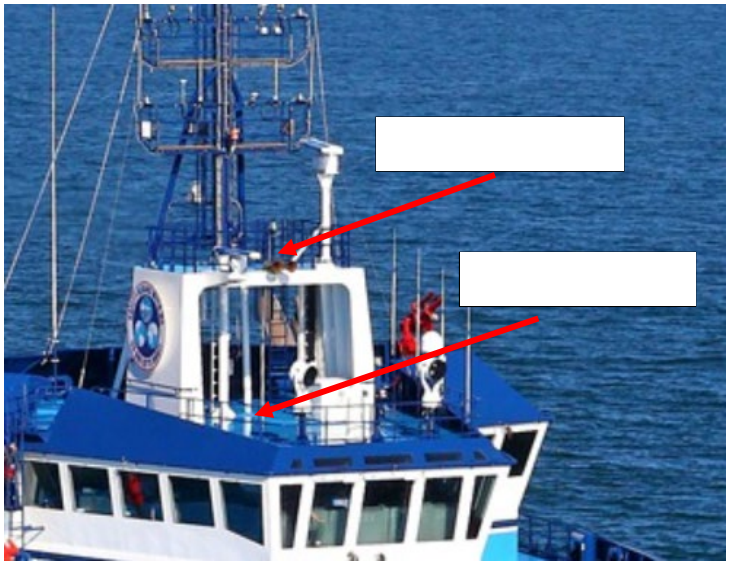

Figure 2. HARVEY ENERGY bridge structure, date unknown. Source: VARD Marine.

4.1.6. AB 1 left the air castle at approximately 1430 to retrieve another air gun after the one AB 2 was using for needle gunning paint malfunctioned.

4.1.7. Roughly ten minutes later, AB 1 returned to the air castle main deck, and reported to AB 2 that there weren't any air guns available, and he would have to sweep the debris off the top of the air castle.

4.1.8. At approximately 1444, A/B 1 positioned himself in front of the messenger/storage box located under the air castle upper deck and struck a disposable lighter. AB 1 stated he was melting a polypropylene line that he wanted to use to secure the air hose for the needle guns. There was no polypropylene line found in the area. The company reported finding a bottle of cigarette butts and pack of cigarettes on the storage box under the air castle after the accident.

4.1.9. The flame introduced into the hazardous zone ignited the methane which had accumulated in the vicinity of the air castle. The ignition of the methane caused a fire approximately 30 feet high by 20 feet wide.

4.1.10. AB 2 felt heat on his back and neck and turned to see AB 1 engulfed in flames running around the deck. AB 2's head, face, and hands were consumed by flames, and he jumped from the air castle upper deck to the air castle main deck. Then AB 1 and AB 2 both jumped from the air castle main deck to the bridge wing deck.

4.1.11. At this time a deckhand and welder were on the aft deck and saw a large, smokeless, and translucent fireball in the air castle area. AB 2 was running down the exterior stairs, from the bridge deck to the main deck, waiving his hands and yelling fire.

4.1.12. The deckhand on the aft deck immediately ran into the house of the vessel to notify others of the situation. The deckhand pulled the fire alarm and began to dress out in a firefighting suit.

4.1.13. The fire alarm activated the vessel's automation to change its fuel consumption from natural gas to diesel, purging the remaining, unconsumed natural gas from the

main engine through the purge piping which terminated approximately 2' above the air castle main deck.

4.1.14. The wire runs and material on the air castle were still burning from the initial fire and ignited the methane released from the purge cycle.

4.1.15. AB 1 was lying on the starboard bridge wing with burns covering his entire body. AB 2 made it to the main deck and was treated for burns on the face, head, neck, and hands by the crew.

4.1.16. The Chief Engineer arrived at the air castle deck and extinguished the fire with a garden hose that was located on the bridge wing. The Chief Engineer continued to cool the deck with the garden hose after the fire was extinguished.

4.1.17. Emergency Services arrived and transported AB 1 and AB 2 to University Hospital in New Orleans, LA due to the extent of their burns. AB 1 also sustained a broken leg as a result of jumping down from the air castle main deck.

4.1.18. Post marine casualty chemical testing was conducted on all crewmembers with the exception of AB 1 and AB 2 due to their hospitalization. All chemical tests came back negative for dangerous drugs and alcohol.

4.2. Additional/Supporting Information:

4.2.1. The HARVEY ENERGY is a steel hulled, multi-certificated Offshore Supply Vessel (OSV), and was delivered in 2015. At the time of the incident, there were 17 total personnel on board.

4.2.2. The HARVEY ENERGY utilizes two different fuel types, diesel, and natural gas, to power three generators.

4.2.3. AB 2 had worked as an Able Seaman for one year, all of which had been with Harvey Gulf International Marine and alongside AB 1.

4.2.4. AB 1 had worked as an Able Seaman for 15 years, two of which had been with Harvey Gulf International Marine.

4.2.5. AB 1 and AB 2 attended the daily planning meeting at approximately 0600 on April 28, 2023, to receive their tasking for the day.

4.2.6. AB 1 and AB 2 were assigned with removing paint and repainting the upper deck of the air castle. The work included sanding, needle gunning, and priming.

4.2.7. AB 1 filled out the necessary job safety analysis (JSA) and hot work permit to conduct the maintenance. Per the vessel's Safety Management System, needle gunning is considered hot work. Chapter 13 of the Safety Management System states, "Any hot work conducted near or in the area of a methanol vent shall be approved by shore-based management prior to commencement of hot work."

4.2.8. Harvey Gulf International does not have a policy stating the methane system shall be offline and tagged out while moored.

4.2.9. The main engine purge lines and crankcase vents terminated approximately 2' off the air castle main deck making the area a hazardous zone. There were two containment boxes directly underneath the goosenecks. One purge line and all crankcase ventilation piping were also covered by a metal box. No explanation was provided for this arrangement. The flame screens were also blown out and ineffective on the goosenecks but appeared to have been in this condition prior to the fire.

4.2.10. The manufacture openly acknowledges that its equipment is subject to methane slip, and that methane slip is more significant when operating the vessel at low loads. At the time of the incident, crew members and Harvey Gulf employees estimated the vessel was operating at 10% load. Methane was therefore likely present in the crankcase ventilation in addition to the changeover purge pipe.

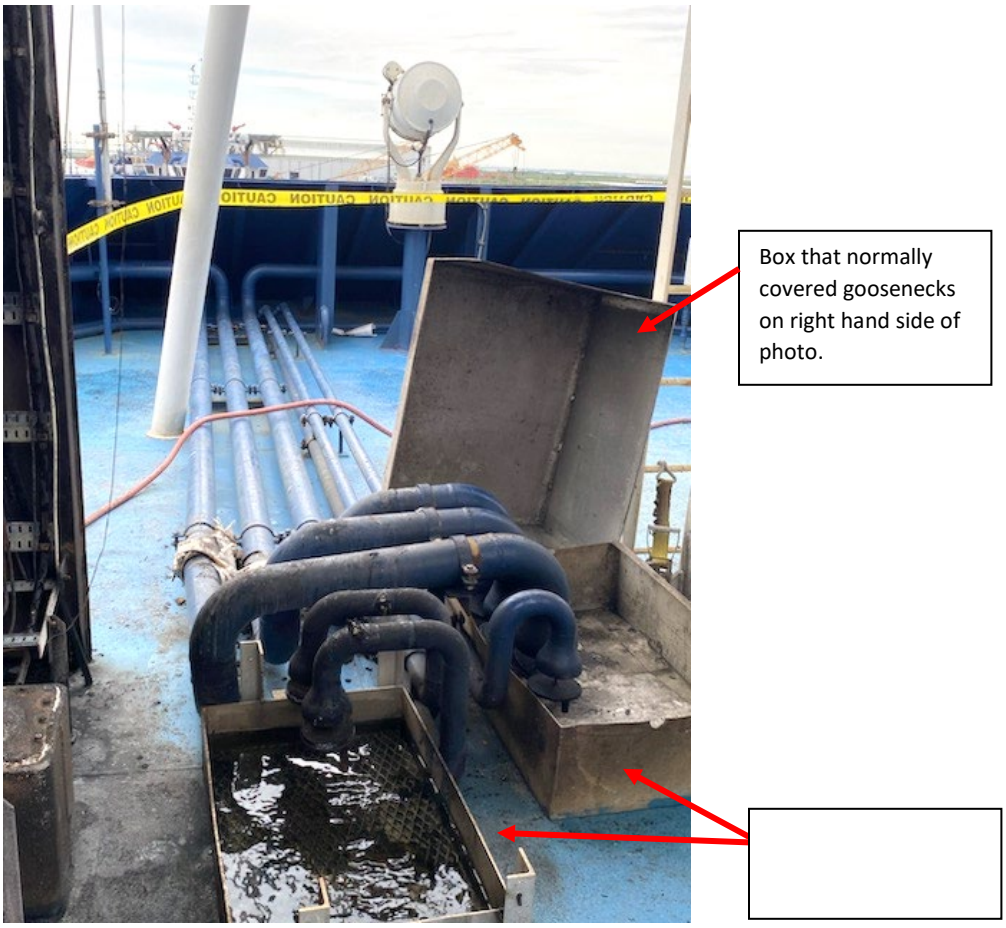

Figure 3. HARVEY ENERGY crankcase ventilation and purge piping arrangement. Source: U.S. Coast Guard.

4.2.11. There were no markings on or around the air castle indicating hazardous location, nor were they required to be by law or regulation.

4.2.12. The vessel's approved hazardous location plan clearly annotated the area above the bridge as a hazardous location.

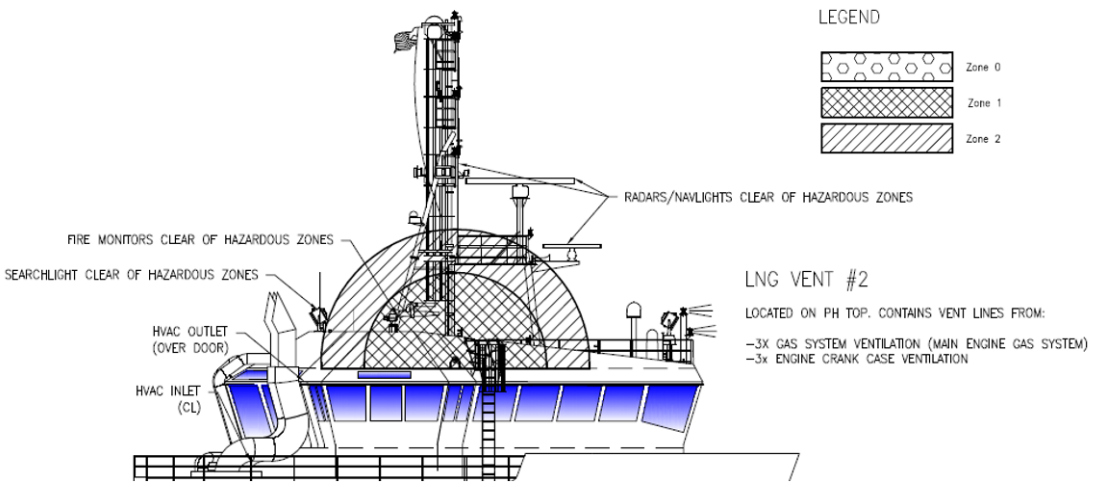

Figure 4. HARVEY ENERGY excerpt from approved Hazardous Location Plan. Source: U.S. Coast Guard.

4.2.13. Although the air castle main deck was a hazardous zone and had a high potential to become an explosive atmosphere, the crew had never conducted fire drills in the area.

4.2.14. No maintenance program exists for the methane purge valve actuator. The valve controls methane discharge from the engine to the air castle main deck when the engine transitions from using methane to diesel as its fuel source. The company believes the methane purge valve installed in the arrangement at the time of the fire was the same valve from the vessel's initial construction.

4.2.15. There is no indicator for the methane purge valve for the vessel's crew to know the position of the valve or if the valve is receiving an adequate signal so that it actuates at the appropriate time in accordance with system design.

4.2.16. The vessel is equipped with gas detection, on the supply side of the engine, as required by the International Code of Safety for Ships Using Gases or other Low-Flashpoint Fuels. However, there are no international or U.S. requirements for the vessel to have gas detection equipment at the purge venting or crankcase exhaust locations, and the vessel was not equipped with any gas detection on the exhaust side of the dual fuel engines.

4.2.17. The vessel's fire alarm system automation is designed to switch fuels if the vessel is utilizing methane as a fuel source when activated. This operation purges the methane from the engine through the vents located on the air castle main deck. The crew of the vessel was not trained on the potential hazard this may create and therefore was unaware that activating the fire alarm would cause the fire to reflash.

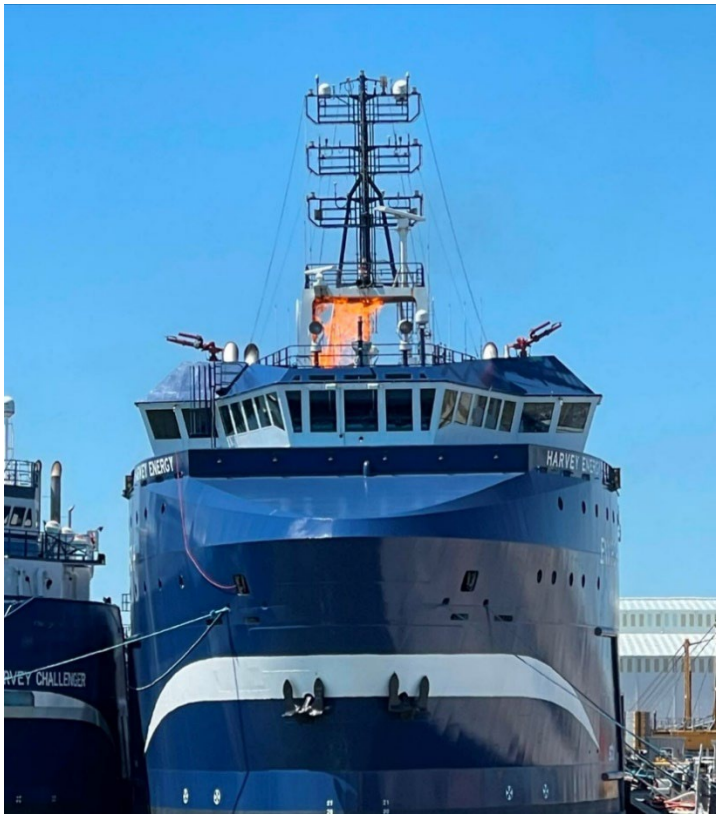

Figure 5. HARVEY ENERGY Fire taken on April 23, 2023. Source: Anonymous Facebook post.

5. Analysis

5.1. **Performing hot work in an unsafe environment.** In the hours leading up to the fire, both AB 1 and AB 2 conducted paint removal via needle gun, which is considered hot work due to the ability of the needle gun to generate sparks with the surface paint is being removed from. Given the known potential for natural gas to be present in the environment in the event of an engine shutdown and subsequent purge cycle, the vessel should not have been operating on natural gas while personnel were conducting hot work in the area. During interviews, the chief engineer stated that he would have ensured the vessel was running on a harbor generator if he had known personnel were conducting hot work in the area. If the vessel had been running on the harbor generator or diesel at the time of the incident, it is reasonable to assume that no methane would have been present in the vicinity of the air castle, and therefore no fuel would have been available to be ignited.

5.2. **Unknown malfunction of the methane purge valve electrical connection.** Unbeknownst to the crew of the vessel, the methane purge valve for the #1 dual fuel generator was intermittently activating due to a loose electrical contact that was easily affected by engine room vibration and varying vessel movements. This malfunction likely introduced more methane into the purge vent arrangement which then collected around the termination of the gooseneck vent approximately six inches above the main air castle deck. If the methane purge valve electrical connection had not malfunctioned, there likely would have been less or no initial accumulation of methane gas in the vicinity of the air castle because, by design, the previous purge cycle of nitrogen should have dissipated any collection of methane.

5.3. **Ineffective construction of ventilation design and purge vents.** At the time of the incident, the venting arrangement for both the methane purge piping and the crankcase ventilation terminated in the vicinity of the main air castle deck with gooseneck vents approximately 2 feet above the deck. Additionally, both ventilation arrangements were surrounded by containment boxes, further increasing the possibility of natural gas settling on the air castle main deck. All crankcase ventilation piping and one of the methane purge valves were covered by an unsecured metal box with three sides that fit over the crankcase ventilation and one methane purge vent. The box was not approved by the Coast Guard or the American Bureau of Shipping (ABS) and there was no provided explanation from the company for the installation of this box, but it likely contributed to the accumulation of flammable vapors in the vicinity of the air castle main deck. The engine manufacturer openly acknowledges that methane slip occurs into the crankcase of its dual fuel engines, and further explains that the rate of methane slip is increased when the generators are operating on low loads. The Chief Engineer estimated the generator to be operating on roughly 10% load at the time of the incident, which likely means methane could have been present in the crankcase ventilation fumes. If the crankcase ventilation and the purge vents terminated higher above the deck and away from the structure of the air castle, it is reasonable to assume that natural gas would not have accumulated to as significant of a degree on deck and within the superstructure of the air castle.

5.4. **Lack of personnel awareness regarding alternate fuels.** While interviewing crew members, it was noted that only the engineering crew had a comprehensive understanding of the vessel's use of natural gas for fuel. Even then, the engineers on board had difficulty initially identifying which ventilation piping correlated to respective engines. Other deckhands and workers not normally assigned to the vessel were completely unaware of the possible presence of natural gas in the vicinity of the air castle while the vessel was running on methane. Additionally, none of the Company representatives acknowledged the potential of methane slip into the crankcase even though the engine manufacturer markets engine upgrades to reduce overall methane slip. If all crew members had been aware of the possible presence of natural gas around the air castle, it is reasonable to assume that the master would not have allowed hot work to be conducted above the bridge while the vessel was operating on natural gas. Additionally, other crew members, such as the Chief Engineer who was not aware of the work being conducted, may have raised concerns about the unsafe condition of the work environment while completing Job Safety Analyses at the morning work meeting which would have prevented hot work from being conducted in a hazardous location.

5.5. **No method of alerting the crew during an unwanted discharge of methane from vent piping**. The vessel's engine methane supply is equipped with multiple gas vapor sensors to alert the crew members to failures in the system that could lead to potential methane vapor discharge. Furthermore, the methane purge valve was not equipped with any indicator to show opened or closed and is void of any failsafe to trigger an alarm if material failure occurs. It is reasonable to assume that if the methane vapor purge valve was equipped with such alarms the crew would have been notified and may have prevented the vapor discharge from occurring.

5.6. **Violation of company policy by using a disposable lighter in hazardous location.** AB 1 and AB 2 had been removing paint with a needle gun on the top deck of the air castle for approximately six hours prior to the fire occurring. It is unclear whether AB 1 struck a lighter to melt polypropylene rope as he stated or whether it was to light a cigarette. Regardless, AB

1 likely believed it was safe to use a lighter on the main deck of the air castle because he and AB 2 had been instructed by the master to conduct hot work in that area and had been conducting paint removal with the needle gun for several hours prior to the fire. It is reasonable to assume that AB 1 struck the lighter within the structure of the air castle since the structure provided a wind break, and believed it was safe to do so because the area is supposed to be gas free when conducting hot work. If AB 1 had been conducting work other than hot work, he may have been more cautious about the use of a lighter and might have verified it was a safe location prior to using the lighter.

5.7. **Lack of markings on the deck to make personnel aware of hazardous locations**. There were no markings around the air castle specifying that the area was a hazardous location, but the vessel's hazardous location plan shows several "bubbles" of Zone 1 and Zone 2 locations directly where AB 1 and AB 2 were working on the day of the casualty. If the vessel had markings of the hazardous location prior to the incident, it is reasonable to assume the master may have known not to allow any work in the area while the vessel was operating on natural gas. Additionally, if there had been hazardous location markings around the air castle, AB 1 and AB 2 may have been hesitant to start hot work without verifying with the rest of the crew that equipment had been locked and tagged out to ensure the area around the air castle was not a hazardous location while hot work was being conducted.

5.8. **Crews lack of knowledge pertaining to the fire alarm automation.** The fire suppression system was automated to change the vessel's use of fuel from natural gas to diesel when the fire alarm system is activated. The deckhand on the aft deck of the vessel was one of the first members of the crew to see the fire at the vessel's air castle and immediately ran forward on the vessel and activated the nearest fire alarm. This activation caused the vessel to initiate the automated fuel changeover, which includes the purge of unconsumed methane from the running generators. The methane purged through the pipes that terminated at the air castle and provided additional fuel to the fire that was still active from burning various wiring around the raceway. If the deckhand on the aft deck knew that natural gas would purge in the vicinity of the burning fire if he activated the fire alarm, he likely would have notified the vessel's crew via an alternate means. However, intentionally circumventing the vessels automation also may have risked the potential for crankcase ventilation vapors with methane slip or the purge pipe with the malfunctioning valve to ignite and make its way to the engine room due to the compromised flame screens.

6. Conclusions

6.1. Determination of Cause:

6.1.1. The initiating event for this casualty occurred when methane gases escaped from the engine arrangement due to the faulty electrical connection on the purge valve actuator, which allowed the purge valve to acuate and release flammable methane vapors, in the area AB 1 and AB 2 had been authorized to conduct hot work. Causal factors leading to this event were:

6.1.1.1. Unknown malfunction of the methane purge valve actuator electrical connection, that allowed for intermittent opening and closing of the valve while utilizing natural gas as fuel.

6.1.1.2. Design of ventilation and purge vents which allowed flammable gases to accumulate in one area of the vessel.

6.1.2. The presence of sustained amounts of methane gas around the air castle led to the subsequent event of the ignition of the methane gas causing a flash fire of approximately 30 feet high by 20 feet wide. Causal factors leading to this event were:

6.1.2.1. Allowing crew members to conduct hot work in a place defined as a hazardous location per the vessel's hazardous zone plan while the vessel was utilizing natural gas as fuel.

6.1.2.2. Violation of company policy by using a disposable lighter in hazardous location.

6.1.2.3. Lack of markings on the deck to make personnel aware of hazardous locations.

6.1.2.4. Overall lack of crew member awareness regarding the vessel's use of alternate fuels and the hazards associated with the vessel while the engines were running on natural gas.

6.1.3. The initial flash fire subsided and the wiring along the air castle raceway continued to burn. The fire alarm was activated and led to the subsequent event of the fire being provided more methane because of the fire alarm automation purge cycle. Causal factors leading to this event were:

6.1.3.1. Automation configuration of the vessel's fire alarm system exacerbated the fire due to the methane being purged in the vicinity of the specific location it was designed to be purged to.

6.1.3.2. Overall lack of crew member awareness regarding the vessel's use of alternate fuels and the hazards associated with the vessel while the engines were operating on natural gas.

6.2. Evidence of Acts by any Coast Guard Credentialed Mariner Subject to Action Under 46 USC Chapter 77: This investigation did not identify any evidence of acts by any Coast Guard credentialed mariners subject to action under 46 USC Chapter 77.

6.3. Evidence of Acts or Violations of Law by U.S. Coast Guard Personnel, or any other person: This investigation did not identify any evidence of acts or violations of law by U.S. Coast Guard Personnel, or any other person.

6.4. Evidence of Acts Subject to Civil Penalty: This investigation did not identify any evidence of acts subject to civil penalty.

6.5. Evidence of Criminal Act(s): This investigation did not identify potential violations of criminal law.

6.6. Need for New or Amended U.S. Law or Regulation: This investigation did not identify a need to require new or amend any current laws or regulations.

6.7. Unsafe Actions or Conditions that were not Causal Factors: This investigation did not identify any unsafe acts or conditions that were not causal factors.

7. Actions Taken Since the Incident

7.1 *Safety Alert #1*. Safety Alert 05-25, titled "Importance of Adhering to Hot Work Procedures & Implementing Robust Lockout/Tagout Procedures", was released for ensuring potential sources of flammable gases are locked out/tagged out while hot work is being conducted in the area.

7.2 *Safety Alert #2*. Safety Alert 05-25, titled "Importance of Hazardous Zone Markings and Safety Protocol Awareness", was released to alert marine employers to the importance of reviewing the vessel's hazardous zone plans and ensure the zones are marked accordingly.

8. Recommendations

8.1. Safety Recommendations:

8.1.1. *Safety Recommendation #1 – Location of Engine Purge and Crankcase Vents*. Recommend Commandant reassess the vessel's current vent heights and locations. The current height of the engine purge and crankcase vents is approximately 2' off the deck and located under the vessel's air castle. While this configuration is in compliance with The International Code of Safety for Ships Using Gases or Other Low-Flashpoint Fuels (IGF Code), the current height of the vents and position of the vents do not allow for proper venting of gases and allows for the accumulation of flammable methane gas in that area. This could lead to additional fires onboard the HARVEY ENERGY, and on other vessels with the same design. Changing the vent heights and/or location would allow the gases to more freely vent into the atmosphere, greatly reducing the possibility of methane accumulation onboard the vessel.

8.2. Administrative Recommendations:

8.2.1 Recommend this investigation be closed.

[redacted]
Chief Warrant Officer, U.S. Coast Guard
Investigating Officer