

Transportation Safety Board
of Canada



Bureau de la sécurité des transports
du Canada

**MARINE INVESTIGATION REPORT
M15C0045**



FIRE AND SINKING

**FISHING VESSEL *FREDERIKE. C-2*
RIMOUSKI, QUEBEC
28 APRIL 2015**

Canada

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Marine Investigation Report M15C0045

Fire and sinking

Fishing vessel *Frederike. C-2*

Rimouski, Quebec

28 April 2015

Summary

On 28 April 2015, at approximately 0230 Eastern Daylight Time, a fire broke out on the fishing vessel *Frederike. C-2* shortly after it departed Rimouski, Quebec. The master and the 3 crew members on board abandoned the vessel using a life raft and were rescued by the fishing vessel *Marie-Karine D.* The Canadian Coast Guard search and rescue cutter *Cap Perce* was dispatched to assist. The *Frederike. C-2* burned to the waterline and sank at position 48°28.74' N, 068°36.85' W. Minor pollution was observed in the vicinity of the wreck. No injuries were reported.

Le présent rapport est également disponible en français.

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1.0 Factual information

1.1 Particulars of the vessel

Table 1. Particulars of the vessel

Name of vessel	<i>Frederike. C-2</i>
Official number	822200
Port of registry	Gaspé, Quebec
Flag	Canada
Type	Fishing vessel, trap
Materials	Fibreglass over wood (oak and veneer)
Gross tonnage	23.13
Length, overall	15.18 m
Draft	1.47 m
Built	2001, Gerald Duguay's Fiberglass Boat Builders Ltd., Cap-Pelé, New Brunswick, Canada
Propulsion	1 high-speed 4-stroke diesel engine (336 kW) driving a single fixed-pitch propeller through a reversing reduction gearbox
Cargo	210 plastic containers (weighing approximately 1428 kg); no catch on board
Crew	4
Registered owner/manager	Maliseet of Viger First Nation, Cacouna, Quebec, Canada

1.2 Description of the vessel

The *Frederike. C-2*¹ was a single-hulled small fishing vessel constructed of fibreglass over wood and used for snow crab fishing (Photo 1). The exposed fibreglass surfaces in the engine compartment were coated with an intumescent paint² to mitigate the localized fire hazard created by the internal combustion engines and the combustible construction materials.

Photo 1. *Frederike. C-2* (Source: Fabienne Gingras)



The hull was subdivided by 3 transverse bulkheads into 4 compartments from forward: a cabin, accessed by stairs descending from the deckhouse, that provided accommodations for 4 people; an engine compartment; an insulated fish hold; and a lazarette that contained the steering gear and 2 diesel fuel tanks that supplied the engine compartment machinery (Appendix A).

The deckhouse, located forward, consisted of the wheelhouse and a compartment containing 2 carbon dioxide (CO₂) cylinders, a hydraulic oil tank, and the shore power box. The wheelhouse contained a conning station on the starboard side fitted with a helm, an echo sounder, a magnetic compass, a radar, an electronic chart system, a global positioning system (GPS), an autopilot, a rudder angle indicator, the main engine control panel, 2 very high frequency (VHF) radiotelephones, and the bilge pump controls. A table with 2 bench seats was located on the port side, and a door leading to the main deck was located aft on the centreline. Beside the door were the navigation light control panel and the generator panel, which comprised the generator controls, gauges, and associated alarms. A secondary conning station was fitted outside on the starboard side of the main deck and consisted of a helm, a main engine control, and hydraulic controls for the fishing gear (Appendix B).

The engine compartment was bordered by the hull on the port and starboard sides and by transverse bulkheads at the forward and after ends. It could be accessed through a hatch located on the starboard side of the wheelhouse or from the cabin through a watertight manhole in the bulkhead. It contained the main engine, located on the centreline of the vessel; a bank of lead-acid batteries; a bilge pump; a hydraulic pump; an electrical fire pump; an additional fire pump coupled to the main engine; and a diesel generator located on the port side of the main engine.

¹ *Frederike. C-2* (without accents and with an Arabic numeral, instead of with accents and a Roman numeral as shown in Photo 1) is the official name of the vessel in the Canadian Register of Vessels.

² Intumescent paint is a type of paint that is classified as a fire-retardant coating by the Underwriters' Laboratories of Canada.

The main engine and the generator could both be started and stopped from the wheelhouse. The main engine controls were at the conning station, and the generator controls were on the panel in the after area of the wheelhouse.

The electrical power distribution consisted of 3 separate systems: 12 volts DC, 120 volts AC, and 240 volts AC. All 3 systems could be powered or isolated via individual breaker panels located in the wheelhouse.

The engine compartment was ventilated by a fan that forced fresh air into the compartment. The air intake and outlet were located on top of the deckhouse, with the intake on the starboard side and the outlet on the port side. The intake and outlet could be closed with remotely controlled flaps.

The 2 diesel fuel tanks in the lazarette could be isolated by means of 2 ball valves installed on the fuel outlet pipes. Each valve had a remote fuel valve shutoff to enable the crew to shut off the valve from the main deck, pulling a wire to turn the handle instead of going down to the lazarette to turn the handle.

1.3 Vessel repairs and modifications

Requirements for authorized representatives (AR)³ to report fishing vessel maintenance and repairs to Transport Canada (TC) are contained in the *Small Fishing Vessel Inspection Regulations*, the *Ships Electrical Standards (TP 127)*, and the *Marine Machinery Regulations*.

On 26 June 2014, the main engine turbocharger and exhaust manifold failed and were replaced. Transport Canada Marine Safety and Security (TCMSS) was not informed of the breakdown or the repairs, and therefore did not verify that the repairs complied with regulatory requirements.⁴

During the winter of 2014–2015, the *Frederike. C-2* underwent various repairs, including the overhaul of the propeller tailshaft, repairs to the alarm system, and the replacement of electrical wires and equipment. The repairs were performed by a shore-side contractor in Rivière-au-Renard, Quebec. On the way back to Rimouski, the vessel experienced electrical failures that required additional repairs. Following the repairs, the vessel did not experience any other electrical failure. TCMSS was not informed of any of these repairs,⁵ and they were not verified for compliance with mandatory electrical standards.⁶

³ The *Canada Shipping Act, 2001*, subsection 14(1), states that every Canadian vessel must have a person, known as the authorized representative, who is responsible for acting with respect to all matters relating to the vessel that are not otherwise assigned to another person.

⁴ *Small Fishing Vessel Inspection Regulations* (C.R.C., c. 1486), sections 48 and 50.

⁵ *Ibid.*, paragraphs 46(1)(g.1) and 47(d).

⁶ Transport Canada, TP 127, *Ships Electrical Standards*, Revision 02, May 2008.

On 24 April 2015, the new turbocharger and the scavenge air cooler failed and were replaced. All of these repairs were performed by the engine manufacturer's service technician. In the 4 days between the last repairs and the occurrence, the *Frederike. C-2* made 3 trips to the fishing grounds without any problems. TCMSS was not made aware of the engine failures or of the repairs, and engine performance and reliability were not verified for compliance with regulatory requirements.⁷

1.4 *History of the voyage*

On 27 April 2015, the *Frederike. C-2* returned from the fishing grounds near the north shore of the St. Lawrence River, 20 nautical miles (nm) out of Rimouski, and refilled the vessel's fuel tanks to full capacity (approximately 1818 litres) in preparation for the next day's fishing trip. At 0145⁸ on 28 April, the *Frederike. C-2* left Rimouski with the master and 3 crew members on board.

At approximately 0230, when the vessel was 8 nm away from Rimouski, charred wood could be smelled in the wheelhouse. A crew member (crew no. 1) went to the engine compartment to investigate and discovered that it was full of white smoke, but there were no apparent flames. From crew no. 1's vantage point (starboard of the main engine), the smoke appeared to be coming from the port side of the engine compartment. Crew no. 1 exited the compartment and the master came down from the main conning station to assess the situation. The master confirmed that the smoke was coming from the port side of the engine compartment, but the exact source could not be determined. At this time the master decided to turn the vessel around and head back to Rimouski.

As the wheelhouse filled with smoke, all crew members evacuated to the main deck. The master maintained control of the vessel using the secondary conning station and used his cell phone to call his brother, the master of the fishing vessel *Marie-Karine D*, which was getting ready to leave Rimouski. The master of the *Marie-Karine D* reported the emergency to Marine Communications and Traffic Services (MCTS) Les Escoumins and proceeded toward the *Frederike. C-2*. MCTS then broadcast a "Mayday Relay" on behalf of the *Frederike. C-2*, and the Québec Maritime Rescue Sub-Centre (MRSC) dispatched the Canadian Coast Guard (CCG) search and rescue cutter *Cap Perce*, stationed in Tadoussac, Quebec.

The crew could not re-enter the engine compartment to attempt to extinguish the fire because they were overwhelmed by the smoke. The master started the electrical fire pump and ordered crew no. 1 and another crew member (crew no. 2) to use the rubber hose (normally used to wash the main deck) to fill the empty fish hold with sea water, which

⁷ *Marine Machinery Regulations (SOR/90-264)*, Schedule IV.

⁸ All times are Eastern Daylight Time (Coordinated Universal Time minus 4 hours) unless otherwise specified.

would leak through the transverse bulkhead⁹ and into the engine compartment. However, the generator eventually stopped, shutting off the fire pump and preventing the fish hold from being flooded.

Crew no. 1 re-entered the wheelhouse and used the control panel to restart the generator. The generator ran for a few seconds before shutting down again, with the coolant gauge on the control panel indicating an abnormally high temperature.

The master then ordered the crew to prepare to abandon ship and told them to get the immersion suits from the cabin. By this time, the wheelhouse was completely full of smoke. Crew no. 1, as the last person to leave the wheelhouse, activated the CO₂ fixed fire suppression system using the remote pull station located on the port side of the after bulkhead of the deckhouse. This had no effect on the fire. The crew members then donned the immersion suits and awaited further instructions from the master.

After several unsuccessful attempts from the MCTS regulator to reach the *Frederike. C-2* on VHF channel 16, the MRSC duty officer eventually reached the master on his cell phone. The nature of the emergency, the vessel's position, and the number of people on board were confirmed, and the duty officer requested to be informed if the crew abandoned the vessel.

Eventually the main engine failed. The master ordered the 3 crew members to bring the inflatable life raft down from the top of the deckhouse and onto the main deck. Once this was done, the life raft was inflated on the water. While they were deploying and boarding the life raft, sparks and flames could be seen coming out of the engine room ventilation intakes and outlets. The crew finally abandoned the vessel at approximately 0300, half an hour after smoke was first detected. Neither MCTS nor MRSC were informed of the abandonment, despite the request of the MRSC duty officer.

The life raft was detached from the vessel and drifted for about half an hour, ending up 30 metres away from the *Frederike. C-2*, which was by then fully engulfed in flames (Photo 2).

⁹ The transverse bulkhead between the fish hold and the engine compartment was not watertight in way of the propeller shaft penetration. This was by design and the bulkhead was not represented, in the TCMSS-approved general arrangement plan, as being watertight.

At around 0330, the *Marie-Karine D* arrived and recovered the crew of the *Frederike. C-2* and the life raft. The *Cap Perce* arrived at 0750, and about an hour later, the *Marie-Karine D* returned the crew of the *Frederike. C-2* to Rimouski. The *Cap Perce* remained on the scene and tried to extinguish the fire by dousing it with water. The fire burned for approximately 12 hours, fueled by the full diesel oil tanks, and by 1515 the *Frederike. C-2* had burned to the waterline and sunk in position 48°28.74' N, 068°36.85' W (Appendix C). A small oil slick was observed on the water where the vessel sank and eventually dissipated on its own.

Photo 2. *Frederike. C-2* in flames (Source: Vincent Brière)



1.5 *Damage to the vessel*

The vessel was a total loss due to the extent of the fire. The remains of the hull sank after drifting for 12 hours on the St. Lawrence River. The wreck has not been salvaged.

1.6 *Environmental conditions*

In the early morning of 28 April, the weather was overcast with periods of rain. At the time of the occurrence, visibility was between 8.5 nm and 9.0 nm, with fog having recently dissipated. The wind was from the northeast at 10 to 15 knots, and the air temperature was 3 °C. The seas were moderate, between 1.2 metres and 1.5 metres. The predicted low tide for Rimouski was at 0403, and sunrise was at 0520.

1.7 *Vessel owner*

The *Frederike. C-2* was part of a fleet of 3 small fishing vessels owned and operated by the *Comité de gestion de l'entreprise de pêche commerciale*, a commercial fisheries committee managed by the Maliseet of Viger First Nation, which is located in Cacouna, Quebec. Its commercial fishing activities include snow crab, northern shrimp, sea urchin, groundfish, and whelk.

The Maliseet of Viger First Nation employs both Aboriginal and non-Aboriginal fishermen to form the crews on board its vessels.

1.8 *Vessel certification*

The *Frederike. C-2* had a valid inspection certificate¹⁰ issued by TCMSS on 18 November 2011 for Near Coastal, Class 2 limited to inland waters, Class II voyages. The certificate was initially valid for only 12 months instead of the usual 4-year term because TCMSS required the vessel to have an approved stability booklet. This requirement was eventually fulfilled by the AR and, on 25 March 2013, the inspection certificate was extended to a full term, with a new expiry date of 17 November 2015.

At the time of the occurrence, the vessel carried the required certificate for a vessel of its type and for the intended voyage.

1.9 *Personnel experience and certification*

The master held a Fishing Master, Fourth Class, certificate issued on 20 March 2008. The certificate had expired on 19 March 2013. He had served as master on board the *Frederike. C-2* since 2008.

Crew no. 1 held a Fishing Master, Fourth Class, certificate issued on 25 February 2014. He had worked as a fisherman on board the *Frederike. C-2* since 2010. Crew no. 1 completed 2 Marine Emergency Duties (MED) training courses in 2012 and 2014.

Crew no. 2 held a Bridge Watch Rating certificate. He had worked in commercial fisheries since 1977 and began snow crab fishing on board the *Frederike. C-2* in 2011. Crew no. 2 completed multiple MED training courses in 1991 and 1999.

Crew no. 3 did not hold any certification. He had done occasional work in various fields in the marine industry (sea urchin fishing, small passenger vessels) since 1989 and began working in the snow crab fishing industry in 2014. The 2015 season was crew no. 3's first season on board the *Frederike. C-2*.

At the time of the occurrence, the *Frederike. C-2* was making daily trips to the fishing grounds, leaving Rimouski early in the morning and returning to port each day and remaining moored overnight between each voyage. Pursuant to the *Marine Personnel Regulations* (MPR),¹¹ and as stipulated in the vessel's minimum safe manning document issued by TCMSS, the following persons were required to be on board whenever the vessel operated on a voyage of not more than 1 day in duration: a master (holding a valid Fishing Master, Fourth Class, certificate) and a seaman. Crew no. 1 was the only person on board holding a valid Fishing Master, Fourth Class, certificate.

¹⁰ Inspection certificate for a vessel exceeding 15 tons gross tonnage but not exceeding 150 tons gross tonnage plying as a non-passenger vessel (Transport Canada Marine Safety and Security Form 85-0433).

¹¹ *Marine Personnel Regulations* (SOR/2007-115), sections 211 and 212.

1.10 *Firefighting and lifesaving equipment*

1.10.1 *Firefighting equipment*

The *Frederike. C-2* had all of the firefighting equipment required by the *Small Fishing Vessel Inspection Regulations*.¹² A fire hydrant was on the main deck, against the after bulkhead of the deckhouse, beside a rack holding a coiled 50-foot-long fire hose and an adjustable nozzle. A selector valve allowed the crew to discharge sea water from either of the 2 fire pumps (1 electrical and 1 engine-driven) to the deck wash hose or to the fire hydrant.

The vessel was also equipped with 3 fire buckets stored on top of the deckhouse, 3 chemical dry powder portable fire extinguishers stored in various locations on board (1 in the forward cabin, 1 in the wheelhouse, and 1 in the engine compartment), and a fire axe. The engine compartment was protected by a CO₂ fixed fire suppression system.

1.10.2 *Lifesaving equipment*

The *Frederike. C-2* was carrying a 6-person inflatable life raft, 5 lifejackets, 5 immersion suits, 2 lifebuoys, 1 emergency position-indicating radio beacon (EPIRB), and 22 pyrotechnic distress signals. There was no portable VHF radiotelephone on board, nor was one required by regulation.

1.11 *Fire detection system*

The engine compartment and the cabin of the *Frederike. C-2* were each fitted with a heat detector, set to trigger a visual and audible alarm at 200 °F and 135 °F (93.3 °C and 57.2 °C), respectively.

An alarm panel was located in the wheelhouse, to the left of the main conning station. The panel contained 3 high level bilge alarms (for the lazarette, the engine compartment, and the cabin) and 2 fire alarms (for the cabin and the engine compartment). When an alarm was activated, a red light on the panel would illuminate and a horn would sound on the main deck.

The vessel's alarm system underwent some repairs in January 2015 because it was defective. During the occurrence, while the fire was burning in the engine compartment, the crew noticed a visual indicator illuminated on the alarm panel, but the alarm associated with the indicator could not be identified, and no audible alarm was heard.

¹² *Small Fishing Vessel Inspection Regulations*, sections 35 to 39.

1.12 Carbon dioxide fixed fire suppression system

1.12.1 Design and principle of operation

Carbon dioxide (CO₂) is a clear, inert, colourless, odourless, non-conductive, non-flammable, and non-corrosive gas. It is often used for fire suppression in confined spaces such as engine compartments: it is heavier than ambient air, allowing it to settle toward the bottom of a space and build upward until the space is filled. As it fills the space, it dilutes the concentration of oxygen in the ambient air to 15 percent or less, inerting the atmosphere and extinguishing the fire. The lowered concentration of oxygen can suffocate or kill anyone in the space who is not wearing a self-contained breathing apparatus.

Another property of CO₂ is the cooling effect it has on surfaces with which it comes into contact. When it is released as a liquid from the storage cylinder, it flashes into a cold-temperature gas that can bring burning materials below their ignition temperature. For marine use, CO₂ is stored in a liquid state in steel cylinders at a pressure of 750 pounds per square inch (psi) at a temperature of 70 °F (52.7 kg/cm² at 21.1 °C). A CO₂ fixed fire suppression system does not require any external power source and therefore can be used in a situation where the vessel is out of power (e.g., blackout conditions).

The *Frederike. C-2* was fitted with a CO₂ fixed fire suppression system consisting of 2 storage cylinders, 2 diffusers located in the engine compartment, steel pipes connecting the storage cylinders to the diffusers, a strobe light for the visual release alarm, a horn for the audible release alarm, 1 pressure-activated electro-switch, and 1 remote pull station.

Although the 2 storage cylinders were identical in construction and were both connected to a common discharge pipeline, they were activated independently. One cylinder had a control head activated by a cable connected to a remote pull station, and the other cylinder had a control head activated by a lever mounted on the top. The cylinders were designed with different control heads in order to provide 2 separate charges of CO₂, giving the crew 2 chances to smother a fire in the engine compartment.

When the *Frederike. C-2* was being built, the quantity of CO₂ required to effectively inert the engine compartment atmosphere in the event of a fire was calculated to be 33.04 pounds (14.99 kg).¹³ The storage cylinders that were installed each contained 35 pounds (15.88 kg) of CO₂, which was more than the minimum required quantity.

The CO₂ fixed fire suppression system was last inspected and certified on 13 March 2015 by an approved specialized shore-side contractor.

¹³ The calculation was performed by a specialized firm contracted to design, supply, and install the fire suppression system.

1.12.2 *Standard operating procedure*

According to the *Fire Detection and Extinguishing Equipment Regulations*, “instructions on operating the smothering installation shall be displayed near the distribution control valves and also near the gas cylinders.”¹⁴ A set of instructions printed on plastic laminated plates was delivered with the other components of the CO₂ system, and TCMSS requested that the instructions be posted at the remote pull station during the vessel’s first inspection in 2002. The investigation could not determine whether the operating instructions were posted in the required location at the time of the occurrence.

The standard operating procedure for CO₂ fixed fire suppression systems usually includes the following basic steps:¹⁵

- Order the CO₂ to be released and inform all crew members.
- Do a head count and ensure that nobody is in the compartment where the CO₂ is to be released.
- Shut off all machinery in the compartment.
- Shut off all fuel and lubricating oil handling equipment, such as pumps and purifiers.
- Shut off all fuel and lubricating oil supplies in the compartment by remotely activating the isolating valves.
- Shut off all air supply and exhaust fans for the affected compartment.
- Shut off all electrical power to the affected compartment.
- Make sure that all doors, portholes, hatches, air intakes, air exhausts, and any other openings in the affected compartment are closed tightly.
- Release the CO₂ by pulling the handle in the remote control cabinet outside the affected compartment, or by pulling the hand lever directly on the control head inside the cylinders storage compartment.

The International Fire Service Training Association’s publication *Marine Fire Fighting for Land-Based Firefighters* notes that “[f]ixed fire suppression systems are only effective if the fire compartment is sealed, allowing the oxygen level to reduce below the point that supports combustion.” Moreover, once the CO₂ has been released, the crew or firefighting party must continue to monitor the fire and confine it to the affected compartment by keeping all openings sealed and by performing boundary cooling using fire hoses. A minimum “soaking time” is required to ensure that all combustible materials have been completely extinguished and that any materials that could re-ignite the fire have been allowed to cool. An additional

¹⁴ *Fire Detection and Extinguishing Equipment Regulations* (C.R.C., c. 1422), Schedule III, subsection 3(11).

¹⁵ These steps are adapted from *Prévention, lutte et sécurité incendie à bord des navires* (La revue maritime l’Escale, 1987).

charge of CO₂ may need to be released to ensure that the oxygen in the compartment is sufficiently diluted.¹⁶

On occasions where a CO₂ fixed fire suppression system is ineffective at controlling or smothering a fire, it is usually due to the system being used incorrectly or by someone unfamiliar with how the system works.¹⁷

1.13 *Radio communications in an emergency situation*

Radio communications in the Canadian maritime industry are governed by international and federal legislation. With regard to the content of radio communications in an emergency situation, the *International Radio Regulations* provide all the relevant procedures and wordings to use in case of emergency. Specifically, they advocate the use of the phonetic alphabet and figure code, abbreviations, and signals where applicable, and recommend the use of the International Maritime Organization (IMO)'s *Standard Marine Communication Phrases* and the *International Code of Signals*.¹⁸ The *Standard Marine Communication Phrases*¹⁹ were developed to standardize safety-related verbal communication between a vessel and other vessels or with shore-side organizations such as MCTS, and contain standard phrases and responses for use in emergency situations.²⁰

At the federal level, radio communications in the Canadian maritime industry are governed by the *Radiocommunication Regulations*. In addition, Industry Canada's Radio Communications and Broadcasting Regulatory Branch governs the operation of shipboard radio stations.²¹

The TCMSS *Small Fishing Vessel Safety Manual* contains a section on the information that should be provided when making a radio distress call on VHF channel 16 (156.8 MHz):

Repeat "MAYDAY" three times, then state:

- the name of your vessel
- your position

¹⁶ International Fire Service Training Association, *Marine Fire Fighting for Land-Based Firefighters* (1st edition). Fire Protection Publications, 2001.

¹⁷ Adapted from *Prévention, lutte et sécurité incendie à bord des navires* (La revue maritime l'Escale, 1987).

¹⁸ *International Radio Regulations*, Chapter VII, article 32.

¹⁹ International Maritime Organization (IMO) Resolution A.918(22), adopted by the 22nd Assembly in November 2001.

²⁰ International Maritime Organization (IMO) website: <http://www.imo.org/en/OurWork/Safety/Navigation/Pages/StandardMarineCommunicationPhrases.aspx> (last accessed 08 April 2016).

²¹ Industry Canada Regulations by Reference (RBR-2), "Technical Requirements for the Operation of Mobile Stations in the Maritime Service," Issue 1, September 2007.

- the nature of your distress
- your radio call sign
- the number of persons on board
- the assistance you need.
- If equipped with DSC [digital selective calling] equipment, you should precede the “MAYDAY” call with a DSC distress alert
- Activate your 406 MHz EPIRB

Listen for a response, and repeat the message until you receive an answer.

If there is no immediate danger to life or property, repeat “PAN PAN” three times instead of “Mayday.” Information on marine radio procedure is available from Transport Canada or the Canadian Coast Guard.²²

When the EPIRB is activated, it sends a radio signal containing the vessel’s information and geographical location to the Joint Rescue Coordination Centre (JRCC),²³ which is staffed by representatives from the CCG and the Department of National Defence. This allows search and rescue resources to be alerted immediately and gives them the precise location of the vessel in distress. EPIRBs are designed to float free and activate automatically if the vessel sinks, but they can also be activated manually by the crew.

In this occurrence, the master did not activate the EPIRB and did not broadcast a distress call containing either “Pan Pan” or “Mayday” on VHF channel 16. MCTS was informed of the situation only when notified by the master of the *Marie-Karine D*.

1.14 Familiarization and training

1.14.1 Familiarization upon joining and periodic training

According to the MPR, “the master and the [AR] of a vessel shall ensure that any person assigned a function on that vessel receives the on-board familiarization and safety training set out in TP 4957²⁴ before they start to perform any duty on board the vessel.”²⁵ Masters of fishing vessels are also required to “take adequate steps to ensure that the crew understands

²² Transport Canada, TP 10038E, *Small Fishing Vessel Safety Manual*, Third Edition, March 2003, p. 91.

²³ Joint Rescue Coordination Centre (JRCC) rescue coordinators are empowered under paragraph 130(2)(b) of the *Canada Shipping Act, 2001* to “direct any vessel to take part in a search for that person, vessel or aircraft or to otherwise render assistance.”

²⁴ Transport Canada, TP 4957, *Marine Emergency Duties Training Courses*, Revision 01, June 2007, Section 4.1.

²⁵ *Marine Personnel Regulations*, Part 2, Division 2, section 205.

the use of the lifesaving and fire-extinguishing appliances and knows where they are located.”²⁶ This includes

- the location and operation of fixed fire-fighting systems;²⁷
- the types, use and limitations of the portable fire extinguishers;
- the general safety practices on board; and
- the location and nature of any special hazards present on board.

On the *Frederike. C-2*, no familiarization was given to new crew members. Each crew member’s knowledge of the characteristics and use of the firefighting and lifesaving equipment was limited to individual experience.

The crew held informal discussions about how to handle various emergencies and which crew member would carry out which duties. However, they did not carry out periodic fire and boat drills to practise performing their emergency duties and using the lifesaving and firefighting equipment, nor were they required to do so by federal regulation.²⁸

1.14.2 Familiarization and training manual

The MPR required the AR of a vessel to provide the master with written instructions that, at a minimum, determine the procedures and the policies to be followed to ensure that each member of the crew, before being assigned any duty on board a vessel, becomes familiar with the shipboard equipment and operational instructions specific to the vessel, and their assigned duties on board the vessel. It must also be ensured that the crew members can effectively perform their assigned safety-critical duties on board the vessel.²⁹

With these procedures and policies in hand, the master is required to ensure that each crew member, when first hired, is trained in the use of the firefighting and lifesaving equipment, can effectively perform their assigned safety-critical duties, and keeps this knowledge up to date. In addition, a record of training must be kept available on board for inspection by TCMSS.

On 19 June 2012, a TCMSS inspector issued a Notice of Deficiency to the AR of the *Frederike. C-2* stating that the vessel needed to have a safety familiarization and training manual on board, specifically relating to firefighting and lifesaving equipment, pollution prevention, and all tasks related to the safe operation of the vessel. The notice did not indicate any timeframe for rectifying the deficiency.

On 25 March 2013, when TCMSS inspected the vessel to extend its short-term certificate to a full 4-year term, there was still no familiarization and training manual on board. However,

²⁶ *Small Fishing Vessel Inspection Regulations*, section 51.

²⁷ The generic designation “fixed fire-fighting systems” includes CO₂ fixed fire suppression systems.

²⁸ *Fire and Boat Drills Regulations* (SOR/2010-83), paragraph 2(2)(a).

²⁹ *Marine Personnel Regulations*, Part 2, Division 2, section 206.

no further action was taken by TCMSS in this matter, and the vessel was allowed to continue operating.

1.15 *Safety guidance for fishing vessels*

1.15.1 *Safest Catch program*

The Safest Catch (SC) program, which is part of the Fish Safe program, was developed by the British Columbia Seafood Alliance and is driven by the commercial fishing industry. The tools it provides to the commercial fishing industry are designed by fishermen, with the goal of promoting ownership of safety on board fishing vessels. Fishermen trained as safety advisors give masters and crew an initial on-board workshop to help them develop familiarization protocols, emergency drills, and safety procedures manuals.

The program also helps commercial fishermen develop a vessel-specific safety management system (SMS) that is compliant with current TCMSS requirements relating to the content of an SMS, even though fishing vessels are not currently required to have an SMS in place.³⁰

In its current form, the SC program is delivering introductory training to crews on their own fishing vessels. This involves safety advisors boarding the vessel and familiarizing, training, and instructing crew members on how to locate and properly use all on-board safety equipment. The next steps for the program are as follows:

- to carry out periodic follow-up monitoring with fishing vessel crews;
- to encourage fishermen to understand how to manage and take ownership of safety as an integral part of their normal fishing operations;
- to help fishermen understand that shipboard safety does not only consist of buying survival equipment and doing a single initial emergency drill – it must also be practised periodically so that the handling of lifesaving and firefighting equipment becomes a reflex; and
- to encourage fishermen to adopt a formal risk assessment procedure whereby the master and crew identify all risks and hazards associated with their particular fishing operations (slips and falls, person overboard, becoming caught in or hitting fishing gear, etc.), and adopt all appropriate preventive methods to mitigate those risks.

Following the success of the SC program, the Department of Fisheries and Oceans Canada (DFO)'s Aboriginal Fisheries Division has had the SC program translated into French for use with Francophone First Nations fishermen. To date, the Listuguj Mi'gmaq First Nation in Quebec has organized the training for 3 of its vessels, and more sessions are planned in 2016. DFO will continue to encourage First Nations to offer the training for all of their vessels and will prioritize contributions for safety training as long as a need exists and program funds

³⁰ Section 2 of the *Safety Management Regulations* (SOR/98-348) refers to the International Convention for the Safety of Life at Sea (SOLAS), Chapter IX, which specifies which vessels are required to have a safety management system.

are available to support training. DFO also hopes that the materials adapted for the East Coast, the experience trainers gain from delivering the course to First Nations, and the fact that First Nations often work with non-Aboriginal partners, will help encourage other fishermen to take the SC program training. This has already begun: a non-Aboriginal fishing crew in Rivière-au-Renard received the training in the winter of 2015.

1.15.2 *Commission de la santé et de la sécurité du travail du Québec*

The Commission de la santé et de la sécurité du travail du Québec³¹ (CSST) is the occupational health and safety regulator and workplace safety and insurance board for the province of Quebec. In accordance with a Memorandum of Understanding with TCMSS, the CSST ensures that all fishing vessels operating in the province comply with *An Act respecting occupational health and safety*. Under this Act, the owner of a fishing vessel “must take the necessary measures to protect the health and ensure the safety and physical well-being of his worker. He must, in particular, [...] give the worker adequate information as to the risks connected with his work and provide him with the appropriate training, assistance or supervision to ensure that he possesses the skill and knowledge required to safely perform the work assigned to him.”³²

The CSST has produced a guide for the commercial fishing industry entitled *Santé et sécurité à bord des bateaux de pêche* [Health and Safety on Fishing Vessels].³³ The guide reminds owners of the regulatory requirement to provide proper training and supervision related to safe work practices, including firefighting, and states that all crew members should be trained in the use of all firefighting equipment (e.g., portable fire extinguishers, self-contained breathing apparatus, fire hoses, fire blankets, and fixed fire suppression systems). It also outlines the 4 main steps to be followed in order to efficiently fight a fire:

- find the location of the fire;
- inform the master, who will activate the alarm and broadcast a distress call;
- control the fire by starving it of fuel and cutting off electrical power; and
- extinguish the fire.

1.16 Safety Issues Investigation into Fishing Safety in Canada

Since 1992, the Transportation Safety Board of Canada (TSB) has made 42 recommendations concerning fishing safety, many of which have been addressed. However, despite the efforts of the Board and others in government and the private sector, many of the causes of fishing accidents today are the same as those identified by the TSB 2 decades ago. Most significantly,

³¹ On 01 January 2016, the Commission de la santé et de la sécurité du travail du Québec (CSST) was absorbed by the newly created Commission des normes, de l'équité, de la santé et de la sécurité du travail (CNESST).

³² *An Act respecting occupational health and safety* (chapter S 2.1), Division II, subsection 51(9).

³³ *Santé et sécurité à bord des bateaux de pêche*, Commission de la santé et de la sécurité du travail du Québec (CSST) Document DC 200-6251, February 2008.

from 1999 to 2008, on average, more than 13 people died in fishing accidents each year. Consequently, in 2009, the TSB began a broad safety issues investigation into accidents involving commercial fishing vessels in Canada.

The *Safety Issues Investigation into Fishing Safety in Canada* (SII) categorized actions impacting safety into 10 significant safety issues and found that there are complex relationships and interdependencies among them. These significant safety issues are further analyzed in the SII.³⁴ In this occurrence, 2 of these 10 significant safety issues were present: *training* and *cost of safety*.

Training is the most common means for transferring knowledge and acquiring skill, and it plays a key role in keeping Canadian fishermen safe. Yet, despite its benefits, many fishermen are reluctant to take part in training for reasons that include cost, training delivery, their age, and their sense of independence or self-reliance.

Even when training delivery is effective, the real safety benefit only comes when fishermen regularly practise the skills they have learned on their own vessels. Practice is particularly important for MED training, where speed and coordinated actions are imperative. In an emergency, crew safety largely depends on the capability and reliability of survival equipment, as well as the crew's familiarity with it and their skill in using it. The decision to abandon a vessel at sea is often made under intense pressure and executed in a very short time. Crews who are familiar with their vessel's survival gear are better able to respond to an emergency. For example, the donning of immersion suits during emergency drills conducted several times a year can reduce the time required to find and don the equipment during a real emergency. Over the years, the Board has identified the importance of emergency drills.

The training aspect of the SII found that fishermen generally conduct their business based on knowledge, skills, and attitude gained primarily through experience, and will also assess and manage their risk based on experience. This means they may resist training if it is seen as too expensive or too much of a time commitment. For example, they

- in some cases, resist training for a variety of reasons (cost, time commitment, age, previous education, attitude);
- cannot justify the cost of training, especially if the season is short;
- are confused about the regulatory requirements for training;
- may comply with training regulations only to obtain certification;
- sometimes cannot meet sea-time requirements for certification because of short fishing seasons;
- are frustrated with training that meets requirements but is ineffective; and
- in some cases, take training that is not required.

³⁴ TSB Marine Investigation Report M09Z0001 (*Safety Issues Investigation into Fishing Safety in Canada*).

The cost of safety is measured in dollars and time. Dollars are spent on training, maintaining vessels in safe operating conditions, and investing in lifesaving equipment. Time is spent on taking training as well as adapting and carrying out safety practices such as drills. Fishermen usually weigh the cost (time and money) of safety drills, training, and equipment against what they may consider to be a very low likelihood of an accident happening or being penalized for a regulatory infraction. The cost of safety can sometimes be seen as an obligation – one that stems from regulations that require unwarranted spending on activities such as training and drills.

1.17 *Previous occurrences and statistics related to fire on fishing vessels*

Before this occurrence, the *Frederike. C-2* had experienced 2 other fires on board:

- In April 2010, a fire broke out while the vessel was off Rimouski.³⁵ The vessel was able to return to port even though the wheelhouse was completely filled with smoke. The fire was extinguished by the crew. The master of the vessel at the time was also the master in this occurrence.
- In July 2002, a fire broke out in the wheelhouse while the vessel was returning to Rimouski.³⁶ The crew extinguished the fire with 2 portable fire extinguishers.

On both occasions, no injuries were reported, and no distress calls were made to the local MCTS.

Since 2005, there have been 225 reported marine occurrences involving fire on board Canadian fishing vessels with an overall length of less than 24 metres. Of these occurrences, 76 (or approximately 34 percent) involved a fire that the crew could not control, forcing them to abandon ship. Some examples include the following:

- On 05 September 2014, the fishing vessel C19838BC reported a fire on board while fishing at Plumper Bay, British Columbia. The 2 people on board were evacuated and taken to hospital to be treated for smoke inhalation. The vessel burned to the waterline.³⁷
- On 19 August 2014, the fishing vessel C22980BC reported a fire on board on the Fraser River, British Columbia. The 3 people on board were evacuated, and the vessel's cabin burned to the deck before the fire was extinguished.³⁸
- On 10 July 2014, the fishing vessel *Theresa Clotil* reported a fire on board. The 5 people on board abandoned into the life raft, and the vessel burned to the waterline. The fishing vessel *My Maria* rescued the crew members and took them to Burin, Newfoundland and Labrador.³⁹

³⁵ TSB marine occurrence M10L0028.

³⁶ Canadian Coast Guard Alerting and Warning Network report 20020448.

³⁷ TSB marine occurrence M14P0237.

³⁸ TSB marine occurrence M14P0204.

³⁹ TSB marine occurrence M14A0310.

- On 09 May 2011, a fire broke out in the engine room of the small fishing vessel *Neptune II*. The 2 crew members attempted to fight the fire, but without success. They abandoned the vessel into their dive tender and issued a distress call. *Neptune II* burned to the waterline and sank east of the Broken Islands in Johnstone Strait, British Columbia. There were no injuries.⁴⁰

1.18 TSB Watchlist

The Watchlist is a list of issues posing the greatest risk to Canada's transportation system; the TSB publishes it to focus the attention of industry and regulators on the problems that need addressing today.

1.18.1 Safety management and oversight is a 2014 Watchlist issue

The TSB has identified safety management and oversight as a Watchlist issue. As this occurrence demonstrates, some transportation companies are not effectively managing their safety risks. The solution will require all operators in the marine industry to have formal safety management processes, with oversight by TC. When companies are unable to effectively manage safety, TC must not only intervene, but do so in a manner that succeeds in changing unsafe operating practices.

1.18.2 Loss of life on fishing vessels is a 2014 Watchlist issue

The TSB has identified the loss of life on fishing vessels as a critical safety issue, given that there continues to be approximately 1 fishing-related fatality per month in Canada. The Board remains concerned about vessel stability, the use and availability of lifesaving appliances on board, and unsafe operating practices. Although regulations have been proposed by TC to address several deficiencies with respect to fishing safety, there have been significant delays in their implementation.

The Watchlist highlights the need for concerted and coordinated action by federal and provincial authorities and by leaders in the fishing community to improve the safety culture in fishing operations, recognizing the interaction of safety deficiencies.

⁴⁰ TSB Marine Investigation Report M11W0063 (*Neptune II*).

2.0 Analysis

2.1 Events leading to the sinking

On 28 April 2015 at around 0230, the *Frederike. C-2* was en route to the fishing grounds along the north shore of the St. Lawrence River when a fire broke out in the engine compartment. The master decided to return to Rimouski, Quebec, and called his brother, the master of the fishing vessel *Marie-Karine D*, for assistance.

The master of the *Frederike. C-2* started the electrical fire pump and the crew used the deck hose to flood the adjacent fish hold, with the hope that water would then leak through the non-watertight transverse bulkhead and into the engine compartment. The generator eventually shut down, rendering the fire pump inoperable. The master then ordered the crew to prepare to abandon ship.

At approximately 0300, the master and the 3 crew members abandoned the *Frederike. C-2* and were picked up by the *Marie-Karine D* at around 0330. By this point the *Frederike. C-2* was fully engulfed in flames. The Canadian Coast Guard (CCG) search and rescue cutter *Cap Perce* reached the occurrence site at approximately 0750, and an hour later the *Marie-Karine D* returned to Rimouski. The *Cap Perce* remained at the scene and attempted to extinguish the fire, but the *Frederike. C-2* burned to the waterline and sank by 1515.

Because the wreckage of the *Frederike. C-2* has not been salvaged, the investigation could not determine the exact cause of the fire. However, the characteristics and reported source of the smoke and the abnormally high reading on the generator's coolant temperature gauge when it shut down suggest that the generator engine may have failed and caused the fire.

2.2 Firefighting response, familiarization and training

When a fire breaks out on a vessel, a prompt and coordinated firefighting response carried out by trained personnel with appropriate equipment is key to ensuring that the fire is brought under control and extinguished.

In this occurrence, the firefighting response was delayed by attempting to return to port instead of stopping to assess the situation. The master had successfully returned to port on a previous occasion involving a fire on board, but on this occasion the fire spread more quickly, filling the engine compartment with smoke.

The crew could not enter the compartment and fight the fire with a portable fire extinguisher or fire hose. In an attempt to fight the fire from the outside, crew no. 1 and crew no. 2 were ordered to use the electrical fire pump to fill the fish hold with enough sea water to flood the fish hold, in the hope that water would leak through the bulkhead and into the engine compartment, and thus extinguish the fire. However, the fire pump shut down and only a small quantity of water had leaked into the engine compartment. Regardless, even if the pump had continued operating and completely filled the fish hold, not enough water would likely have leaked through the bulkhead to extinguish the fire.

By this point, approximately 20 to 30 minutes had elapsed, and it was only then that the carbon dioxide (CO₂) fixed fire suppression system was activated. However, the first charge of CO₂ was released without performing crucial preliminary steps, particularly ensuring that all compartment openings were sealed. Because the compartment was not sealed, fresh air entered the compartment, diluting the CO₂ and rendering it ineffective at extinguishing the fire. A second charge of CO₂ was available to the crew, but they were not aware of this because they had not received formal familiarization or training sessions on this equipment then.

The authorized representative (AR) of the vessel did not make formal familiarization or training available to the crew members when they first joined the *Frederike. C-2*. Instead, they acquired their knowledge of the firefighting and lifesaving equipment on board on an individual, ad hoc basis. This meant that not everyone knew where to find the equipment and how to operate it in an emergency.

The crew had informally discussed emergency preparedness and designated specific duties to each crew member. However, these duties were not formalized or practised in fire and boat drills to ensure that the assignment of duties was feasible. In this occurrence, all crew members ended up focusing on fighting the fire and did not prepare the lifesaving equipment until 30 minutes after the fire broke out.

Although fire and boat drills are not required by federal regulation on fishing vessels of less than 150 tons, gross tonnage, such as the *Frederike. C-2*, they can help familiarize the crew with the location and use of firefighting and lifesaving equipment (e.g., the CO₂ fixed fire suppression system) and enable them to practise their assigned emergency duties so that they can act immediately and in a coordinated manner. Drills can also ensure that duties are divided among all crew members so that preparations for abandoning ship can be made while the emergency is being handled.

If the AR of a vessel does not ensure that familiarization and training on the available firefighting and lifesaving equipment is provided to all crew members, there is a risk that the crew will not have the knowledge and skills required to respond appropriately to an emergency.

If crew members do not have formalized emergency duties that are practised in fire and boat drills, there is a risk that their emergency response will be delayed or uncoordinated, potentially endangering the safety of the crew and of the vessel.

2.3 *Communications*

Marine radio communications procedures and terminology are standardized and regulated to provide mariners with a simple means of exchanging information between vessels and between a vessel and shore-based entities such as Marine Communications and Traffic Services (MCTS). In an emergency situation, the sooner a broadcast is transmitted, the sooner search and rescue (SAR) authorities can prepare to be dispatched and stand by as the situation develops.

When smoke is observed on board a vessel, a “Pan Pan” is to be declared on very high frequency (VHF) channel 16, stating the name of the vessel and its position, the nature of the problem, the vessel’s radio call sign, the number of people on board, and the assistance that may be needed. As the situation deteriorates and the crew confirms the presence of a fire on board, a “Mayday” call should be broadcast, repeating the information from the “Pan Pan” call and indicating what assistance is required immediately. The crew should then activate the vessel’s emergency position-indicating radio beacon (EPIRB) to send its identification and exact geographical position to the Joint Rescue Coordination Centre (JRCC).

In this occurrence, the master did not transmit a “Pan Pan” or a “Mayday” on VHF channel 16 or activate the EPIRB at any point during the emergency. Instead, the master, believing that commercial fishermen help each other when a problem occurs and that no CCG intervention was required, called the master of the *Marie-Karine D* on his cell phone.

SAR operations were not ordered until the master of the *Marie-Karine D* reported the situation to MCTS, and the only information provided was that there was a fire on board a fishing vessel off Rimouski. The MCTS regulator was unable to reach the crew of the *Frederike. C-2* to get additional information because they had evacuated the wheelhouse and could not use the 2 fixed VHF radiotelephones. The Marine Research Sub-Centre (MRSC) duty officer did manage to reach the master of the *Frederike. C-2* on his cell phone, but the call had to be ended so that the master could deal with the worsening emergency. The master was requested to inform MCTS when the crew abandoned ship but did not do so.

The crew of the *Frederike. C-2* was rescued after spending approximately 30 minutes in the life raft. The weather was good and the seas were moderate, allowing the *Marie-Karine D* to arrive quickly to recover the crew, and making it easier for SAR resources to fight the fire. However, the SAR response could have been even faster had distress calls been broadcast at the first sign of smoke and when the crew abandoned ship.

If marine communications equipment such as VHF radiotelephones and EPIRBs are not used to broadcast distress calls in a timely manner, SAR resources may not be provided with all the information required, and there is an increased risk that the response will not be rapid, efficient, and coordinated.

2.4 Safety issues in the fishing industry

The *Safety Issues Investigation into Fishing Safety in Canada* (SII) categorized actions impacting safety into 10 significant safety issues and found that there are complex relationships and interdependencies among them. These significant safety issues are further analyzed in the SII.⁴¹ In this occurrence, practices and procedures relating to 2 of the 10 significant safety issues identified in the SII were evident:

⁴¹ TSB Marine Investigation Report M09Z0001 (*Safety Issues Investigation into Fishing Safety in Canada*).

2.4.1 Training

Finding of the Safety Issues Investigation into Fishing Safety in Canada	Relationship to this occurrence
Fishermen <ul style="list-style-type: none"> • generally conduct their business based on knowledge, skills and attitude gained primarily through experience • assess and manage their risk based on experience. 	The crew was not familiarized with the firefighting equipment upon joining the vessel, and no periodic boat and fire drills ever took place.

2.4.2 Cost of safety

Findings of the Safety Issues Investigation into Fishing Safety in Canada	Relationship to this occurrence
Fishermen usually weigh the cost (time and money) of safety drills, training, and equipment against the likelihood of an accident happening or being penalized for a regulatory infraction.	The crew did not spend time or resources on periodic boat and fire drills. Informal discussions among crew members were deemed sufficient to address potential shipboard emergencies, including fire.

2.5 Interdependency of safety issues

The safety of fishermen is compromised by numerous issues that are interconnected. The following safety issues share a complex relationship and contributed to this occurrence:

- Training – formal fire and boat drills were not considered necessary in order to ensure that the crew knew how to use the firefighting equipment in an emergency.
- Cost of safety – the risks of a fire on board were deemed low enough that crew members did not need formal familiarization and training on the firefighting equipment when they were first hired. In addition, informal discussions were used as a substitute for fire and boat drills.

Past attempts to address these safety issues on an issue-by-issue basis have not led to the intended result: a safer environment for fishermen. The SII emphasizes that, in order to obtain real and lasting improvement in fishing safety, change must address not just one of the safety issues involved in an accident, but all of them, recognizing that there is a complex relationship and interdependency among those issues. Removing a single unsafe condition may prevent an accident, but only slightly reduces the risk of others. The safety of fishermen will be compromised until the complex relationship and interdependency among safety issues are recognized and addressed by the fishing community.

If a fishing vessel crew is not adequately familiarized with and trained on all firefighting equipment on board, there is a risk that the crew will not be able to respond to emergencies promptly and effectively.

3.0 Findings

3.1 Findings as to causes and contributing factors

1. A fire broke out in the engine compartment of the *Frederike. C-2*, possibly caused by a failure in the generator engine.
2. The engine compartment filled with dense smoke, preventing the crew from fighting the fire with a fire hose or portable fire extinguishers.
3. The smoke eventually filled the wheelhouse, forcing the crew to evacuate onto the main deck.
4. The crew attempted to flood the fish hold with sea water, with the intention of causing the water to leak through the transverse bulkhead and into the engine compartment, but this was unsuccessful.
5. The carbon dioxide fixed fire suppression system was activated approximately 30 minutes after the first signs of fire, but the engine compartment was not sealed, rendering the first charge ineffective. A second charge of carbon dioxide was available but not used.
6. The vessel burned to the waterline and sank.

3.2 Findings as to risk

1. If the authorized representative of a vessel does not ensure that familiarization and training on the available firefighting equipment is provided to all crew members, there is a risk that the crew will not have the knowledge and skills required to respond appropriately to an emergency.
2. If crew members do not have formalized emergency duties that are practised in fire and boat drills, there is a risk that their emergency response will be delayed or uncoordinated, potentially endangering their safety and that of the vessel.
3. If marine communications equipment such as very high frequency radiotelephones and emergency position-indicating radio beacons are not used to broadcast distress calls in a timely manner, SAR resources may not be provided with all the information required, and there is an increased risk that the response will not be rapid, efficient, and coordinated.
4. If a fishing vessel crew is not adequately familiarized with and trained on all firefighting equipment on board, there is a risk that the crew will not be able to respond to emergencies promptly and effectively.

3.3 *Other findings*

1. Electrical repairs performed on the vessel during the winter of 2014–2015 were not reported to Transport Canada Marine Safety and Security and were not verified for compliance with mandatory electrical standards.
2. The *Frederike. C-2* experienced 2 main engine failures in less than 1 year (June 2014 and April 2015), but these were not reported to Transport Canada Marine Safety and Security, and engine performance and reliability were not verified for compliance with regulatory requirements.
3. Despite the vessel's minimum safe manning document requiring the master to hold a valid Fishing Master, Fourth Class, certificate, the master's certificate had expired on 19 March 2013, more than 2 years before the occurrence.
4. In January 2015, the vessel's alarm system, which included the fire detection system, had been found defective and underwent repairs. However, during the occurrence, the audible alarm on the fire detection system did not work.
5. The vessel was equipped with only fixed very high frequency radiotelephones and did not have a portable very high frequency radiotelephone, meaning that the crew's personal cell phones were the only means of communication with search and rescue resources.
6. On 25 March 2013, during the Transport Canada Marine Safety and Security (TCMSS) inspection to extend the vessel's short-term certificate to a full 4-year term, there was no familiarization and training manual on board. No further action was taken by TCMSS in this matter, and the vessel was allowed to continue operating.

4.0 *Safety action*

4.1 *Safety action taken*

4.1.1 *Transport Canada Marine Safety and Security*

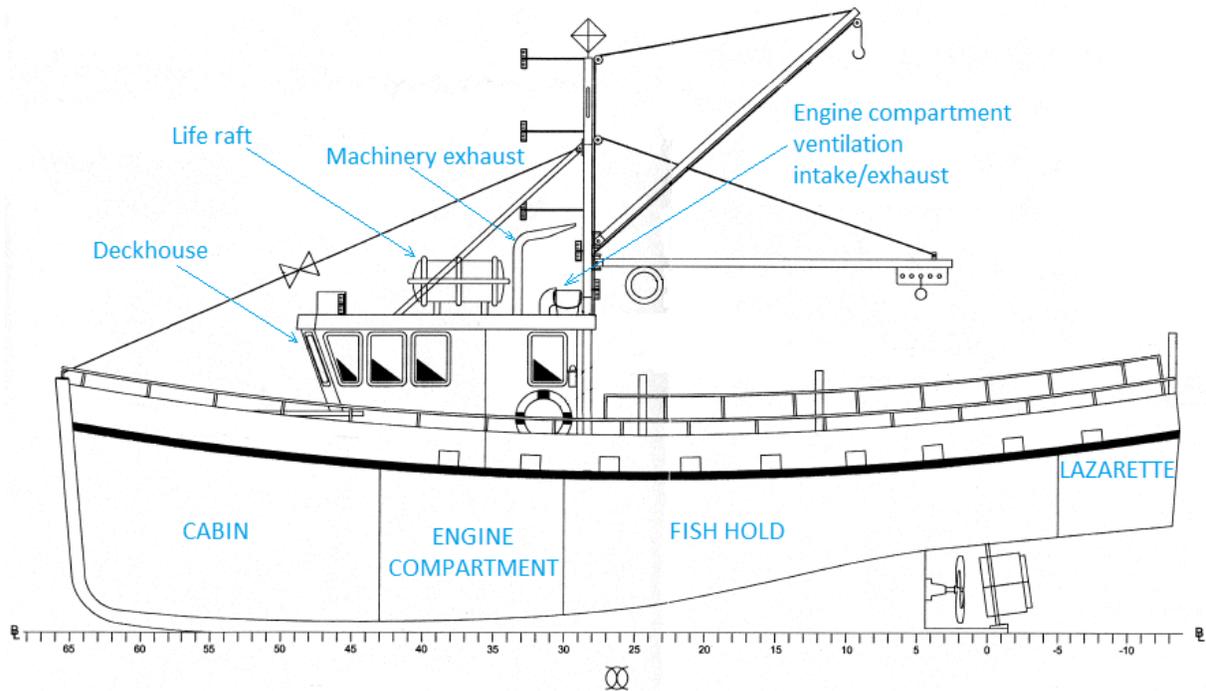
Following the occurrence, Transport Canada Marine Safety Inspectors at the local Marine Safety Service Centre in Rimouski, Quebec, have started to add compliance deadlines to Notices of Deficiency issued in relation to the familiarization and training manual. The notices state that the authorized representative must ensure that the vessel has “written procedures and a training logbook before the next season.” Failure to comply with this notice by the deadline will result in administrative monetary penalties, pursuant to the *Administrative Monetary Penalties and Notices (CSA 2001) Regulations*.

This report concludes the Transportation Safety Board’s investigation into this occurrence. The Board authorized the release of this report on 20 April 2016. It was officially released on 28 April 2016.

Visit the Transportation Safety Board’s website (www.tsb.gc.ca) for information about the TSB and its products and services. You will also find the Watchlist, which identifies the transportation safety issues that pose the greatest risk to Canadians. In each case, the TSB has found that actions taken to date are inadequate, and that industry and regulators need to take additional concrete measures to eliminate the risks.

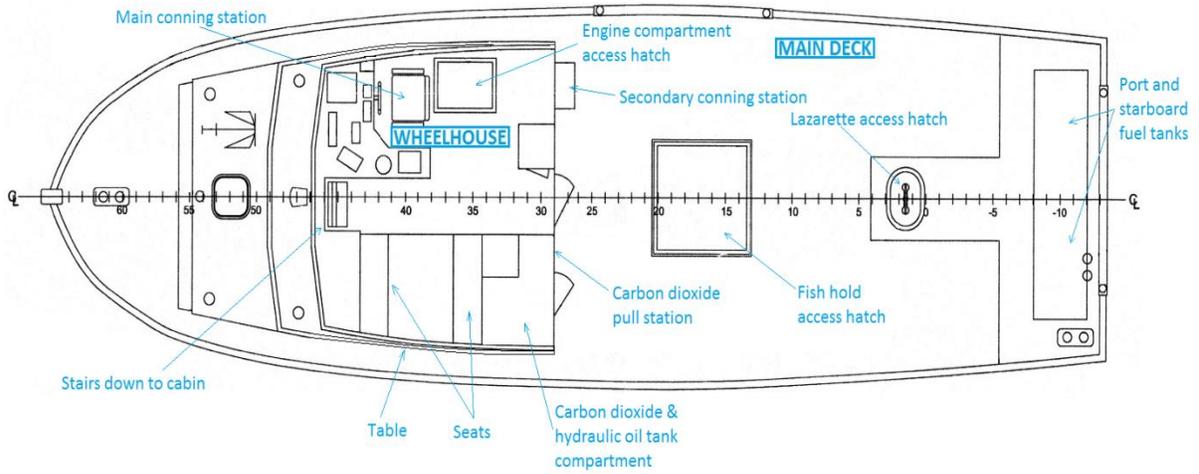
Appendices

Appendix A – Layout of the Frederike. C-2, showing profile viewed from port side



Source: David Fortin, Bleu Marine Services Enr., with TSB annotations

Appendix B – Layout of the Frederike. C-2, showing plan view, including wheelhouse interior



Source: David Fortin, Bleu Marine Services Enr., with TSB annotations

