



Transportation
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Bureau de la sécurité
des transports
du Canada



MARINE TRANSPORTATION SAFETY INVESTIGATION REPORT M20C0101

CREW FALL OVERBOARD AFTER WORKBOAT STRUCK BY MOORING LINE

Unregistered workboat belonging to the bulk carrier *Manitoulin*
St. Clair River, near Sombra, Ontario
12 May 2020

Canada 

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Le présent rapport est également disponible en français.

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Summary

On 12 May 2020, 3 of the *Manitoulin's* crew members were crossing over a submerged mooring line in the vessel's workboat while proceeding to shore near Sombra, Ontario, when tension came on the line and it struck the workboat. The impact caused all of the crew members to fall overboard. One of the crew members swam to shore and the other 2 re-boarded the workboat. No injuries were reported.

1.0 FACTUAL INFORMATION

1.1 Particulars of the vessels

Table 1. Particulars of the vessels

| | | |
|-------------------------------------|---|---|
| Name of the vessel | <i>Manitoulin</i> | Unnamed workboat |
| IMO number | 8810918 | n/a |
| Official number | 838002 | n/a |
| Port of registry | Port Dover, Ontario | none |
| Flag | Canada | none |
| Type | Bulk carrier | Workboat |
| Gross tonnage | 19 570 | <5 |
| Length overall | 202.5 m | 4.3 m |
| Breadth extreme | 23.8 m | 1.7 m |
| Draft at the time of the occurrence | Forward: 6.7 m Aft: 6.8 m | n/a |
| Hull material | Steel | Aluminum |
| Built | 1991, by Uljanik Brodogradiliste Shipyard in Pula, Croatia | 2011, by Legend Boats in New Paris, Indiana, U.S. |
| Propulsion | 1 diesel engine providing 6050 kW with a controllable-pitch propeller | 1 outboard engine providing 3.7 kW (5 hp) |

| | | |
|---|-----------------------------|-------------------------|
| Crew complement | 17 | n/a |
| Owner | Lower Lakes Towing Ltd. | Lower Lakes Towing Ltd. |
| Classification society / Recognized organisation | Lloyd's Register | n/a |
| Issuing authority for the International safety management certification | American Bureau of Shipping | n/a |

1.2 Description of the vessels

1.2.1 *Manitoulin*

The *Manitoulin* (Figure 1) is a River class self-unloading Great Lakes bulk carrier¹ of steel construction with the machinery space and accommodation located aft. The vessel has a self-unloading system with a boom that is located forward. On either side of the vessel, near amidships, there is a gangway that can be lowered to the waterline. The vessel has a rescue boat² located on the starboard side of the accommodation. The vessel also has a workboat that was stored on the main deck. At the time of the occurrence, the rescue boat was undergoing repairs and had been unserviceable since the morning of the occurrence.

Figure 1. *Manitoulin* (Source: Martin Palardy)



1.2.2 Workboat

The *Manitoulin's* workboat is a 14-foot aluminum boat of open construction (Figure 2). It has been on the *Manitoulin* since 2015 and is used approximately 15 to 20 times a year for crew transfers and mooring operations. At the time of the occurrence, the workboat was

¹ River class bulk carriers are smaller than standard Great Lakes bulk carriers and are used to transport bulk cargoes to small ports on the inland waters of the Great Lakes.

² A rescue boat is typically used for rescuing persons overboard and for operations involving life rafts. The *Manitoulin* was required to carry a rescue boat to comply with the *Life Saving Equipment Regulations*.

powered by a 2-stroke 5 hp gasoline outboard engine that weighed 26.2 kg. The engine had a kill switch with a lanyard that was designed to be clipped to the workboat operator.

Figure 2. Overhead and profile views of a boat of the same model as the workboat on the *Manitoulin* (Source: Legend Boats)



The workboat has a Canadian compliance notice³ posted on the hull that indicates the boat is a Category C, which is a designation for boats “designed to operate in typical steady winds of Beaufort force 6 or less and the associated significant waves heights of up to 2 m.”⁴ The compliance notice also indicates that the workboat’s recommended safe limits are as follows:

- A maximum of 4 persons on board, weighing a total of 275 kg
- A maximum total weight of 468 kg, including all persons, gear, and the engine
- An outboard engine with a maximum power of 26 kW and maximum weight of 190 kg

The workboat is launched and retrieved using an electric winch that is hooked to the *Manitoulin*’s hatch crane davit.

1.3 History of the occurrence

On 12 May 2020, at approximately 1500,⁵ the *Manitoulin* was approaching a shoreline facility near Sombra, Ontario, to unload stone and carry out a crew transfer (Appendix A). At this facility, there is no dock, but there are mooring chains located on shore to facilitate

³ A Canadian compliance notice is a statement from the manufacturer or importer indicating that the vessel is built according to the construction requirements of the *Small Vessel Regulations*. Most vessels with motors are required to display compliance notices under the *Small Vessel Regulations*.

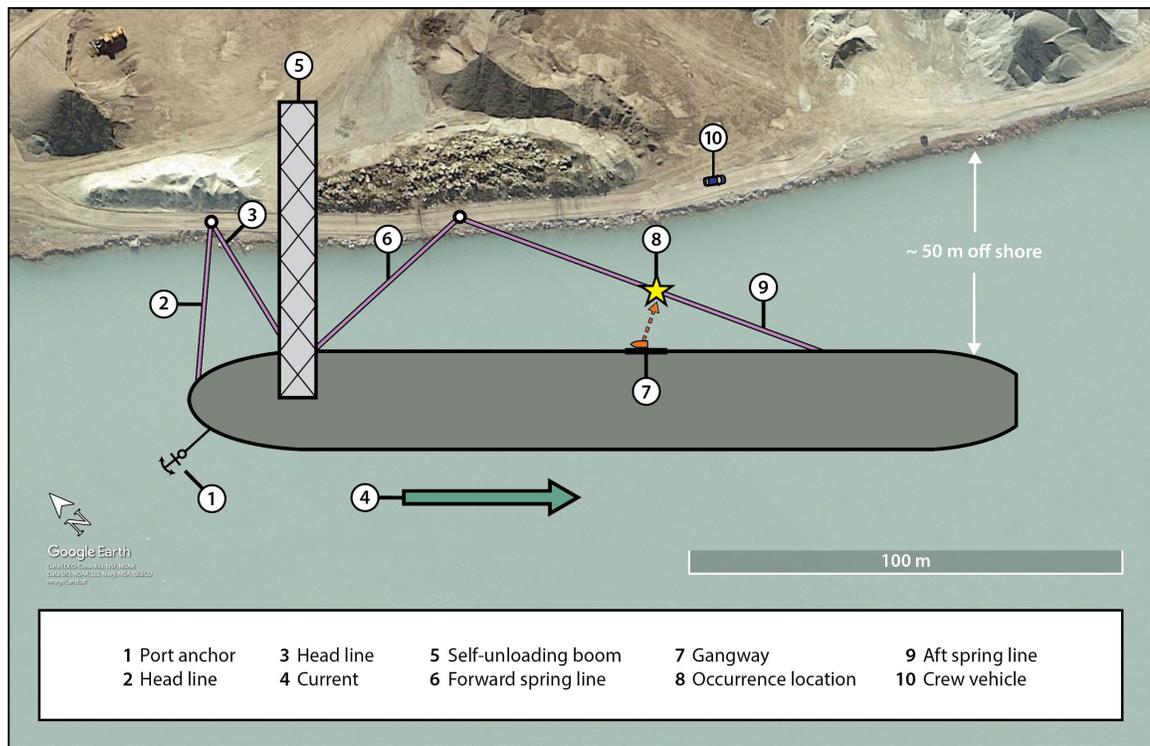
⁴ International Organization for Standardization, ISO 12217-1: Small craft – Stability and buoyancy assessment and categorization – Part 1 Non-sailing boats of hull length greater than or equal to 6 m, 3rd edition (15 October 2015), paragraph 7.2.3.

⁵ All times are Eastern Daylight Time (Coordinated Universal Time minus 4 hours).

securing of vessels.⁶ As the *Manitoulin* neared the facility, the workboat was launched to help transfer the vessel's steel mooring lines ashore. The *Manitoulin* then came alongside the river bank, approximately 50 m off shore, and maintained position while the mooring lines were being secured.

By 1530, the port anchor had been deployed, and 4 of the vessel's mooring lines had been secured to shore (Figure 3, items 1, 2, 3, 6, and 9). The aft spring line was secured to shore but kept slack for emergency use in the event that the other mooring lines parted or detached from shore. The line had approximately 9 to 12 m of slack on it. Keeping the aft spring line slack for emergency use was common practice at this location.

Figure 3. The *Manitoulin's* mooring arrangement at the time of the occurrence (Source: Google Earth, with TSB annotations)



At 1536, unloading operations using the vessel's self-unloading system (Figure 3, item 5) began. The chief officer was supervising these operations from the starboard side of the main deck. The second officer was assisting from one of the 2 unloading control rooms that are located forward.

Meanwhile, the workboat, which had remained in the water after the mooring lines were secured, was used to carry out a crew transfer. Two relief crew members who were waiting on shore were transferred from the shore to the *Manitoulin* on the workboat. The relief

⁶ The *Manitoulin* had visited this facility on a number of occasions. Shoreline facilities of this type, without a traditional berth, are common in the Great Lakes area.

crew members and the workboat operator then boarded the *Manitoulin* using the starboard-side gangway,⁷ leaving the workboat secured to the base of the gangway.

Once these crew members had transferred aboard the *Manitoulin*, a watch handover was done, and a new workboat operator boarded the workboat in preparation for transferring 2 other crew members ashore. The new operator, wearing a personal flotation device (PFD), seated himself at the back of the workboat beside the engine. The operator started the engine without attaching the engine kill switch lanyard to himself.

The operator waited as the 2 crew members (Crew 1 and Crew 2) boarded the workboat with their gear. Crew 2 was wearing a PFD. The operator assigned the 2 crew members to seats: Crew 1 on the middle seat on the centreline of the workboat, and Crew 2 at the front of the workboat facing toward the operator. Their gear, a total of 3 bags, was stowed on either side of the workboat. The estimated total weight on board was approximately 284 kg.⁸

Before departing, the operator checked the position of the aft spring line, which dropped straight down the side of the *Manitoulin* with the remainder of the line submerged in the water. The operator also checked to see if the *Manitoulin* was moving in the current; it appeared stationary. The current was downstream at approximately 2 to 3 knots. Crew 2 released the painter line that had been securing the workboat to the gangway. The operator initially allowed the workboat to float backwards with the current. He then turned his visual attention toward the shore and used the engine to manoeuvre the workboat stern-first⁹ toward the crew vehicle waiting on shore (Figure 3, item 10).

The most direct route between the gangway on the *Manitoulin* and the crew vehicle required the workboat to pass over the *Manitoulin's* submerged aft spring line. The same route had been taken earlier by the previous operator when transferring the relief crew to the *Manitoulin*. The mooring winch for the aft spring line was unattended.

The workboat was halfway to shore when it passed over the submerged line. At that moment, the *Manitoulin* shifted and the line came under tension. Crew 2 shouted a warning as the line suddenly rose out of the water. It caught the workboat between the transom and the outboard engine, rapidly lifting the stern into the air and submerging the bow into the water. All 3 crew members were thrown into the water. The workboat filled with water but remained partially floating due to its reserve buoyancy.

Crew 2 was able to hold onto the workboat and climbed back on board. From inside the workboat, Crew 2 was able to help the operator climb back into the workboat as well. At

⁷ The port-side gangway was not used due to the strong current.

⁸ This estimate takes into account the approximate weight of the crew members, their gear, and the engine. The quantity of fuel could not be determined. For the purpose of this estimate, it was considered to be approximately 4.5 kg.

⁹ The decision to manoeuvre stern-first with the current was made after considering the strength of the current in relation to the workboat's engine power.

this time, the workboat's engine was still running. Crew 1 started to swim the approximately 20 m to shore using his backpack for flotation.

The chief officer observed the incident and used his hand-held very high frequency radiotelephone to broadcast a call about persons overboard on the vessel's working channel. The master, who was on the vessel's bridge, began to coordinate a response. A few crew members who were standing on the cargo deck were assigned to keep a watch on the crew members in the water.

Approximately two minutes after the swamping, Crew 1 had reached the shore, and the operator and Crew 2 had motored the swamped workboat to shore. None of the crew members were injured. The workboat was pulled out of the water and onto the shore bank with the assistance of a front-end loader.

1.4 Damage to the workboat

The workboat's engine was a total loss, as it would not start after it was used to motor the swamped vessel to shore. The workboat itself was not damaged.

1.5 Environmental conditions

At the time of the occurrence, the sky was clear and the visibility was 25 nautical miles. The wind was 14 knots from the west. The air temperature was 5 °C, and the water temperature was 7 °C. The wave height was 0.3 m, and the current was 2 to 3 knots downstream.

1.6 Personnel certification and experience

The master on the *Manitoulin* held a Master, Near Coastal certificate of competency that was first issued in 2019. He had worked for Lower Lakes Towing Ltd. since 2011.

The workboat operator involved in the occurrence held a bridge watch rating certificate¹⁰ issued in 2019 and had served as a deckhand and wheelsman on board the *Manitoulin* for approximately 1 year. He had been an ordinary seaman since 2015. The workboat operator had completed training on the operation of the *Manitoulin's* workboat in June 2019. The training was provided by the vessel's second officer at that time and consisted of familiarization with a company procedure for workboat operations and practice operating the workboat.

1.7 Vessel certification

The *Manitoulin* carried all of the required certificates for a vessel of its class and for the intended voyage. The *Manitoulin* was a delegated vessel and had last been inspected by its

¹⁰ An operator of a workboat under 8 m in length overall that is not carrying passengers and is engaged on a voyage of not more than 2 nautical miles from shore is required to hold a pleasure craft operator card. A bridge watch rating certificate is accepted as proof of competency.

recognized organization (RO) on 13 September 2019. The *Manitoulin's* workboat was not required to be registered¹¹ or inspected.¹² Consequently, it was not registered with and had never been inspected by Transport Canada (TC).

TC is in possession of a Small Vessel Declaration of Conformity form that applied to the model of workboat on the *Manitoulin*. The form is a declaration from the importer that the workboat was built to comply with the construction requirements of the *Small Vessel Regulations* (SVR). The form had been submitted to TC by the importer in 2010.

1.8 Use of workboats on lake freighters

Workboats are common on lake freighters and tend to be used for various purposes, including vessel inspection and maintenance, transfers of crew and materials, and oil pollution emergencies. In addition to the *Manitoulin*, Lower Lakes Towing Ltd. has 8 other lake freighters, all of which have workboats on board.

1.9 Mooring line hazards

There are various hazards associated with mooring lines, primarily because of the large loads these lines carry. One type of hazard is the uncontrolled movement of slack mooring lines. Factors like wind, current, waves, and passing vessels can cause a vessel to move constantly if moored with slack lines, especially if the vessel is in an exposed location with a limited number of lines. As the vessel moves, slack mooring lines can rapidly come under tension and suddenly rise up, creating a slingshot effect. Being struck by a mooring line in such a situation can result in injury or death.^{13,14,15}

Developing a mooring plan provides an opportunity to evaluate the vessel's mooring arrangement and prevent the uncontrolled movement of mooring lines. A mooring plan typically establishes the number and position of lines required to prevent a vessel from moving, as well as other specific precautions that may be needed. Lower Lakes Towing Ltd. did not require its vessels to develop mooring plans, and the *Manitoulin* did not have a mooring plan for mooring at the shoreline facility near Sombra.

¹¹ Commercial vessels of less than 15 in gross tonnage and powered by motors totaling less than 7.5 kW (10 hp) are not required to be registered.

¹² Workboats are not required to be listed on a vessel's record of safety equipment and therefore are not subject to monitoring inspections by Transport Canada or statutory inspections by recognized organizations.

¹³ TSB marine transportation safety occurrences M15C0201, M12L0089, M10L0115, M08L0153, and M07C0060.

¹⁴ United Kingdom Marine Accident Investigation Branch, Accident Investigation Report No. 13/2017: Report on the investigation of the failure of a mooring line on board the LNG carrier Zarga while alongside the South Hook Liquefied Natural Gas terminal, Milford Haven resulting in serious injury to an officer on 02 March 2015 (June 2017).

¹⁵ Dutch Safety Board, Fatality during mooring operation in lock M/V Flinter Aland, Terneuzen, 09 September 2012 (November 2013).

1.10 Effect of expectations on reaction time

For a person to interrupt what they are doing in order to react to a hazard, a condition or stimulus needs to be visible or detectable (available to the senses), perceived (assigned meaning), and recognized (as sufficiently important). Expectations about a situation can affect whether and how appropriately a person responds to hazards in the environment. When people receive information that they expect to receive, they tend to react quickly and without error. However, when they receive information that they do not expect, their performance tends to be slow or inappropriate.¹⁶

At the time of the occurrence, the workboat operator did not expect to see the aft spring line to come under tension and rise up and could not take action to avoid it.

1.11 Falling overboard

In Canada, falling overboard is one of the top causes of death in the marine industry. A person falling into water that is below 15 °C¹⁷ experiences an initial cold shock, which can be fatal. If they survive the cold shock, exhaustion can quickly set in as they attempt to stay afloat. Exhaustion increases rapidly if the person is not wearing a PFD.

PFD use can minimize the adverse consequences of being immersed in cold water and increase a person's chances of survival until help arrives. Not wearing a PFD when there is a risk of falling in the water is a safety issue that has been identified by the TSB on both commercial vessels and fishing vessels¹⁸.

Rapid recovery of the person from the water is also critical to increasing their chances of survival and can be facilitated by vessels having a person-overboard procedure and a rescue plan in place. Under the *Maritime Occupational Health and Safety Regulations* (the MOHS Regulations),¹⁹ when a hazard of drowning exists, employers are required to provide PFDs, emergency equipment, a written emergency response procedure, a qualified person ready

¹⁶ G. J. Alexander and H. Lunenfeld, U.S. Department of Transportation Report No. FHWA-TO-86-1: Driver expectancy in highway design and traffic operations (April 1986).

¹⁷ C. J. Brooks, K. A. Howard, et al., *Survival at Sea for Mariners, Aviators and Search and Rescue Personnel*, Chapter 10: Drowning is Not a Helpful Diagnosis Written on the Death Certificate (North Atlantic Treaty Organization and Research and Technology Organization, February 2008), at <https://www.sto.nato.int/publications/STO Technical Reports/RTO-AG-HFM-152/AG-HFM-152-ALL.pdf> (last accessed on 24 March 2021).

¹⁸ TSB recommendation M16-05, as well as TSB marine investigation reports M17C0232, M15P0286, and M09Z0001.

¹⁹ The MOHS Regulations apply to marine sector employers and employees working in the federally regulated marine sector where the *Canada Labour Code* applies. These regulations are intended to help protect workers on board Canadian vessels and prevent accidents and injuries in the workplace. Among other things, these regulations have specific requirements for employers with respect to hazard prevention programs and protection against drowning.

to intervene, and a vessel that is ready to respond.²⁰ The *Manitoulin* was subject to the MOHS Regulations.

Finding: Other

At the time of the occurrence, Lower Lakes Towing Ltd. did not have a procedure for persons overboard, and the rescue boat on the *Manitoulin* was out of service for repairs.

PFDs were available in the workboat, but only 2 of the 3 crew members in the workboat were wearing one.

TC is responsible for enforcing the MOHS Regulations.²¹ One of the ways it does this is through routine visits to workplaces, such as vessels.

Finding: Other

The *Manitoulin* had not been subject to a maritime occupational health and safety inspection in the last 5 years.

1.12 Safety management system

The *International Safety Management Code* (ISM Code) provides an international standard for the safe management and operation of vessels and for pollution prevention.²² Its objectives are to ensure safety at sea, prevent human injury or loss of life, and avoid damage to the environment and to property.

Under TC's *Safety Management Regulations*, vessels that are subject to the *International Convention for the Safety of Life at Sea* (SOLAS) must comply with the ISM code, which requires companies and vessels to develop and implement a safety management system (SMS) that establishes safeguards against all identified risks. This involves establishing procedures, plans, instructions, and checklists for shipboard operations that concern the safety of personnel, the vessel, and the environment. The Code specifies that the various tasks should be defined and assigned to qualified personnel.

The ISM Code also requires companies to identify potential emergency shipboard situations and establish procedures to respond to them. For example, a potential emergency shipboard situation on any vessel is a person overboard. A procedure to respond to this situation should identify the equipment intended to be used for recovery purposes and measures to be taken by the crew.

Vessel operators that are required to have an SMS must go through an auditing process by a third party (an RO or a classification society) to ensure that their SMS meets the

²⁰ Government of Canada, SOR/2010-120, *Maritime Occupational Health and Safety Regulations* (as amended 25 June 2019), section 147.

²¹ Transport Canada and Employment and Social Development Canada's Labour Program have a memorandum of understanding on the application and enforcement of the *Canada Labour Code* Part II, which sets out the powers, duties, and functions of TC with respect to regulatory oversight of the MOHS Regulations.

²² International Maritime Organization, *International Safety Management Code with Guidelines for its Implementation* (IMO Publishing, 2018).

requirements of the ISM Code and that the company and the vessel are operating in accordance with the SMS. Both the company and its vessels must obtain certificates to indicate compliance (the company is issued a document of compliance [DOC] and the vessel is issued a safety management certificate [SMC]).

Operators for whom the ISM Code does not apply may choose to voluntarily adopt it. Companies that voluntarily implement SMS may opt to have their SMS audited by a third party. Upon verifying that the voluntary SMS meets the requirements of the ISM Code and that the company and the vessel are operating in accordance with the SMS, the third party will issue the company a DOC and the vessel an SMC. As a non-Convention vessel, the *Manitoulin* was not required to comply with the ISM Code. However, Lower Lakes Towing Ltd. had voluntarily implemented an SMS on the vessel. In 2016, Lower Lakes Towing Ltd. was issued a voluntary document of compliance, and in 2017, the *Manitoulin* had been issued a voluntary SMC issued by the American Bureau of Shipping. These certifications indicated that the company and the vessel complied with the requirements of the ISM Code. The *Manitoulin's* SMS contained a risk assessment on the operation of the workboats in the fleet, as well as a workboat operations procedure. Both the risk assessment and the procedure were developed in 2015. These documents were generic and applied to all of the workboats in the fleet.

TC is in the process of amending Canada's *Safety Management Regulations*. When the proposed amendments come into force, Canadian vessels of 500 gross tonnage or more and the companies that operate them will be required to develop, implement, and maintain an SMS in compliance with the ISM Code.

1.12.1 Risk management

Risk management under an SMS is a continuous cycle that involves identifying hazards, assessing their risk, implementing mitigation measures to reduce or eliminate them, and assessing the effectiveness of these measures. Effective mitigations not only help to reduce the severity and probability of a hazard, but also can help recalibrate the way that the hazard is perceived (i.e., a hazard with no risk mitigations in place can be perceived as not being a threat compared to one with risk mitigations in place). Risk management is a continuous process, and assessments should be reviewed regularly by all parties involved.

Recognizing the importance of risk management, the MOHS Regulations require employers to develop, implement, and monitor a program for the prevention of hazards in the workplace.²³ Lower Lakes Towing Ltd. had developed a hazard prevention program guide that was revised in 2019, and each vessel in the fleet had a copy on board. For all policies, procedures, and risk assessments, the hazard prevention program made reference to Lower Lakes Towing Ltd.'s voluntary SMS.

²³ Government of Canada, SOR/2010-120, *Maritime Occupational Health and Safety Regulations* (as amended 25 June 2019), section 120.

The risk assessment that Lower Lakes Towing Ltd. had completed for the operation of the workboats identified hazards of falling overboard, drowning, and slipping and falling. The overall risk for the operation of the workboats was initially evaluated as moderate. Mitigating measures were listed as adherence to the workboat operations procedure, crew training, and use of all appropriate personal protective equipment (PPE). The residual risk was assessed as tolerable.²⁴

The risk assessment did not identify specific hazards associated with workboats transiting in proximity to mooring lines. As well, there was no requirement for masters to develop mooring plans or complete risk assessments at shoreline facilities where the use of workboats was necessary.

1.12.2 Workboat operations procedure

The workboat operations procedure provided instructions for how to prepare, launch, and recover the workboats, as well as how to safely embark and disembark (Appendix B). It also listed required PPE and safety equipment to be worn by persons in the workboats. Training provided to workboat operators was based on this procedure.

Among other things, the procedure instructed crew members to use extreme caution when navigating between the forward and aft ends of the vessel due to mooring line hazards and propellers.²⁵ The procedure also mentioned that workboats need to be inspected before launching, but no specific crew members were assigned to this task and no record of maintenance for the *Manitoulin's* workboat was found as part of the investigation. However the procedure did not include weather restrictions or information about the purpose and use of kill switches, nor did it inform operators of specific mooring line hazards that may be present. It also did not specify the workboats' recommended safe limits.

In this occurrence, the operator's understanding was that the maximum capacity of the *Manitoulin's* workboat was 5 persons, although the compliance notice specified 4 persons.

1.12.2.1 Workboat safety equipment

As a power-driven vessel of less than 15 in gross tonnage, the *Manitoulin's* workboat was subject to the SVR, which required the workboat to carry approved lifejackets; a marine emergency first aid kit; a buoyant heaving line; a watertight flashlight; flares; oars; an anchor with chain, rope, or cable; a manual bilge pump; a sound-signalling device or appliance; navigation lights; and a magnetic compass.

The required PPE and safety equipment listed on the workboat operations procedure included helmets and PFDs for everyone in the workboat, as well as spare PFDs for persons

²⁴ The risk assessment guidance states that for "tolerable" risks, "no additional controls are required[, and] monitoring is required to ensure control is maintained." (Source: Lower Lakes Towing Ltd., Risk Assessment – M.V. Manitoulin, Deck Ship Specific Training [May 2015]).

²⁵ Lower Lakes Towing Ltd., M.V. Manitoulin Ship Specific Training, Procedure for Punt Use Guidance (July 2015). The policy refers to "wire hazards"; this report uses the term "mooring line hazards" for clarity and consistency.

transferring between the vessel and the shore or vice versa. The list also included oars, a painter line, and a hand-held very high frequency radiotelephone.

At the time of the occurrence, and in recent years, the *Manitoulin's* workboat was equipped with PFDs, oars, a portable fuel tank, a bailer, buckets, a painter line and a hand-held very high frequency radiotelephone. The workboat did not have the following required items on board: a marine emergency first aid kit; a watertight flashlight; flares; an anchor with chain, rope or cable; a manual bilge pump; a sound-signalling device or appliance; navigation lights; or a magnetic compass.

1.12.3 Guidance for owners and operators of small commercial vessels

To encourage owners of small commercial vessels to comply with regulations, TC has developed the Small Vessel Compliance Program (SVCP)²⁶ and a Small Commercial Vessel Safety Guide.²⁷ Both the SVCP and the guide include checklists that cover safety procedures, operations, crew training, equipment, maintenance, and emergency preparation. Among other things, the checklists prompt operators to

- ensure that the vessel has a procedure for the safe operation of the vessel and for dealing with emergencies,
- ensure that passengers are given a complete pre-departure safety briefing,
- ensure that the vessel has equipment and a procedure for dealing with hypothermia and cold water shock, and
- consider the maximum wave heights and wind speeds in which the vessel will be operating.

The workboats on the vessels operated by Lower Lakes Towing Ltd. were not enrolled in the SVCP, and Lower Lakes Towing Ltd. did not use the Small Commercial Vessel Safety Guide for its workboat operations procedure. As such, the company had not incorporated in its operations any of these considerations from TC.

²⁶ The SVCP is a voluntary program available to owners and operators of small commercial vessels to help them understand and meet their legal obligations. During the enrollment process, an owner submits a detailed compliance report that is reviewed by a TC marine safety inspector. Any shortcomings are communicated to the owner to be rectified before the vessel's enrollment in the program to ensure the vessel complies with regulatory requirements.

²⁷ The Small Commercial Vessel Safety Guide is available on the TC website and is intended to inform owners and operators of small commercial vessels of the safety requirements that apply to their operations and how to comply (Source: Transport Canada, Small Commercial Vessel Safety Guide - TP 14070 E (2010), at <https://tc.canada.ca/en/marine-transportation/marine-safety/small-commercial-vessel-safety-guide-tp-14070-e-2010> [last accessed 26 April 2021]).

Finding: Other

Some safety considerations that are included in TC's guidance for small commercial vessel operators had not been addressed by the company's SMS.

1.13 TSB survey of companies operating lake freighters with workboats

In September 2020, the TSB sent a survey to 9 other companies operating lake freighters in order to collect data about their workboats. Five companies responded. One company had a procedure for the operation of its workboats. Two of the companies indicated that they had risk assessment sheets on board their workboats. These companies had identified hazards associated with the workboats that encompassed slip, trips, falls, engine trouble, malfunction of the appliances used to launch and recover the workboat, strong current or tide, high waves, poor visibility, traffic in proximity to the workboat, loss of communication, and hazards around mooring lines.

Three companies indicated that their workboats were not registered, nor were they part of the SVCP. One company indicated that the safety equipment carried on its workboats did not comply with the SVR.

1.14 Engine kill switch lanyard

The workboat's engine had a kill switch with a lanyard that was designed to be clipped to the operator while the engine was in operation. If the lanyard was pulled from its connector switch, the engine would stop to prevent it from running with no one at the controls. At the time of the occurrence, the lanyard was tied to the side of the workboat, and the operator was not aware of how it functioned. Previous investigations by the TSB²⁸ and by the United Kingdom's Marine Accident Investigation Branch²⁹ have noted that not using this safety device could lead to a situation where the engine continues to run with no one at the controls when people are in the water.

1.15 Supervision

Supervision can have a significant impact on many factors that influence employee behaviour in the workplace.³⁰ Supervision supports and reinforces compliance with procedures and priorities. It can also assist with employee engagement and motivation, the management of workload, the identification of workplace hazards, and the prevention of unsafe acts.

²⁸ TSB marine transportation safety investigation reports M16C0137 and M09L0068.

²⁹ United Kingdom Marine Accident Investigation Branch, Accident Investigation Report 5/2014, Ejection of 6 people from rigid inflatable boat Milly resulting in 3 people injured, 2 seriously and loss of 2 lives (23 January 2015).

³⁰ M. Fleming, Offshore Technology Report 1999/065: *Effective supervisory safety leadership behaviours in the offshore oil and gas industry* (Robert Gordon University, prepared for the Health and Safety Executive, 2001), at <https://www.hse.gov.uk/research/otopdf/1999/oto99065.pdf> (last accessed 20 July 2021).

At the time of the occurrence, the senior deck officers on the *Manitoulin* were involved with self-unloading operations and were not supervising the crew transfer. No one instructed the crew members on board the workboat to wear PFDs, nor did anyone brief the operator about hazards related to the operation.

1.16 TSB Watchlist

The TSB Watchlist identifies the key safety issues that need to be addressed to make Canada's transportation system even safer.

Safety management is a Watchlist 2020 issue. As this occurrence demonstrates, even when formal processes are present, they are not always effective in identifying all hazards or managing the risks in every aspect of a vessel's operations. Furthermore, when an operator voluntarily implements an SMS, the system does not receive any oversight from TC to ensure that it is effective.

ACTIONS REQUIRED

Safety management will remain on the Watchlist for the marine transportation sector until:

- TC implements regulations requiring *all* commercial operators to have formal safety management processes; and
- Transportation operators that do have an SMS demonstrate to TC that it is working—that hazards are being identified and effective risk-mitigation measures are being implemented.

1.17 Previous TSB occurrences involving workboats on lake freighters

Since 2002, the TSB has received 4 reports of occurrences involving workboats on lake freighters:

M16C0222 – On 22 December 2016, the workboat belonging to the *Mississagi* capsized during launching and 3 crew members fell into the water in Sault Ste. Marie, Ontario. The crew members were immediately retrieved from the water and sustained minor injuries. There was no damage or pollution. The *Mississagi* is also owned by Lower Lakes Towing Ltd.

The TSB sent a marine safety information letter to Lower Lakes Towing Ltd. and TC noting that, in this occurrence, the guidance provided in the workboat operations procedure had not been followed. The company issued a memorandum to the vessel's crew, but neither the procedure nor the 2015 risk assessment on workboat operations were revised following this occurrence.

M13F0027 – On 07 December 2013, the workboat belonging to the *CSL Tadoussac* capsized and 1 crew member fell into the water in Ashtabula Harbour, Ohio, U.S. The crew member swam to shore.

M10C0060 – On 04 August 2010, the workboat belonging to the *Saginaw* capsized and 3 crew members were thrown into the water in Sarnia, Ontario. No injuries were reported.

M02C0079 – On 25 November 2002, the workboat belonging to the *Algomarine* capsized while crew were preparing to disembark and 3 crew members were thrown into the water

in Windsor, Ontario. The crew members were wearing lifejackets and were recovered with mild hypothermia.

2.0 ANALYSIS

All 3 crew members on the *Manitoulin's* workboat were thrown into the water after the workboat crossed over a slack mooring line that suddenly came under tension. The investigation looked at the risk associated with the uncontrolled movement of mooring lines, the company's process for assessing and mitigating risks related to the use the workboat, as well as the adequacy of the workboat operations procedure.

2.1 Factors leading to the occurrence

The *Manitoulin* was moored 50 m offshore at a facility that is not equipped with a dock, and so the vessel's workboat was used to transfer crew members ashore.

Findings as to causes and contributing factors

While the *Manitoulin* was moored, the aft spring line was left slack, which meant the line could submerge and then unexpectedly rise out of the water with the vessel's natural movements, posing a risk to anyone crossing near or over it.

Because of the way the vessel's mooring lines were arranged, and the strong current on the port side, the route from the starboard gangway to the crew vehicle waiting ashore required the workboat to cross over the slack aft spring line, which was submerged.

The vessel's senior officers were focused on unloading operations and did not brief the workboat operator or supervise the crew transfer, which resulted in a missed opportunity to consider the risk posed by uncontrolled movement of the aft spring line.

After the workboat operator boarded and did the watch handover, and before departing, he checked for potential spring line hazards by looking at the position of the aft spring line, which appeared to be slack and submerged in the water. He also visually checked, and determined that the *Manitoulin* was not moving, which would make spring line hazards less likely. These observations were consistent with an expectation that the direct route from the *Manitoulin* to shore would be clear of hazards, and so the operator proceeded with the crossing.

Finding as to causes and contributing factors

Given that the *Manitoulin* appeared to be stationary and that the aft spring line was submerged and not expected to rise up, the operator proceeded with crossing.

However, it was very difficult to predict the vessel movements in the strong current with any reliability, and even a small shift in the vessel's position could result in the uncontrolled movement of the mooring line. Additionally, from the operator's perspective in the workboat, and with his visual attention primarily on the shore, it would have been difficult to detect any movement of the *Manitoulin* or of the aft spring line.

Finding as to causes and contributing factors

As the workboat was crossing over the aft spring line, the *Manitoulin* shifted in the current and the line rose up, catching the workboat by the stern and throwing all 3 of the crew members into the water.

The speed at which the line rose out of the water and the fact that this event was unexpected meant that the workboat operator was unable to manoeuvre the workboat out of the path of the line in time to avoid the impact.

2.2 Uncontrolled movement of mooring lines

The uncontrolled movement of mooring lines poses a risk of injury or death to anyone working near or over them because they can come under tension quickly and unpredictably. The uncontrolled movement of lines must therefore be prevented at all times. This can be accomplished by keeping all mooring lines as close to taut as possible, or by carefully monitoring any lines with slack on them to reduce the consequence of any unexpected tension. Ensuring that crew working near mooring lines are fully aware of the risks and are following safe working practices can also prevent injury or death.

On the *Manitoulin*, it was common practice to leave the aft spring line slack in the water at locations without formal docking facilities. At these locations, there was no requirement in the safety management system (SMS) for the master to develop a mooring plan that considered the uncontrolled movement of mooring lines, nor was there a requirement to establish safety precautions for mooring lines. As a result, the aft spring line was left slack and obscured below the water without precautions to mitigate the risk of it rising out of the water without warning. As well, the *Manitoulin's* mooring arrangement meant that there was no clear path for the workboat to cross from the starboard side of the vessel to shore.

Finding as to risk

If precautions are not taken to mitigate the hazards associated with the uncontrolled movement of mooring lines, there is a risk that workers in the vicinity of mooring lines will be injured or killed if they are in the path of a line that suddenly comes under tension.

2.3 Risk management

Effective risk management is an ongoing process involving individuals at all levels of an organization. It entails identifying hazards, analyzing and evaluating the risk associated with those hazards, and putting mitigating measures in place. Since operational risks are not static but can emerge and change over time, it is crucial that risk assessments be regularly evaluated and updated in order to address new hazards or identify existing hazards that may have been initially overlooked. It is also important that any mitigating measures put in place have adequate controls to ensure that the people performing the mitigation measures are monitored and complying with these measures.

Although a risk assessment on workboat operations had been carried out in 2015, it had not been revisited since then. Even after an occurrence in 2016 where crew members on

another vessel owned by Lower Lakes Towing Ltd. went overboard from a workboat, the risk assessment was not updated. This resulted in a missed opportunity to evaluate whether hazards associated with workboat operations were being addressed effectively.

The 2015 risk assessment looked at workboat operations in general and did not consider specific hazards associated with crew transfers. This meant that a number of factors that have the potential to affect the safety of crew transfer operations were not assessed, including

- whether the workboat is transiting near mooring lines and the hazards of doing so,
- whether there is a rescue plan in the event of a person going overboard,
- whether the rescue boat is serviceable at the time for a crew transfer,
- whether the workboat's outboard engine is sufficiently powered for the current, and
- whether the workboat is compliant with current regulations.

Effective and well-documented procedures for routine tasks on board a vessel help crew members to perform these tasks with an understanding of the associated risks and control measures. When followed, these procedures contribute to consistent and safe working practices on board a vessel. In this occurrence, there was no procedure in place to respond to and recover persons going overboard, the rescue boat was unserviceable, and not all of the safety equipment required by both regulation and company procedure was available or being used on the workboat. Because these factors had not been assessed, there were no mitigating measures in place, which may have contributed to a perception that the crew transfer was a low-risk activity. Without mitigations in place to recalibrate risk perception, the subjective evaluation of low personal risk may lead to an increase in the performance of high-risk activities.³¹

Although there were some mitigating measures to address other risks that had been identified by the 2015 risk assessment, there were no controls in place to ensure that crew members complied with them. For example, although use of all personal protective equipment (PPE) was required, not everyone in the workboat was wearing a PFD, and there were no controls in place, such as supervision and inspections, to ensure that this was being complied with.

As a result, in this occurrence, the *Manitoulin's* mooring location had not been assessed for the safety of a crew transfer, and the risks of navigating over a mooring line that could move unexpectedly and rapidly were not fully appreciated.

³¹ G. J. S. Wilde, "Homeostasis drives behavioural adaptation," *Behavioural Adaptation and Road Safety: Theory, Evidence and Action* (2013), Chapter 5, pp. 61–86.

Finding as to risk

If hazards associated with the use of a workboat are not adequately addressed through risk mitigation measures and if compliance with these measures is not monitored, occurrences involving workboats will continue to happen.

2.4 Workboat operations procedure

Effective documented procedures can contribute to consistent and safe working practices on board a vessel, as well as compliance with applicable regulations. It is important that procedures provide key information to ensure that operators are informed about any hazards or limitations that impact safety.

Given that the *Manitoulin* and other vessels in the Lower Lakes Towing Ltd. fleet frequently moored at shoreline facilities without traditional berths and that their workboats were regularly used for crew transfers and transporting mooring lines ashore, it was important that the workboat operations procedure provided information to operators about the hazards of navigating near mooring lines.

The investigation determined that, although the *Manitoulin's* workboat operations procedure mentioned that operators should use extreme caution due to mooring line hazards, it did not specify the nature of these hazards or provide options to mitigate their risks. The operator of the workboat may have benefitted from information about the hazard of slack mooring lines suddenly coming under tension and the comparatively slow speed of human reaction time. Options to mitigate the risk of this hazard could have included a requirement for a mooring plan that prevented the uncontrolled movement of mooring lines or a prohibition on navigating over slack mooring lines.

The investigation also identified that the workboat operations procedure did not include some key information necessary for the safe operation of the workboat. For example, it did not prompt the operator to provide a safety briefing to personnel on board and to ensure that they wore PPE. It also did not cover the workboat's recommended safe limits (maximum total weight and number of persons), waves and wind limitations, or the use of the kill switch lanyard. Training for the operators, which was based on the workboat operations procedure, did not cover any additional information about these items. As a result, the workboat operator did not know the workboat's safe limits and was not aware of how the kill switch lanyard functioned. The lanyard was not clipped to him in this occurrence, and so the engine remained running in proximity to the crew members in the water, posing a risk of injury.

Finally, the investigation identified that the list of safety equipment included in the workboat operations procedure did not include all of the items required under the *Small Vessel Regulations*. As a result, although the workboat carried the equipment listed in the procedure, it did not meet the requirements of the *Small Vessel Regulations*. Because a workboat is not part of a vessel's lifesaving equipment and is not required to undergo external inspections, it can be overlooked by the crew, the company, and the regulator. In this case, Lower Lakes Towing Ltd. was not aware of the safety equipment requirements in

the *Small Vessel Regulations*, and none of the workboats in the fleet were carrying the equipment necessary for compliance.

Finding as to risk

If procedures for the use of workboats do not contain key safety information regarding operations, hazards, and limitations, there is a risk that workboats will be unknowingly operated in a manner that compromises the safety of those on board.

3.0 FINDINGS

3.1 Findings as to causes and contributing factors

These are conditions, acts or safety deficiencies that were found to have caused or contributed to this occurrence.

1. While the *Manitoulin* was moored, the aft spring line was left slack, which meant the line could submerge and then unexpectedly rise out of the water with the vessel's natural movements, posing a risk to anyone crossing near or over it.
2. Because of the way the vessel's mooring lines were arranged, and the strong current on the port side, the route from the starboard gangway to the crew vehicle waiting ashore required the workboat to cross over the slack aft spring line, which was submerged.
3. The vessel's senior officers were focused on unloading operations and did not brief the workboat operator or supervise the crew transfer, which resulted in a missed opportunity to consider the risk posed by uncontrolled movement of the aft spring line.
4. Given that the *Manitoulin* appeared to be stationary and that the aft spring line was submerged and not expected to rise up, the operator proceeded with crossing.
5. As the workboat was crossing over the aft spring line, the *Manitoulin* shifted in the current and the line rose up, catching the workboat by the stern and throwing all 3 of the crew members into the water.

3.2 Findings as to risk

These are conditions, unsafe acts or safety deficiencies that were found not to be a factor in this occurrence but could have adverse consequences in future occurrences.

1. If precautions are not taken to mitigate the hazards associated with the uncontrolled movement of mooring lines, there is a risk that workers in the vicinity of mooring lines will be injured or killed if they are in the path of a line that suddenly comes under tension.
2. If hazards associated with the use of a workboat are not adequately addressed through risk mitigation measures and if compliance with these measures is not monitored, occurrences involving workboats will continue to happen.
3. If procedures for the use of workboats do not contain key safety information regarding operations, hazards, and limitations, there is a risk that workboats will be unknowingly operated in a manner that compromises the safety of those on board.

3.3 Other findings

These items could enhance safety, resolve an issue of controversy, or provide a data point for future safety studies.

1. At the time of the occurrence, Lower Lakes Towing Ltd. did not have a procedure for persons overboard, and the rescue boat on the *Manitoulin* was out of service for repairs.
2. The *Manitoulin* had not been subject to a maritime occupational health and safety inspection in the last 5 years.
3. Some safety considerations that are included in Transport Canada's guidance for small commercial vessel operators had not been addressed by the company's safety management system.

4.0 SAFETY ACTION

4.1 Safety action taken

4.1.1 Lower Lakes Towing Ltd.

Following the occurrence, a due diligence report was completed by the master and crew. While completing the report, the master and crew discussed the incident, and the workboat operators on the *Manitoulin* were told to never cross slack mooring lines.

On 18 January 2021, Lower Lakes Towing Ltd. issued a policy on the prevention of falls overboard. The policy includes best practices and lessons learned to prevent falls overboard. It also includes descriptions of activities and hazards that may lead to falls overboard, critical activities for various crew members in the prevention of falls overboard, and a job hazards analysis. A memorandum was issued to all captains, engineers, and officers to inform them about the policy.

4.1.2 Smoker Craft Inc.

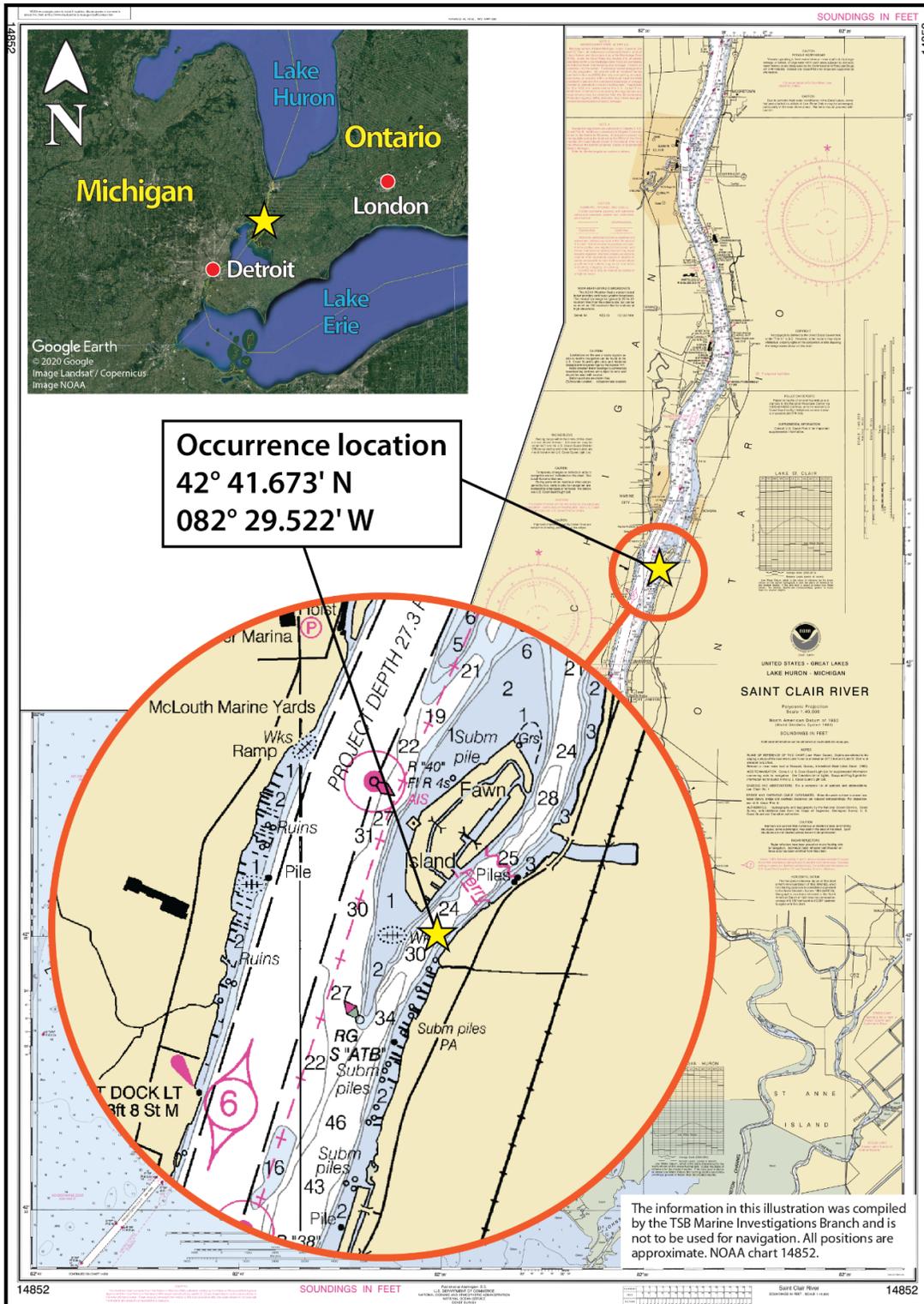
Following the occurrence, Smoker Craft Inc., the manufacturer of the workboat, performed a flotation test on a workboat of the same model. The test resulted in a change to the recommended safe limits for the power and weight of engines used with this model of workboat. The revised maximum power limit is 22 kW (30 hp), and the revised weight limit is 159 kg. Smoker Craft Inc. is in the process of notifying all relevant parties about these changes.

This report concludes the Transportation Safety Board of Canada's investigation into this occurrence. The Board authorized the release of this report on 14 July 2021. It was officially released on 30 July 2021.

Visit the Transportation Safety Board of Canada'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 key safety issues that need to be addressed to make Canada's transportation system even safer. 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 – Chart of occurrence location, with inset image showing map of occurrence location



Source of main image: National Oceanic and Atmospheric Administration, Chart 14852: Saint Clair River, with TSB annotations

Source of inset image: Google Earth, with TSB annotations

Appendix B – Workboat operations procedure

M.V. MANITOULIN Ship Specific Training

Lower Lakes Towing Ltd.

| | |
|---------------|-----------|
| Revision Date | JULY,2015 |
| Revision No. | |
| No. of pages | 2 |

Procedure for: PUNT USE GUIDANCE

Procedure No: DECK 14

PURPOSE OF PROCEDURE

- To provide basic guidance in proper punt preparation prior to and on arrival when launching the punt to the water
- To provide proper guidance in embarking and disembarking from the punt
- To highlight possible dangers if not following these policies

Policy Details:

- When preparing for a punt job all equipment being used shall be inspected to make sure it is in good condition
- The painter shall be 5/8 polypropylene rope (or equivalent) and shall be inspected for fraying, cuts and wear. If any of these are found the painter is to be replaced.
- The hoisting bridle is to be checked to make sure there are no defects. Bridle to be replaced if wear, fraying and/or cuts are found.
- The hoisting bridle will be made of 3 or 4 straps to properly handle the weight of the punt when hoisting or lowering.
- Shackles are to be inspected to make sure they are screwed on tight and properly attached to the hoisting bridle and moused to ensure it does not come unscrewed.
- The hoisting gear (chain falls, motor winch or hand crank winch) will be inspected to make sure that it is properly working
- The hoisting cable will be inspected for broken strands, wear and/or brittleness, if any of these are found the cable is to be replaced immediately.
- Prior to the punt being launched over the side an inspection to make sure the plug is put in and secured, there are 2 oars with oar locks, enough fuel for the motor
- Once punt is hooked up to hoisting gear the punt will remain on deck until the Captain gives the order to launch the punt over the side
- Once the punt is lowered to the waterline a ladder long enough to reach the water and a set of ladder hooks are to be placed into position.
- When launching the punt the punt shall face upstream, and the painter shall be tied off forward of the punt securing it so not to float away.
- Life jackets are to be worn by everyone in the punt. Life jackets will be fully secured (zippers and straps)
- The 1st deckhand will only descend to the punt when the Captain says it is safe enough to do so
- After the 1st deckhand is in the punt and before any further deckhands descend the ladder to board the punt, the lead deckhand shall unhook the hoisting cable in case the painter breaks which will allow the punt to float down river rather than turn sideways and tip because of the hoisting cable still attached.
- The punt motor will then be started
- Only after the motor is started and the 1st deckhand in the punt has control, the other personnel may descend down the ladder to the punt.
- Once crew is safely in the punt, the painter can be untied and walked up the deck with the punt to receive the line to go ashore. This allows the persons on deck to hold the crew and punt in place if the motor was to stop running.
- The crew in the punt will then safely navigate to the shore to tie up the ship.
- The deckhand operating the punt will use extreme caution when navigating between the forward and aft end of the ship due to wire hazards and ships prop.

M.V. MANITOULIN Ship Specific Training**Lower Lakes Towing Ltd.**

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| Revision Date | JULY,2015 |
| Revision No. | |
| No. of pages | 2 |

Procedure for: PUNT USE GUIDANCE**Procedure No: DECK 14**

-
- When deckhands are finished and plan to board the vessel, the 1st deckhand coming aboard will bring up the end of the painter to tie the punt off.
 - The second deckhand will then ascend the ladder
 - The last deckhand will make sure the motor is off and the hoisting cable is attached to the bridle then he/she will make their way up the ladder.
 - Once crew is out and clear of the punt and on board the ship the ladder will then be pulled up and placed in a safe area so not to trip over it.
 - The punt will then be hoisted up and pulled back onto the main deck and safely put away and secured.

Minimum Personal Protective Equipment Required:

- Hard hat
- Work gloves
- Rubber soled steel toed boots or steeled rubber boots
- Appropriate non loose fitting clothing
- Life jackets for the persons in the punt
- Spare life jacket in the punt for persons transferring from shore to ship or ship to shore

Summary of Equipment Used:

- Punt
- Punt motor
- Ladder and ladder hooks
- Hoisting winch
- Oars
- Tag line or Painter for the punt
- Punt Ironman
- Hand held VHF radio for Deckhands in Punt