

Working On and Around Oil Sands Tailings Ponds

A PROGRAM DEVELOPMENT GUIDELINE

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Preface



PURPOSE

This document provides guidance for managing risks associated with working on and around bodies of process affected water ponds such as tailings ponds.

The intended audience includes oil sands companies and employers that work in tailings operations but is not limited to health and safety, risk management, maintenance, engineering, and contractor personnel.

SCOPE AND LIMITATIONS

This guide provides general guidance and should not be viewed as a complete repository of information. This document will provide a strong foundation for the development of a comprehensive program or working on or around water and ice.

This guide will address:

- Hazardous ground conditions;
- Tailings storage facilities;
- Determining ground characteristics;
- Working on bodies of water or fluid;
- Working on frozen surfaces;
- Working in proximity of water or fluid;
- Personal protective equipment;
- Marine specific training; and
- Emergency response preparedness.

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1.0 Introduction

The risk associated with tailings operations present a challenge for the oil sands industry. This guideline specifically focuses on operations and situations in oil sands, tailings, and mining.

2.0 Common Language and Concepts

2.1 WORKING AROUND HAZARDOUS GROUND CONDITIONS IN OIL SANDS MINING & TAILINGS OPERATIONS

Oil sands mining and extraction processes involve water. Rain, groundwater and snowmelt accumulate in the mine and reclamation salvage areas and collect in ditches and sumps throughout the mine. Water management and dewatering is critical to mining operations and require workers to maintain earthworks and pumps near water bodies.

In mining operations, the oil sand is transported to a crusher that feeds a hydro-transport facility. The ore is hydraulically pumped as a slurry to the extraction facility where the bitumen is removed from the sand and soil. The leftover slurry is called tailings. The tailings slurry is pumped to a tailings storage facility (TSF) where it is discharged. After discharge, the heavier sand particles settle first, creating a sandy beach. The water and slower settling fine soil particles flow to the lowest point and form a pond in the centre of the facility. Tailings sand is used in dyke construction, the water is recycled, and the fluid tailings are treated and reclaimed. Tailings operations involve many operational groups and specialized contractors working on and around ice/water year-round.

Expect to encounter water, soft ground, and heavy equipment when in a tailings area.

2.2 TAILINGS STORAGE FACILITIES

Tailings storage facilities are typically several square kilometres in size and the terrain varies throughout and between facilities. Tailings can be stored in the previously mined pit, known as in-pit tailings placement, or in external tailings facilities constructed above grade using engineered dykes.



Aerial photo of an oil sands tailings storage facility. Source: osqar.suncor.com

2.3 GROUND CHARACTERIZATION GUIDE

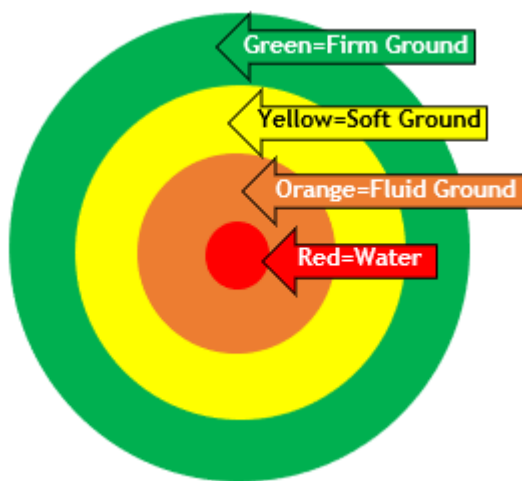
It is critical to recognize the unique hazards associated with the varied ground conditions commonly found in the environments affected by tailings, mining, and process water.

Although the following guide is used to generally describe key ground characteristics, it should be noted that conditions may change. Such as but not limited to: weather changes, process upsets, pipeline leak, etc.

The ground characterization guide (Figure 1) is to be used when:

- Accessing and working around soft or unknown ground conditions off main access roadways
- Working on water or fluid

Figure 1. Ground characterization guide





Water

- Water bodies that can support the safe travel of marine vessels.
- **Examples include** tailings ponds, deep water sumps, any process-affected ponds, ditches, or wetlands.



RULES:

- A life jacket or personal flotation device should be worn within 5 m of an unprotected water's edge and should be worn where there is a foreseeable hazard of drowning, such as when working from a vessel (see section 5.2 for additional guidance).
- A water safety checklist or departure plan should be completed before leaving shore.
- All vessels being used on water should meet the appropriate [Small Vessel Compliance Program](#) requirements from Transport Canada, when applicable.
- All vessel operators should hold a valid operator certificate applicable to the class of vessel.
- Ensure you have completed a fall protection and emergency response plan for on water activities.



Fluid Ground

- Fluid-like tailings or other mining waste with limited water cover.
- Inaccessible using marine vessels and too soft for terrestrial equipment or foot traffic.
- Extreme temperature fluctuations caused by seasonal changes require additional assessment and mitigation.
- Examples include drying cells, mud dumps, process thickened tailings, slop dumps, muskeg.



RULES:

- Access to these locations is restricted.
- Due to unknown fluid/ground conditions caused by seasonal changes, ground competency must be determined. Therefore, an appropriate level of hazard/risk assessment (such as a trafficability assessment and recovery plan) should be conducted and approved by the company-designated authority before starting work.
- See section 6.0 for additional guidance.



Soft Ground

- Uncompacted sand, areas of wet and loose soil.
- Accessible using appropriate tracked equipment with a recovery plan and knowledge of geotechnical stability.
- Seasonal changes with extreme temperature fluctuations require additional assessment and mitigation.



- **Examples include** sand dumps, beach, un-trafficked beach, slop dumps.

RULES:

- These areas are typically accessed by low ground pressure and tracked equipment.
- A safe operating distance should be set in proximity to live feed/pour or ponded water.
- A recovery plan should be in place before accessing the work area.



Firm Ground

- Engineered or constructed structures.
- **Examples include** roads, dykes, and dozer-compacted cells.



RULES:

- All identified firm ground areas are considered accessible for personnel and mobile equipment traversing and working, unless determined otherwise in the job safety analysis (JSA) and/or field level hazard assessment (FLHA).

3.0 Working on Bodies of Water

Any practices or procedures that are developed should align with applicable Transport Canada Standards.

In addition to normal controls, consider the following best practices:

- Modifications on the design and structure of the vessels are strictly prohibited unless they have been reviewed and approved by the manufacturer and/or an engineer. All approved modifications shall be documented.
- All loads must be secured to prevent movement and reduce the risk of capsizing.
- Every person operating a vessel is legally responsible for inspecting, equipping, and operating it in compliance with federal and provincial regulations and for any damage that may be caused by operation of the vessel.

- The person in command of the vessel must know the requirements for operation and navigation of the vessel, the local regulations, and the policies and procedures within this guideline.
- Passengers are to be seated whenever possible during vessel movement. If seats are not available for all crew members, they must maintain three-point contact during movement, with the locations verified by the vessel captain.
- Any vessel should *not* be operated on the water by a single occupant unless there is an established means of communication for emergency response.
- When work is to be performed on or from the vessel, it is mandatory for a minimum of two occupants. One person must always maintain care and custody of the vessel.
- All occupants of the vessel must understand the location of and how to use the safety equipment, as required.

Weather considerations when working on water:

- Weather forecast for the duration of the shift must be reviewed prior to departure. Under no circumstances should a small vessel be in operations during lightning storms or when a lightning warning is issued for the area.
- Additional mitigations should be considered when there is an increased risk due to high winds, snow, ice, fog, or heavy rain.

3.1 WATER DEPARTURE PLAN/SAFETY CHECKLIST

Each employer is responsible to define how to best operationalise their plan.

It is recommended that a water safety checklist, departure plan, permit or equivalent be completed prior to leaving shore. A copy should be carried and one left with the contact on the shore.

At a minimum, content of the checklist should include:

- Description of vessel (e.g., Length, colour)
- Departure time
 - Estimated duration of work
- Duration
- Type of work being performed
- Classification of ground condition
- How emergency response will be initiated, e.g., radio, cell phone, contact names and numbers
- Location being travelled to
- Type of water safety PPE required
- List of crew and passenger names
- Forecasted weather conditions

4.0 Working on Frozen Surfaces

Outside of normal ice management operations using vessels, working on or around ice is high-risk work. Ice found in the oil sands and mining environment may have low strength due to fluctuating water levels, process affected water and hydrocarbons.

Frozen surfaces can disguise dangerous hidden hazards. Examples include undercuts, washouts, and unsupported ice surfaces due to changing water levels.



Due to the significantly increased risk and history of incidents. Before work begins, a risk assessment should be completed. This could lead to additional activities required to take place, such as: trafficability assessment, constructability assessment, etc.

5.0 Mobile Equipment Working in Proximity to Water

Whenever work is to be carried out within 5 m of a body of water using mobile equipment:

- Operator must be trained in any provided self-rescue equipment (e.g., glass break tool**) prior to commencing work.
- The area must be inspected beforehand. Inspections must include but are not limited to cracking, soft areas, undercuts and working slope.
- Where practicable, a safety berm should be built to protect equipment from sliding into the water. Tailings cell dozers will follow tailings cell construction safe work practices (where applicable).
- Only manually inflatable personal flotation devices (PFDs) are permitted inside closed cab equipment.
- Each piece of mobile equipment must have a means of egress either by an emergency escape hatch and/or glass break tool**.

- Based on risk assessment, when working in cabbed equipment where there is a risk of submersion in water, an emergency air supply – Spare-Air or Emergency Underwater Breathing Apparatus (EUBA) – may be necessary to extend the amount of time to egress the cab in an emergency. Consider keeping the door of the equipment open and/or not wearing a seatbelt, or use of a seatbelt that would provide easy unbuckling in case of emergency, provide seatbelt cutter, where applicable.

****NOTE:** Glass breaking tools are only useful on tempered glass and an evaluation of equipment working closely to water should be evaluated for glass type.

During winter operations:

- All tracked equipment working around bodies of water must have ice lugs installed.
- If the equipment does not have ice lugs installed, then sand or other material must be placed in the work area to aid traction of the equipment.

5.1 TRAFFICABILITY ASSESSMENT

When ground conditions are unknown or when surface cracks are discovered, a trafficability risk assessment or ground constructability assessment must be conducted in conjunction with geotechnical engineer approval to complete a safe access plan. The plan must be reviewed with the area manager before starting work.

If ground conditions are well-known, then the ground characterization guide (Figure 1) may be used for guidance on the appropriate hazard mitigation.

6.0 Amphibious Equipment

6.1 AMPHIBIOUS EXCAVATORS

Amphibious excavators are used in tailings to support dredging operations, sampling activities, pipeline construction, wildlife management and vegetation control. This work can be done safely, but controls must be put in place to mitigate the risk of capsizing and operator entrapment:

- An engineered stability assessment should be completed before use on fluids.
- When operating in fluids, all engineered controls from the stability assessment should be employed, and the cab door latched open. The cab door may be latched shut for breaks, but only when all functions are idle.
- When operating in fluids, the operator should have access to, and be competent in the use of an emergency air supply (Spare-Air or Emergency Underwater Breathing Apparatus (EUBA)).
- Manually inflatable PFDs should be worn inside closed cab equipment.
- Underwater egress training for operators is strongly encouraged.
- A system or process for monitoring pontoon integrity is strongly encouraged.
- Operations in water deeper than the draft of the pontoons should be avoided.

Note: The term “fluids”, is used to describe water and slurries of soil and water. Fluids have insufficient bearing capacity to support the amphibious excavator, instead relying on the buoyancy of the pontoons.

6.2 AMPHIBIOUS ALL-TERRAIN VEHICLES

Amphibious all-terrain vehicles (ATV) are used in tailings for the transportation of personnel and equipment. For clarity, brands such as Argo, Fat Truck, Sherp, HydraTrek, and Mudd-Ox would be considered Amphibious ATVs for the purpose of this standard. Because of their amphibious design, these ATV's enable travel on most ground characterizations and offer protection to passengers in an ice failure scenario. Recommended controls:

- Before departure, a pre-use inspection should be completed. If the unit's amphibious features are being relied upon for travel in water, or as a risk mitigation for personnel safety when working on soft ground, the pre-use inspection should also:
 - Verify that the GVW does not exceed the manufacturer's recommended maximum
 - Verify that the buoyant elements of the vehicle are sound
 - Verify that drain plugs are installed
- Ensure a means of equally capable backup is available should the equipment get stuck or suffer a mechanical breakdown.

When used over fluids, controls should be in place to address the risk of vehicle submersion.

7.0 Personal Protective Equipment

7.1 COMMUNICATION DEVICES

A communication device must be available so workers can contact emergency response and site personnel. All vessels, regardless of location, must always have an effective and functional means to communicate with onshore personnel. Examples include but are not limited to:

- Cell phone
- Radio
- Marine radio (VHF)

7.2 LIFE JACKETS & PERSONAL FLOTATION DEVICES

Life jackets and personal flotation devices (PFDs) are personal protective equipment to protect workers from drowning. Life jackets are designed to keep an unconscious person face-up in the water. PFDs provide buoyancy to keep a worker's head above water but may not right an unconscious worker. Life jackets can be bulky and create ergonomic hazards while working, therefore, legislation allows workers to wear a PFD while working on a vessel for an extended period, subject to life jackets being available on the vessel. Life jackets and PFDs come in multiple styles, each with unique applications and limitations.

BOUYANCY	LIFE JACKET OR PFD	ACTIVATION	TYPICAL USE
Intrinsically buoyant	Both	N/A	General duties, all weather
Manual inflate	PFD only	Pull Cord	Below deck, cab of equipment
Auto inflate	Both	Submersion	General duties, fair weather

All life jackets and PFDs must be inspected, adjusted and worn as per the manufacturer’s instructions and must meet applicable regulations. It is advisable to have a sound signalling device (pea-less whistle) securely attached to the front of the PFD/Lifejacket and accessible to the user.

A life jacket or PFD must be worn where there is a foreseeable danger that a worker could be exposed to the hazard of drowning.

A hazard of drowning exists to workers when:

- Working within 5 m of an unprotected water’s edge.
- Working on a vessel.*
- A risk assessment deems it necessary.

* Life jackets and PFDs are both manufactured with auto inflate technology. However, Alberta legislation only permits the use of intrinsically buoyant life jackets.

All bodies of water must have appropriate and clearly visible signage at the main access points warning of the hazard of drowning. Signage must clearly state, for example, “OPEN SUMP” or “WATER HAZARD”. Required PPE must also be posted (double hearing protection, life jacket, etc.).

A lifebuoy must be present at all bodies of water where the hazard of drowning exists. Lifebuoys must be at least 61 cm (24 in) in diameter and have a Transport Canada approval stamp. Each lifebuoy must be attached to a buoyant line of not less than 15 m in length, which must be securely fixed and be kept in good condition as per manufacture specifications. In remote areas without lifebuoys throw bags are acceptable.

7.3 SPECIALIZED EQUIPMENT FOR CONSIDERATION - AS IDENTIFIED IN A RISK ASSESSMENT

7.3.1 FALL PROTECTION



An appropriate fall protection system may be considered and secured to an appropriate anchor, in conjunction with a life jacket or PFD when there is potential for workers to fall into water/be exposed to the hazard of drowning by falling from a location other than a vessel, e.g., a dredge.

Example of a life jacket with fall arrest attachment

7.3.2 THERMAL PROTECTION SUITS (TPS)

This type of PFD provides wearers with a high degree of safety if they fall overboard. The additional buoyancy makes it easier to stay afloat with little or no effort.

If the water is cold (i.e., less than 15 C), the TPS is superior because it gives the body a chance to recover from cold shock. Cold shock is the initial gasping and shallow, rapid breathing that occurs immediately after immersion in cold water. The buoyancy provides protection against the rapid failure in swimming ability that develops due to exhaustion and cold limbs.

Thermal protection suits are PFDs that have added thermal protection to delay the onset of hypothermia if in the water for an extended period. If working around cold water, a hazard assessment must be done to determine if a thermal protection suit is required.

		
Immersion Suit	Anti-Exposure/Survival Suit	Flotation Coat

8.0 Marine Specific Training

All employers are required to ensure adequate training and competencies, including compliance with applicable regulations and site requirements.

When following the Transport Canada guidelines which are based on the size and classification of the vessel.

Examples of specific training include, but not limited to:

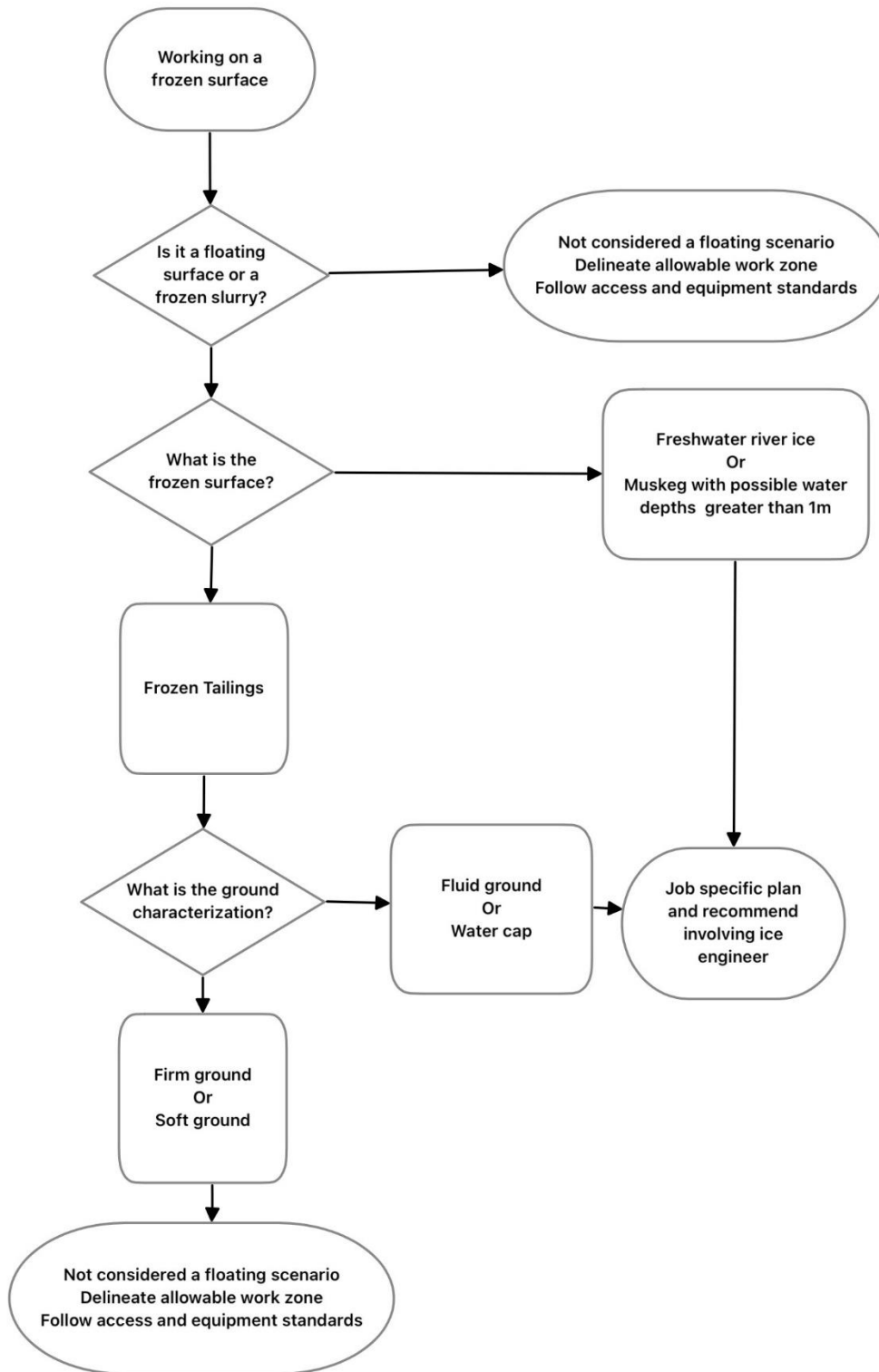
- Vessel competency
- Person overboard training
- Small domestic vessel basic safety (SDVBS) (formerly MEDA3)
- Marine basic first aid
- Pleasure craft operating card (PCOC)
- Small vessel operating proficiency (SVOP)

9.0 Emergency Response Preparedness

The work site should have an Emergency Response Plan that complies with the Alberta Occupational Health and Safety Code (OHS). including but not limited to the following components:

- Identification of potential emergencies.
- Procedures for dealing with the emergencies.
- Procedures for rescue and evacuation.
- Identification of emergency responders and evacuation workers.
- Identification, location and operational procedures for emergency equipment and PPE for rescue and evacuation workers.
- Based upon emergency response times, evaluate first aid requirements.
- Emergency response training requirements.

Appendix A: Ground Assessment Guide



Appendix B: Glossary

TERM	DESCRIPTION
Body of water	Any location where water flows or is present and the hazard of drowning exists.
Extended period of time	A time duration of one hour or more.
Established beach	Tailings sands, beaches and dyke/dyke structures.
Fluids	Water and slurries of soil and water. Fluids have insufficient bearing capacity to support the amphibious excavator, instead relying on the buoyancy of the pontoons.
Freeboard (marine vessel)	The distance between the water and the working deck of the vessel.
Hazard of drowning	A situation or condition where a worker may succumb to death by being suffocated by water or other liquid.
Life jacket	Designed for wear when abandoning a vessel in an emergency. They generally provide more buoyancy and give the wearer more freeboard (distance between the mouth and the water) by inclining the person onto their back to keep their mouth and nose further from the water.
Mobile equipment	Any equipment capable of moving under its own power or of being pulled or carried and not intended to be secured to land or a structure.
Navigable water	A body of water used by vessels, including a canal or any other water body created or altered as a result of construction of any work.
Non-water capped tailings	Fluid like tailings or other mining waste with limited water cover.
Passenger	For the purpose of this code of practice, anyone on a vessel except: <ul style="list-style-type: none">• The captain• A member of the crew
PCOC	Pleasure Craft Operator Card. Generally required for pleasure crafts, but also required for operating vessels for commercial use in non-navigable waters.

Personal floatation device	For use when over-water or in full-float situations. Designed for comfort and <i>constant wear</i> . As a result, most models provide less buoyancy than life jackets and will not roll wearers face up or incline them onto their backs. The wearer must be able to move arms and legs to avoid rolling forward.
Small vessel	Small passenger vessels (non-pleasure craft) operated for commercial purposes and which range from 0 to 150 gross tons.
Soft deposits	Uncompacted sand or areas of wet and loose soil, with insufficient water for any vessel.
Steeply sloped ground	Ground sloped in a manner that would prevent a worker/equipment from stopping momentum before reaching the water's edge if the worker was to slip.
Survival suit / immersion suit	Suits that provide the best protection from cold and exposure in the water as long as they are transport Canada approved.
SVOP	Small Vessel Operator Proficiency. A course that provides training specific to the operation of vessels, with practical assessments and examinations.
Trafficability	The ability of a piece of equipment to travel across a tailings deposit. Specific equipment has specific ground pressure requirements.
Unprotected water's edge	The absence of berms, barricades, handrails and midrails or other adequate form of protection to separate the worker from the water within 5m of the water's edge.
Vessel	Any on-water vessel propelled by machinery. Barges and dredgers are not deemed to be vessels.

Appendix C: References

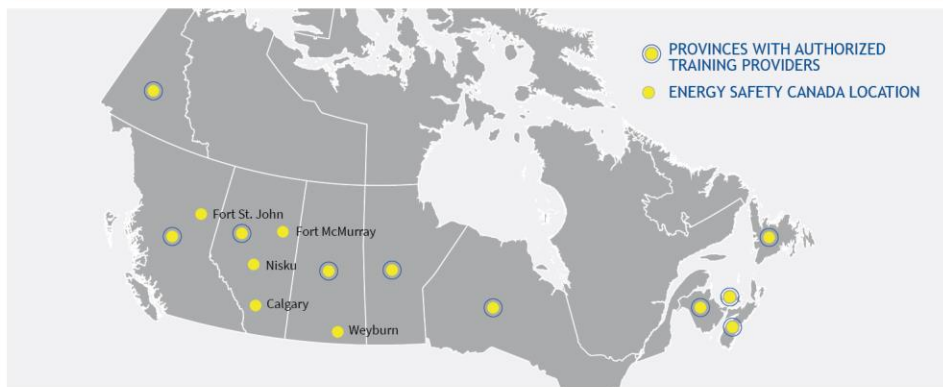
- [Best Practice for Building and Working Safely on Ice Covers in Alberta](#)
- Canada Shipping Act - <https://laws-lois.justice.gc.ca/eng/acts/c-10.15/>
- Canada Marine Act - <https://laws-lois.justice.gc.ca/eng/acts/C-6.7/>
- Marine Personnel Regulations - <https://laws-lois.justice.gc.ca/eng/regulations/sor-2007-115/>
- Navigable Waters Works Regulations - https://laws-lois.justice.gc.ca/eng/regulations/C.R.C.,_c._1232/page-1.html#h-499646
- Collision Regulations - https://laws-lois.justice.gc.ca/eng/regulations/c.r.c.,_c._1416/page-1.html
- Small Vessel Compliance Program - <https://www.tc.gc.ca/en/programs-policies/programs/small-vessel-compliance-program.html>
- Vessel Fire Safety Regulations - <https://laws-lois.justice.gc.ca/eng/regulations/SOR-2017-14/index.html>
- Construction Standards for Small Vessels - <https://www.tc.gc.ca/eng/marinesafety/tp-tp1332-menu-521.htm>
- Alberta OHS Act, Regulation and Code - <https://www.alberta.ca/ohs-act-regulation-code.aspx>
- Marine First Aid Training - <https://www.redcross.ca/training-and-certification/course-descriptions/workplace-and-corporate-first-aid-courses/marine-advanced-first-aid>
- Marine operation Training - <https://marinetrainingbc.com/>
- All Marine Specific Regulations - <https://www.tc.gc.ca/eng/marinesafety/rsqa-marine-regs-3129.htm>

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