
WORKER PROTECTION IN MOBILE EQUIPMENT NEAR WATER



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CHIEF AUDITOR'S REMARKS

In accordance with section 2.6 of the *Mines Act*, I am pleased to share the report for the following audit: *Worker Protection in Mobile Equipment Near Water*.

Prompted by previous incidents at B.C. mines, this audit examined existing regulatory requirements and actions by the Ministry of Energy, Mines and Low Carbon Innovation (the Ministry) related to protecting workers operating mobile equipment near water. The audit generated three recommendations, all of which have been accepted by the Ministry.

I would like to thank the audit team for their time and dedication to this audit. In addition, I would like to thank Ministry staff and the First Nations Energy and Mining Council for sharing their knowledge and providing feedback throughout the audit process. I am also appreciative of the support and expertise provided by Bill Kessels with EY to help ensure our work aligns with audit best practice.

Finally, the audit benefited from the assistance of staff and members from the Association for Mineral Exploration, the British Columbia Stone, Sand & Gravel Association, the Mining Association of British Columbia and the United Steelworkers. These groups helped us understand the perspectives of the mining industry and workers in B.C. in relation to the audit subject matter.



Karina Sangha
Chief Auditor

Audit Snapshot

Why this audit was conducted

- ▶ Between 2000 and 2020, there were five water-related fatalities involving mobile equipment at B.C. mines. These deaths accounted for more than 20% of all mining-related fatal incidents in the province over this period.
- ▶ The loss of these workers points to the high-risk nature of operating mobile equipment near water and the importance of ensuring effective regulation in these settings by the Ministry of Energy, Mines and Low Carbon Innovation (the Ministry).

Objective

To determine whether the Ministry's regulatory requirements and actions protect workers from undue risks to their health and safety when operating mobile equipment near water.

What was found

The findings and recommendations from this audit fall into four areas: regulatory requirements, compliance and enforcement, incident data management, and outreach and education.

REGULATORY REQUIREMENTS

- ▶ The Ministry has regulatory requirements in place to support worker protection in mobile equipment near water. The audit focused on four sections of the Health, Safety and Reclamation Code for Mines in B.C. (the Code): section 3.3.3 (Drowning Hazard), sections 1.11.1 and 1.11.2 (Training) and section 4.1.4 (Access to Work Areas).
- ▶ These provisions may be subject to differing interpretations, and the Ministry does not have supporting guidance to clarify their intent or application.
- ▶ While the Code is aligned with most other Canadian jurisdictions in its requirements for access, egress and alternate escape, other Canadian jurisdictions generally have more detailed or comprehensive requirements related to training and working near or on water.

RECOMMENDATION 1

The Ministry should explore opportunities to strengthen current regulatory requirements to support the protection of workers operating mobile equipment near water, including:

- ▶ Reviewing existing regulatory requirements in consideration of clarity and common elements in other Canadian jurisdictions
- ▶ Revising the requirements, as necessary
- ▶ Supporting the consistent interpretation and application of these requirements

COMPLIANCE AND ENFORCEMENT

- ▶ The Ministry is meeting its inspection goals related to mobile equipment.
- ▶ Inspectors of Mines are issuing orders for remedial action in relation to the Code provisions considered in this audit.

INCIDENT DATA MANAGEMENT

- ▶ To inform the audit objective and approach, the audit team examined 122 non-fatal incidents involving mobile equipment between 2000 and 2020. The team could not locate investigation reports for more than 50% of these incidents.
- ▶ New Ministry systems and processes introduced since 2019 may help address these deficiencies going forward.

RECOMMENDATION 2

The Ministry should review its current systems and processes to determine whether they are resulting in the effective management of incident data and take action to address any noted challenges.

OUTREACH AND EDUCATION

- ▶ The Ministry has developed processes, systems and tools to learn from and communicate about past incidents.
- ▶ There is a lack of clarity regarding the use and distribution of the Ministry's outreach and education tools, and some communications have included information that may create or contribute to confusion about current Code requirements.

RECOMMENDATION 3

The Ministry should develop a clear, consistent approach to using and distributing its outreach and education tools and ensure all communications are aligned with the Code.

Conclusion

The Ministry has regulatory requirements in place to support the protection of workers operating mobile equipment near water. In terms of Ministry actions, the Ministry is inspecting mobile equipment and has developed processes, systems and tools to learn from and communicate about past incidents, including water-related incidents involving mobile equipment.

The audit team also identified areas for improvement. Some of the Code provisions considered in this audit lend themselves to differing interpretations, and a comparison with other Canadian jurisdictions highlights opportunities to strengthen current requirements. In addition, the audit team found gaps in the Ministry's incident data and a lack of clarity related to the Ministry's outreach and education efforts. Unaddressed, these matters may impact the Ministry's effectiveness in protecting workers from undue risks to their health and safety when operating mobile equipment near water.

LIST OF ABBREVIATIONS

Act	<i>Mines Act</i>
Chief Inspector	Chief Inspector of Mines
Code	Health, Safety and Reclamation Code for Mines in British Columbia
Inspector	Inspector of Mines
MERP	Mine Emergency Response Plan
Ministry	B.C. Ministry of Energy, Mines and Low Carbon Innovation
PPE	Personal protective equipment
PFD	Personal flotation device

INTRODUCTION

Mining operations in British Columbia of all types and sizes use mobile equipment to manipulate and move materials. Common types of mobile equipment found on mine sites include dozers, loaders, excavators, haul trucks, shovels, graders, drills and forklifts.

Most mobile equipment has an operator cab from which a worker controls the machine. These cabs can take different forms, but most cabs are designed and built with similar safety features, including a primary entry and exit, alternate or emergency escape, rollover protection, protection from falling objects, seatbelts and windows.



When operating mobile equipment on a mine, workers may encounter a range of hazards, including water. Mobile equipment is regularly used to construct and maintain water structures on mines, ranging from small water collection sumps to kilometres-long tailings storage facilities. Working near or on water is unavoidable in these circumstances.

Water-related incidents involving mobile equipment on mine sites are infrequent, but when they occur, the consequences can be devastating. Between the years 2000 and 2020, there were 15 incidents¹ at B.C. mines where mobile equipment broke through ice, rolled into water or the operator fell into water. In five of these incidents, the operators died from drowning, accounting for more than 20% of all mining-related fatal incidents in B.C. over this period.

Based on records held by the Ministry of Energy, Mines and Low Carbon Innovation (the Ministry), there were potential breakdowns in incident prevention, preparedness and response among these 15 incidents. Hazard identification, assessment and mitigation were noted as deficient in multiple cases. Some records also pointed to

¹ For the purposes of this audit, an incident refers to any occurrence on a mine site that must be reported to the Ministry under sections 1.7.1 to 1.7.3 of the Health, Safety and Reclamation Code for Mines in B.C.

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inadequate operator training or challenges with equipment exits, including one incident where the alternate escape from the operator cab was unusable. In each of the incidents where emergency response was required, rescue efforts were unsuccessful.

Given the high-risk nature of operating mobile equipment near water, the Mine Audits Unit conducted this audit to determine whether there are any opportunities for the Ministry to improve its regulatory program and better support the protection of workers in these settings.

Audit Objective and Approach

The objective of this audit was to determine whether the Ministry’s regulatory requirements and actions protect workers from undue risks to their health and safety when operating mobile equipment near water.²

In B.C., the health and safety of mine workers is regulated under the [Mines Act \(the Act\)](#) and the [Health, Safety and Reclamation Code for Mines in B.C. \(the Code\)](#). One of the stated purposes of the Code is to “Protect employees and all other persons from undue risks to their health and safety arising out of or in connection with activities at mines.”

The Ministry is responsible for administering the Act and the Code. This responsibility includes:

- ▶ Overseeing regulatory development and review
- ▶ Promoting, verifying and enforcing mining sector compliance with regulatory requirements
- ▶ Conducting outreach and education activities to help prevent worker incidents
- ▶ Ensuring continuous improvement and accountability in the Ministry’s regulation of the mining sector

In answering the audit objective, the audit team examined relevant Code requirements to determine whether they are clear and aligned with comparable regulations in other Canadian jurisdictions.

The audit team also reviewed the Ministry’s actions to determine whether the Ministry is regularly verifying and enforcing compliance with relevant Code requirements and whether the Ministry has processes, systems and tools in place to identify and communicate learnings from past incidents, including water-related incidents involving mobile equipment.

The audit focused on the following sections of the Code, each of which deals with subject matter related to protecting workers in mobile equipment near water:

- ▶ Section 3.3.3 (Drowning Hazard)
- ▶ Sections 1.11.1 and 1.11.2 (Training)
- ▶ Section 4.1.4 (Access to Work Areas)

For the purposes of this audit, mobile equipment refers to self-propelled vehicles that operate on wheels or tracks and that are designed to manipulate or move materials. Autonomous or remotely controlled equipment was not considered in the audit because workers generally operate these types of equipment at a safe distance from water.

The audit team relied on the following sources of information for the audit:

- ▶ The Code (2021)
- ▶ Regulatory documents from other Canadian jurisdictions
- ▶ Ministry records of incidents (2000-2020)

2 The objective for this audit was revised after the [Terms of Reference](#) was published on the Mine Audits Unit’s website in April 2020. This revision is documented in an addendum to the Terms of Reference.

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- ▶ Ministry data on mobile equipment inspections, including inspection frequencies, observations, orders, warnings and advisories (2018-2020)
- ▶ Ministry operational policies, including Compliance & Enforcement Policy (2020), Inspection Procedures (2009), Mines Act Order Writing Procedure (2019) and Incident Management Process (2021)
- ▶ Annual Reports of the Chief Inspector of Mines (2015-2020)
- ▶ Ministry Service Plans (2015-2020)
- ▶ Ministry outreach and education publications (available or referenced on the Ministry's website as of May 18, 2021)
- ▶ Engagement with current and previous Inspectors of Mines, industry, labour unions and equipment manufacturers
- ▶ A survey of industry and workers on current regulatory requirements and related mine practices

Examples are provided throughout this report to support the audit conclusion and recommendations. These examples are provided for illustrative purposes and are not intended to be an exhaustive detailing of the information considered by the audit team.

AUDIT CONCLUSION

The Ministry has regulatory requirements in place to support the protection of workers operating mobile equipment near water. In terms of Ministry actions, the Ministry is inspecting mobile equipment and has developed processes, systems and tools to learn from and communicate about past incidents, including water-related incidents involving mobile equipment.

The audit team also identified areas for improvement. Some of the Code provisions considered in this audit lend themselves to differing interpretations, and a comparison with other Canadian jurisdictions highlights opportunities to strengthen current requirements. In addition, the audit team found gaps in the Ministry's incident data and a lack of clarity related to the Ministry's outreach and education efforts. Unaddressed, these matters may impact the Ministry's effectiveness in protecting workers from undue risks to their health and safety when operating mobile equipment near water.

Audit Discussion and Recommendations

This report presents the key findings and recommendations from the audit in two sections. [Section 1](#) discusses the regulatory requirements considered in this audit. [Section 2](#) discusses the Ministry's compliance verification, enforcement, and incident learning and education activities.

1. Regulatory requirements

The Code establishes regulatory requirements for the protection of workers at mines in B.C. Most of the requirements related to the safe operation of mobile equipment can be found in Parts 1-4 of the Code.

Section 3.3.3 of the Code outlines what is required when workers are exposed to drowning risks, including the circumstances in which workers must be provided with and must wear personal flotation devices (PFDs).³ In addition, this section requires the mine manager to ensure life buoys are readily available when workers are required to work near or on water.

While more general in their application, other Code provisions also support worker protection when near water. Worker training can play a key role in incident prevention, preparedness and response by ensuring mobile equipment operators understand their working environment and the safe operation of their equipment. Section 1.11.1 requires the mine manager to ensure workers are adequately trained and receive instruction in safe work practices. Section 1.11.2 requires the mine manager to maintain training records.

In emergency scenarios involving water, mobile equipment operators may need to quickly exit their cabs to get to safety. Section 4.1.4 of the Code requires the mine manager to ensure that all places where work is performed have safe means of entering and exiting, including an alternate means of escape (if necessary). This section also requires emergency exits to be clearly marked and to allow for a quick and unimpeded exit.

Table 1 provides the full text of the Code provisions considered in this audit.

³ Code section 3.3.3(2) prescribes PFDs that conform to CAN/CGSB-65.7-M88. However, this standard sets out specifications for inherently buoyant life jackets; PFDs are considered under a different standard from the Canadian Government Specifications Board (CAN/CGSB-65.11-M88). To avoid confusion, this report refers to the personal protective equipment required under section 3.3.3(2) as PFDs, consistent with the language in the Code.

TABLE 1: RELEVANT CODE PROVISIONS

Drowning Hazard	<p>3.3.3</p> <p>When persons are required to work or be near water, where drowning could be a risk</p> <p>(1) the manager shall provide, at conspicuous locations, life-buoys equipped with heaving lines of adequate length which conform with Ministry of Transport (Canada) standards, and</p> <p>(2) if the person is required to work alone at these sites or be transported across water that person shall be provided with and shall wear a personal floatation device conforming to Canadian Government Specifications Board Standard CAN/CGSB-65.7-M88.</p>
Training	<p>1.11.1</p> <p>The manager shall ensure that</p> <p>(1) workers are adequately trained to do their job or are working under the guidance of someone who has competency both in the job and in giving instruction, and</p> <p>(2) ensure that all employees receive thorough orientation and basic instruction in safe work practices.</p> <p>1.11.2</p> <p>The manager shall maintain a record of all training workers and supervisors have received, and make this record available to an inspector upon request.</p>
Access to Work Areas	<p>4.1.4(1) and (3)(a)</p> <p>(1) The manager shall ensure that all places where work is performed have safe means of access and egress and if necessary an alternate means of escape appropriate to the conditions of the work, and workers shall not use any other means that are, or may be, hazardous.</p> <p>(3) (a) Emergency exits shall be clearly marked and designed to provide quick and unimpeded exit.</p>

The audit team found that these Code provisions may be subject to differing interpretations, and the Ministry does not have supporting guidance to clarify their intent or application ([section 1.1](#)). Additionally, the audit team found that the Code is aligned with most other Canadian jurisdictions in its requirements for access, egress and alternate escape; however, other Canadian jurisdictions generally have more detailed or comprehensive requirements related to training and working near or on water ([section 1.2](#)).

Overall, the findings outlined in sections 1.1 and 1.2 of this report suggest there are opportunities to strengthen the Code provisions considered in this audit to support the protection of workers operating mobile equipment near water.

1.1 CLARITY

The Code provisions considered in this audit contain unclear language that may lead to confusion regarding their application, both generally and in the context of mobile equipment. A lack of clarity can make it difficult for Inspectors of Mines (inspectors), industry and workers to have confidence that their actions are consistent with regulatory intent. In addition, if a Code requirement is unclear, the Ministry may be challenged to enforce a specific interpretation.

For example, Code section 1.11.1 requires the mine manager to ensure that “workers are adequately trained to do their job” and that “all employees receive thorough orientation and basic instruction in safe work practices.” Without a definition or metric to articulate “adequately trained,” “thorough” or “basic,” it is not clear what mine managers should do to achieve compliance with this provision or what inspectors should look for to verify compliance. A

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similar challenge occurs with Code section 4.1.4(1), which requires an alternate means of escape “if necessary.” Without clear terms, various parties using the Code may have different, potentially conflicting, interpretations of this language.

The clarity of Code section 4.1.4 is further complicated by the organization of the Code, which makes it unclear whether or how this section applies to mobile equipment. Section 4.1.4 is located under the heading “Buildings – General,” and although subsection (1) sets requirements for “all places where work is performed,” subsections (2) and (3) appear to be mostly focused on buildings. Generally, headers are not considered part of the enforceable or regulatory language of the Code, but they do play an important role in the accessibility and navigation of the requirements.

The audit team conducted an online survey of industry representatives and workers regarding the clarity of these Code provisions. Despite the potential issues with clarity noted above, nearly all respondents indicated that Code section 1.11.1 is either “clear” or “very clear.” However, when asked what training is provided to mobile equipment operators on their mine sites, the answers varied, suggesting differing interpretations about how to apply Code section 1.11.1 in the context of mobile equipment.

In some cases, regulators may opt to add clarity to regulatory requirements through guidance materials. Guidance may not be enforceable under the regulatory framework, but it can help achieve a consistent interpretation and application of regulatory requirements. The Ministry does not currently have guidance related to interpreting or applying the Code provisions considered in this audit.

1.2 ALIGNMENT WITH OTHER JURISDICTIONS

The audit team compared the Code provisions considered in this audit to those in other Canadian jurisdictions, including Alberta, Manitoba, Newfoundland and Labrador, Northwest Territories and Nunavut,⁴ Ontario, Quebec, Saskatchewan and Yukon. The audit team also included WorkSafeBC in the comparison given their role as the health and safety regulator for most non-mining workplaces in B.C. For more information about this comparative analysis, please see the [appendix](#) to this report.

The comparative analysis indicated that other Canadian jurisdictions have more detailed requirements for training relative to the Code. More than half of the jurisdictions examined prescribe minimum training content for workers, either by listing the items on which all workers must be trained or by prescribing certain training programs. In addition, all of the jurisdictions reviewed expressly require training for mobile equipment operators. Two-thirds require workers to demonstrate competency and/or to be authorized by their employer or supervisor before independently operating mobile equipment.

Results from the audit survey of industry and workers indicated that 67% of respondents have mobile equipment-specific training and 92% have competency assessments in their training programs. Between 2018 and 2020, 37 orders issued by inspectors in relation to Code sections 1.11.1 or 1.11.2 required mine managers to provide workers with training specific to mobile equipment and/or to maintain records of such training. These actions suggest the importance of mobile equipment-related training to worker health and safety.

It should be acknowledged that, while other jurisdictions have more detailed training requirements, the Code is among a minority in requiring the mine manager to maintain training records. Only 44% of the examined jurisdictions expressly require worker training records to be kept or maintained.

⁴ For the purposes of this audit, the Northwest Territories and Nunavut were considered as a single jurisdiction because occupational health and safety in both territories is overseen by the same regulatory body, namely the Workers' Safety and Compensation Commission.

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The comparative analysis also revealed that other jurisdictions generally have more comprehensive requirements related to working near or on water. Code section 3.3.3 is aligned with the jurisdictions examined in requiring buoyant personal protective equipment (PPE) when a worker is at risk of drowning. However, while more than 75% of the jurisdictions reviewed require buoyant PPE whenever a worker is at risk of drowning unless certain conditions are met, Code section 3.3.3(2) is limited to when workers are working alone near a drowning hazard or being transported across water.

Two-thirds of the jurisdictions reviewed require mines to develop rescue procedures and/or ensure trained rescue personnel when a worker is at risk of drowning, with most also setting out specific rescue resources that must be maintained on site (e.g., rescue boats, life buoys). Code section 3.3.3(1) requires life buoys, but it does not address rescue procedures, trained personnel or other equipment.

Plans or procedures for water-based rescue may be captured by Code section 3.7.1, which requires the mine manager to develop a Mine Emergency Response Plan (MERP). Two hazard alerts published by the Chief Inspector of Mines (Chief Inspector) in 2020⁵ recommend that mines ensure their MERP is adequate for emergency responses involving water, but the Ministry's [Mine Emergency Response Plan Guidelines \(2017\)](#) do not include specific considerations for water-based rescue.

Finally, the Code takes a similar approach to other jurisdictions in its requirements for access, egress and alternate escape. Like Code section 4.1.4, most of the jurisdictions reviewed have requirements for access, egress and alternate escape that apply broadly to any place where work is performed, with only two jurisdictions setting requirements specific to mobile equipment. Given some of the clarity issues with Code section 4.1.4 discussed above, it is worth noting that many of these jurisdictions are clear that their general provisions for access, egress and alternate escape apply to mobile equipment.⁶

In summary, while the Code is aligned with most other Canadian jurisdictions in its requirements for access, egress and alternate escape, the other jurisdictions examined generally have more detailed or comprehensive requirements for training and working near drowning hazards. The audit did not include a performance assessment of the other jurisdictions; as a result, the audit team did not examine whether other jurisdictions' requirements have contributed to better outcomes for workers relative to the Code. However, this discussion does point to common elements across Canadian jurisdictions and highlights opportunities to strengthen the Code.

RECOMMENDATION 1: Regulatory requirements

The Ministry should explore opportunities to strengthen current regulatory requirements to support the protection of workers operating mobile equipment near water, including:

- ▶ Reviewing existing regulatory requirements in consideration of clarity and common elements in other Canadian jurisdictions
- ▶ Revising the requirements, as necessary
- ▶ Supporting the consistent interpretation and application of these requirements

⁵ These two hazard alerts refer to [Excavators on Mine Sites \(2020\)](#) and [Dozers on Mine Sites \(2020\)](#).

⁶ Most of the jurisdictions examined require safe access, egress and alternate escape from a "work site" or "workplace." Many of these jurisdictions include mobile equipment in their definitions for these or related terms.

2. Ministry actions

In addition to the regulatory requirements, Ministry actions can also play an important role in supporting worker protection on mine sites. As the regulator, the Ministry is responsible for verifying mining sector compliance with existing requirements and taking enforcement action, as necessary. The Ministry also receives and maintains incident data from the B.C. mining sector. The Ministry can use that data to identify and communicate health and safety learnings to help address hazards and prevent incidents.

The audit team found that the Ministry is meeting its inspection goals related to mobile equipment, and Ministry inspectors are issuing orders for remedial action in relation to the Code provisions considered in this audit ([section 2.1](#)).

The audit team also found that the Ministry has developed processes and systems to learn from and communicate about past incidents related to operating mobile equipment near water ([section 2.2](#)). However, the Ministry's incident learning and education efforts may be hindered by data limitations and a lack of clarity regarding the use and distribution of its outreach and education tools. Previous outreach and education publications have also included information that may create or contribute to confusion about current Code requirements.

2.1 COMPLIANCE VERIFICATION AND ENFORCEMENT

Ministry inspectors are responsible for promoting, verifying and enforcing mining sector compliance with the Act and the Code. The Ministry's general expectations for its inspectors are set out in the [Compliance & Enforcement Policy \(2020\)](#). The Ministry does not set specific targets for inspections involving mobile equipment, but the Ministry's Inspection Procedures (2009) indicate that all inspectors should evaluate "machine and equipment use."⁷

The audit team found that, since 2015, the Ministry has met or exceeded its annual inspection targets (Table 2).

TABLE 2: COMPARISON OF ANNUAL INSPECTIONS WITH MINISTRY TARGETS

Year	2015	2016	2017	2018	2019	2020
Inspection Target ^a	1200	1250	1300	1325	1350	1550
Inspection Actual ^b	1203	1345	1308	1335	1733	1852 ^c

a From [Annual Ministry Service Plans](#)

b From [Annual Reports of the Chief Inspector](#); totals include both field and office-based inspections

c Annual Reports of the Chief Inspector switched to fiscal year accounting in 2020/21; total accounts for inspections from April 1, 2020 to March 31, 2021 and includes COVID Protocol Checks

Available data also suggests inspectors are regularly examining mobile equipment during their inspections. Between 2018 and 2020, inspectors included an order, warning or advisory⁸ related to mobile equipment in at least 21% of inspections. The proportion of inspections that considered mobile equipment over this period is likely higher because orders, warnings and advisories only show instances where issues were identified.

⁷ In addition to the 2009 Inspection Procedures, the Ministry also has a more recent Mine Inspection Procedure from 2018. Though no longer widely used, the audit team understands that the 2009 procedure is still in effect and used by some technical disciplines in the Ministry. As the 2018 procedure does not contain any inspection objectives related to mobile equipment, the audit team relied on applicable objectives in the 2009 procedure for this audit.

⁸ Orders, warnings and advisories are defined in the Ministry's Compliance & Enforcement Policy.

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Over 30% of orders issued by inspectors between 2018 and 2020 under Code sections 1.11.1 and 1.11.2 (Training) were related to mobile equipment. While this data indicates that inspectors are applying training provisions in the Code in relation to mobile equipment, many of these orders prescribed actions not specified by these sections, including training specific to mobile equipment, worker competency assessments or signoff, and related records. As a result, these orders may not be aligned with the Ministry's Mines Act Order Writing Procedure (2019).

The audit team also found inspectors are issuing orders related to drowning hazards and access, egress and alternate escape in the context of mobile equipment. Between 2018 and 2020, 5% of orders issued pursuant to Code section 3.3.3 (Drowning Hazard) and 8% of orders issued pursuant to Code section 4.1.4 (Access to Work Areas) were related to mobile equipment.

Overall, the Ministry is meeting its goals related to the inspection of mobile equipment. Given the information presented in [section 1](#) of this report regarding the Code provisions considered in this audit, inspectors may be challenged to meaningfully verify and enforce compliance with these regulatory requirements. As these requirements have already been discussed in this report, further recommendations are not provided here.

2.2 INCIDENT LEARNING AND EDUCATION

As the holder of a significant volume of incident data, the Ministry should be able to identify and communicate health and safety learnings related to the operation of mobile equipment near water to inspectors, industry and workers. These learnings can help prevent similar incidents and may even support regulatory improvements. In examining the Ministry's actions in this area, the audit team considered the Ministry's available incident data, as well as the Ministry's outreach and education efforts.

2.2.1 Incident data management

When an incident occurs at a mine site, mine managers are required to notify the Ministry (Code section 1.7.1) and submit an investigation report for that incident (Code section 1.7.2). These communications are a critical source of data and information for the Ministry in identifying and responding to health and safety trends in the mining sector.

The Ministry is responsible for ensuring that incident reports are effectively filed and managed. The Ministry is also responsible for following up with mine managers on any investigation reports that have not been received.

To inform the audit objective and approach, the audit team reviewed files for 122 non-fatal incidents involving mobile equipment between 2000 and 2020. The team could not locate investigation reports for more than 50% of these incidents.

The Ministry has updated its practices for managing incident files in recent years, which may help address these deficiencies going forward. In June 2019, the Ministry modernized the tracking and storage of incident-related files through its digital information management system: Core. Additionally, in January 2021, the Ministry introduced a new policy for incident management (Incident Management Process, 2021), which outlines a process for incident file management and verifying and enforcing compliance with Code section 1.7.2.

RECOMMENDATION 2: Incident data management

The Ministry should review its current systems and processes to determine whether they are resulting in the effective management of incident data and take action to address any noted challenges.

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2.2.2 Education efforts

The audit team found that the Ministry has established processes for identifying health and safety trends and learnings based on incident data. Introduced in January 2021, the Ministry's Incident Management Process describes the role of a Review Board composed of Ministry staff to review serious incidents and help identify and track "safety-related industry trends."

Given the recent introduction of the Ministry's Incident Management Process, the audit team did not evaluate its implementation or sufficiency in detail. Though the commitment to identify and track safety trends is sound, internal Ministry procedures do not speak to whether, when or how these trends will be addressed or communicated to Ministry staff and/or the mining sector.

Despite the absence of a clear trigger for communication, the Ministry does have tools for communicating trends and learnings from past incidents. According to the Ministry's website, "The Office of the Chief Inspector of Mines publishes dangerous occurrence weekly updates, hazard alerts, health and safety notices and incident information to communicate potentially hazardous issues related to mining activity in the B.C." These publications are available on the Ministry's website, and in some cases, they have been distributed *via* email to Ministry staff and mine managers.

In reviewing the outreach and education publications available on the Ministry's website, the audit team found three hazard alerts related to the operation of mobile equipment near water:

- ▶ [Dozers on Mine Sites \(December 2020\)](#)
- ▶ [Excavators on Mine Sites \(June 2020\)](#)
- ▶ [Excavators in the Mining Industry \(August 2009\)](#)

Across these hazard alerts, the Chief Inspector has provided eight unique recommendations related to safely operating mobile equipment near water. The two hazard alerts published in 2020 also provide the reader with a list of relevant Code sections.

As written, these hazard alerts may create or contribute to confusion about what is required when operating mobile equipment near water. While the two hazard alerts published in 2020 are explicit that the list of Code sections provided is not exhaustive, they do not reference Code section 3.3.3 or 4.1.4, despite making recommendations regarding PFDs and alternate escape.

In some cases, the hazard alerts present recommendations as optional when at least some aspects may be required by the Code. For example, the two hazard alerts published in 2020 recommend the reader "Consider securing doors open and removing bush guards, barriers or other items that may impair a quick exit." Removing barriers or items that could impede a quick exit from an operator cab could be interpreted as required under Code section 4.1.4.

In one instance, the hazard alerts reviewed do not clearly align with current Code requirements. The two hazard alerts published in 2020 recommend that mines use appropriate PFDs when operating mobile equipment on or near water, noting that "buoyant PFDs may hinder an operator more than a manually activated PFD when escaping from a submerged cab." Manually activated PFDs do not meet the standard prescribed under Code section 3.3.3(2), and their use would require a variance pursuant to Code section 1.2.1.

Although the audit examination focused on hazard alerts related to operating mobile equipment near water, the audit team first reviewed the Ministry's full suite of outreach and education materials to identify those that may be in scope of the audit. Through this review, the audit team identified multiple outreach and education tools,

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including Chief Inspector's directives, hazard alerts, information letters, health & safety notices, weekly dangerous occurrence summary reports, and health & safety guidelines.

As of May 17, 2021, there was limited information on the Ministry's website, and the team was unable to locate an applicable Ministry policy, that clearly explains the differences between the Ministry's various outreach and education tools, when they will be used, or how they will be distributed. As the high-level purpose of these tools is outreach and education, the lack of clarity regarding their use may undermine the Ministry's efforts.

RECOMMENDATION 3: Outreach and education

The Ministry should develop a clear, consistent approach to using and distributing its outreach and education tools and ensure all communications are aligned with the Code.

APPENDIX: COMPARATIVE ANALYSIS

Introduction

As part of the assessment of current regulatory requirements, the audit team compared the Code provisions considered in this audit (Table A1) to similar requirements in nine other Canadian jurisdictions. This comparative analysis is discussed in section 1.2 of the audit report.

TABLE A1: RELEVANT CODE PROVISIONS

Drowning Hazard	3.3.3 When persons are required to work or be near water, where drowning could be a risk <ol style="list-style-type: none"> (1) the manager shall provide, at conspicuous locations, life-buoys equipped with heaving lines of adequate length which conform with Ministry of Transport (Canada) standards, and (2) if the person is required to work alone at these sites or be transported across water that person shall be provided with and shall wear a personal floatation device conforming to Canadian Government Specifications Board Standard CAN/CGSB-65.7-M88.
Training	1.11.1 The manager shall ensure that <ol style="list-style-type: none"> (1) workers are adequately trained to do their job or are working under the guidance of someone who has competency both in the job and in giving instruction, and (2) ensure that all employees receive thorough orientation and basic instruction in safe work practices. 1.11.2 The manager shall maintain a record of all training workers and supervisors have received, and make this record available to an inspector upon request.
Access to Work Areas	4.1.4(1) and (3)(a) <ol style="list-style-type: none"> (1) The manager shall ensure that all places where work is performed have safe means of access and egress and if necessary an alternate means of escape appropriate to the conditions of the work, and workers shall not use any other means that are, or may be, hazardous. (3) (a) Emergency exits shall be clearly marked and designed to provide quick and unimpeded exit.

Methods

Canadian jurisdictions neighbouring B.C. and/or with an established mining presence⁹ were included in the comparative analysis. The audit team also examined WorkSafeBC given their role as the health and safety regulator overseeing most non-mining workplaces in B.C.

Table A2 lists the jurisdictions selected for the comparative analysis, including their statutes and regulations relevant to the audit. The audit team last accessed and reviewed the listed statutes and regulations on December 1, 2021. Any amendments after this date have not been captured in the analysis.

⁹ All Canadian jurisdictions with at least \$1B in mineral production in 2020, as reported by [Natural Resources Canada](#).

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TABLE A2: SELECTED JURISDICTIONS AND REGULATORY FRAMEWORKS

Jurisdiction	Statute	Regulation
Alberta	<i>Occupational Health and Safety Act</i>	Occupational Health and Safety Code
British Columbia: WorkSafeBC	<i>Workers Compensation Act</i>	Occupational Health and Safety Regulation
Manitoba	<i>The Workplace Safety and Health Act</i>	Workplace Safety and Health Regulation Operation of Mines Regulation
Newfoundland and Labrador	<i>Occupational Health and Safety Act</i>	Occupational Health and Safety Regulations
Northwest Territories and Nunavut	<i>Mine Health and Safety Act</i>	Mine Health and Safety Regulations
Ontario	<i>Occupational Health and Safety Act</i>	Mines and Mining Plants Industrial Establishments Regulation
Quebec	<i>Act Respecting Occupational Health and Safety</i>	Regulation Respecting Occupational Health and Safety Regulation Respecting Occupational Health and Safety in Mines
Saskatchewan	<i>The Saskatchewan Employment Act</i>	The Occupational Health and Safety Regulations The Mines Regulations
Yukon	<i>Occupational Health and Safety Act</i>	Occupational Health and Safety Regulations

3	4—5	6	7—8	9—10	11	12—19	20—25
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The audit team searched the statutes and regulations listed in Table A2 for requirements addressing drowning hazards, training, and access, egress and alternate escape that could reasonably apply in the context of mobile equipment operation. Requirements were found using word searches related to the subject matter. For example, drowning hazard requirements were found using the words such as “water,” “drowning,” “life jacket” and “ice.” The audit team considered provisions generally applicable to all types of work on a mine and provisions specific to mobile equipment operation.

As each jurisdiction has unique circumstances that may lend themselves to unique requirements, the audit team focused their comparison on recurring regulatory themes across the jurisdictions examined. The audit team reviewed the relevant requirements from each jurisdiction and compiled a list of common regulatory elements – a requirement or type of requirement that was present in most of the jurisdictions reviewed (at least five out of nine jurisdictions, excluding the Ministry). The audit team then compared the Code against the list of common regulatory elements to determine the level of alignment between the Code and other Canadian jurisdictions.

The audit team’s comparative analysis did not include a performance assessment of each jurisdiction. As a result, this analysis should not be taken to imply that the common regulatory elements identified are needed for effective worker protection or that their absence will necessarily contribute to negative worker outcomes. What this analysis does show is themes in worker health and safety regulation and opportunities to strengthen applicable regulatory requirements in the Code.

Findings

Table A3 summarizes the common regulatory elements identified by the team, including the percentage of jurisdictions in which the element was found. Table A3 also indicates whether these elements are present in the Code, with explanatory notes.

In addition to the findings summarized in Table A3, the audit team identified three regulatory elements present in more than one jurisdiction but less than a majority, resulting in them not being identified as “common.” For completeness, these elements are summarized in Table A4, including whether they are present in the Code.

TABLE A3: COMMON REGULATORY ELEMENTS AND THE CODE

Topic	Common regulatory elements			Health, Safety and Reclamation Code for Mines in B.C.	
	Element	Description	% of Jurisdictions	Present (Yes/No)	Explanation
Drowning hazards	General				
	Drowning hazard controls	Requirement expressly addressing drowning risks and associated controls (e.g., PPE, rescue preparedness)	89%	Y	Code section 3.3.3 sets out requirements to reduce the risk of drowning.
	PPE				
	Buoyant PPE	Requirement for buoyant PPE (e.g., life jacket, PFD) when a worker is at risk of drowning	78%	Y	Code section 3.3.3(2) requires PFDs in specific circumstances (i.e., when workers are required to work alone near a drowning hazard or are being transported across water). Note: Other jurisdictions' requirements are more broadly applicable than the Code, requiring buoyant PPE whenever a worker is at risk of drowning unless other safety measures are in place and/or the PPE would be ineffective or unreasonable (e.g., water too shallow).
	Buoyant PPE standard	Requirement for buoyant PPE to meet a specific technical standard or be approved by Transport Canada or a body recognized by Transport Canada	67%	Y	Code section 3.3.3(2) requires PFDs to conform to Canadian Government Specifications Board Standard CAN/CGSB-65.7-M88. Note: As noted in footnote 3 of the audit report, the standard cited by Code section 3.3.3(2) sets parameters for inherently buoyant life jackets, not PFDs. PFDs are considered under a different standard from the Canadian Government Specifications Board (CAN/CGSB-65.11-M88).
	Rescue preparedness				
	Rescue equipment	Requirement for rescue equipment to be made available when a worker is at risk of drowning (e.g., boat with boat hook, life buoy attached to a nylon rope)	56%	Y	Code section 3.3.3(1) requires life buoys with heaving lines.
	Rescue procedures and/or trained personnel	Requirement for sites to have rescue procedures and/or personnel trained in rescue procedures when a worker is at risk of drowning	67%	N	Code section 3.7.1 requires a MERP, but the Ministry's MERP Guidelines do not include any specific considerations for water-based rescue.

TABLE A3: COMMON REGULATORY ELEMENTS AND THE CODE (CONTINUED)

Topic	Common regulatory elements			Health, Safety and Reclamation Code for Mines in B.C.	
	Element	Description	% of Jurisdictions	Present (Yes/No)	Explanation
Training	General				
	Training for all workers	Requirement for workers to receive training to protect their health and safety in the workplace	100%	Y	Code section 1.11.1 requires training for all workers.
	Minimum training content	Requirement prescribing minimum training content for workers (e.g., worker rights and responsibilities, hazards, working alone or in isolation, PPE, and emergency procedures)	67%	N	The Code does not specify minimum training content that would apply to all workers and work areas. Code section 9.3.2 specifies potential training areas (e.g., PPE, wildlife safety), but this section is specific to mineral and coal exploration activities.
	Mobile equipment training				
	Training for mobile equipment operators	Requirement that mobile equipment operators be trained and/or the content of that training	100%	N	The Code does not contain training requirements specific to mobile equipment operators.
Access, egress and alternate escape	Competency demonstration and/or authorization	Requirement for workers to demonstrate competency and/or be authorized by their supervisor or employer prior to operating mobile equipment independently	67%	N	The Codes does not require workers to demonstrate competency or receive authorization before operating mobile equipment independently.
	Access and egress	Requirement for safe access to and egress from work areas	78%	Y	Code section 4.1.4(1) addresses safe access to and egress from “all places where work is performed.”
	Alternate escape	Requirement for alternate or emergency escape from work areas	56%	Y	Code section 4.1.4(1) requires alternate escape from work areas “if necessary” and “appropriate to the conditions of the work.” Note: Other jurisdictions are generally more specific than the Code as to when alternate escape is required, such as when the worker could be isolated from the primary means of egress and/or the primary means of egress could become unusable or dangerous.

TABLE A4: OTHER REGULATORY ELEMENTS AND THE CODE

Topic	Regulatory elements			Health, Safety and Reclamation Code for Mines in B.C.	
	Element	Description	% of Jurisdictions	Present (Yes/No)	Explanation
Drowning hazards	Safe work on ice	Requirement addressing work or travel on ice, which may include testing for ice thickness before work begins, safe work procedures, training and/or rescue plans	44%	N	The Code does not contain requirements specific to working or travelling on ice.
Training	Training records	Requirement to keep records of worker training or orientation	44%	Y	Code section 1.11.2 requires training records for workers and supervisors to be maintained.
Access, egress and alternate escape	Alternate escape from mobile equipment	Requirement for mobile equipment with a single cab door to have an alternate escape	22%	N	The Code does not contain requirements specific to alternate escape from mobile equipment.



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