ANNUAL REPORT
TO PARLIAMENT 2018–19

Transportation Safety Board of Canada

Transportation Safety Board of Canada
Bureau de la sécurité des transports du Canada

Canada

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13 June 2019

The Honourable William Francis Morneau, P.C., M.P.
Minister of Finance and Acting President of the Queen's Privy Council for Canada
House of Commons
Ottawa, Ontario K1A 0A3

Dear Minister,

In accordance with subsection 13(3) of the *Canadian Transportation Accident Investigation and Safety Board Act*, the Board is pleased to submit, through you, its Annual Report to Parliament for the period 1 April 2018 to 31 March 2019.

Yours sincerely,

Original signed by

Kathleen Fox
Chair

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MESSAGE FROM THE CHAIR

The Transportation Safety Board of Canada's efforts to modernize its policies, processes and products continued to pay dividends for the safety of the Canadian transportation system in 2018–19.

In May 2018, we introduced a key element of our modernization efforts—our revised Policy on Occurrence Classification. This policy sets out criteria to guide decision making and priority setting for investigations, allocate resources efficiently, and help manage stakeholder and public expectations about investigations.

Under the policy, we now issue post-deployment summaries and limited-scope investigation reports for some occurrences. These are two examples—among others—that demonstrate how we have stepped up our efforts to share clear and timely information with Canadians.

As this annual report shows, these changes have allowed the TSB to complete more investigations during the year compared to 2017–18, while maintaining quality, and reducing the average time to do so.

We issued Watchlist 2018 in October to draw focussed attention on seven issues requiring government and industry action. Among these is crew fatigue, a persistent contributor to occurrences and one that requires profound cultural change within the federally regulated transportation industry.

Watchlist 2018 underlines the slow pace of progress on a number of outstanding recommendations. We witnessed improvement in some areas, and were able to close 16 of these older recommendations. However, three additional recommendations have now passed the 10-year mark, bringing the number of old outstanding recommendations to 49. Much remains to be done to adequately mitigate the safety deficiencies associated with these outstanding recommendations.

Three items—transportation of flammable liquids by rail, the need for on-board voice and video recorders in main-track lead locomotives, and unstable aircraft approaches that continue to a landing—no longer appear on the Watchlist, due to stakeholder actions and/or reductions in underlying risks. However, we continue to monitor these areas through investigations, assessment of progress achieved on active recommendations and ongoing interactions with stakeholders.

Stakeholder engagement continues to be a crucial aspect of our work, since it allows Board members and staff to connect with the people and groups best placed to effect meaningful change. This year, that included participation in a national forum on fatigue in transportation, annual conferences of aviation and rail associations, a panel on mitigating the risk of fatigue and substance abuse in the commercial fishing industry, and technical committees of the Canadian Standards Association tasked with developing new standards for the pipeline industry.

The 2019–20 fiscal year will see us move into the next phase of our modernization agenda. We will turn our attention to improving our workplaces, as well as the technology and the tools that we use for investigations, safety analysis, and project management. Our objective is to provide TSB staff with modern facilities, technologies and tools that enable them to continue delivering quality services to Canadians.

Advancing safety is all about change. The work showcased in this annual report highlights our commitment to continual improvement to ensure we remain a relevant, efficient and effective advocate for transportation safety in Canada.

Kathleen Fox

Chair

Every year, staff from the Transportation Safety Board of Canada (TSB) fan out across the country in response to accidents and incidents that occur in the aviation, marine, pipeline and rail sectors.

The TSB's seasoned investigators and technical staff assess the circumstances of these occurrences. When they determine that an investigation could help improve transportation safety, they collect data and carry out analysis in order to identify the causes and contributing factors, and highlight known and emerging safety concerns. These efforts have, since 1990, contributed to Canada's transportation system being regarded as one of the safest in the world.

In May 2018, the TSB introduced a new approach to classifying the accidents and incidents reported to it. The revised Policy on Occurrence Classification, including new limited-scope, fact-gathering investigations (class 4), is helping the TSB be more timely and effective by setting out criteria to guide decision making and set investigative priorities, and to help manage stakeholder and public expectations.

The total number of occurrences reported to the TSB under the *Transportation Safety Board Regulations* in the 2018 calendar year (3,850) was slightly more (1.4%) than the 2017 total (3,796).

After a downward trend from 2008 to 2016, the overall number of accidents reported in 2018 (1,657) was 2.5% above the 2017 level (1,615), and just above the 10-year average of 1,648.

There were fewer fatalities (115) in 2018 across all transportation sectors than in 2017 (121). This is also a 21% drop from the 10-year average of 146.

The 2,193 incidents reported to the TSB in 2018 remained roughly at the same level as that recorded in 2017 (2,181). However, the 2018 total was 31% higher than the 10-year average (1,679). This difference partly results from changes to the *Transportation Safety Board Regulations* that were introduced in July 2014.

The TSB at work

Deployments

TSB investigators deployed 79 times during the 2018–19 fiscal year (up from 68 the previous year) in response to occurrences in all sectors. These deployments took staff from the TSB regional offices and Head Office to locations across the country.

FIGURE 1. Transportation occurrences reported to the TSB, 2008 to 2018

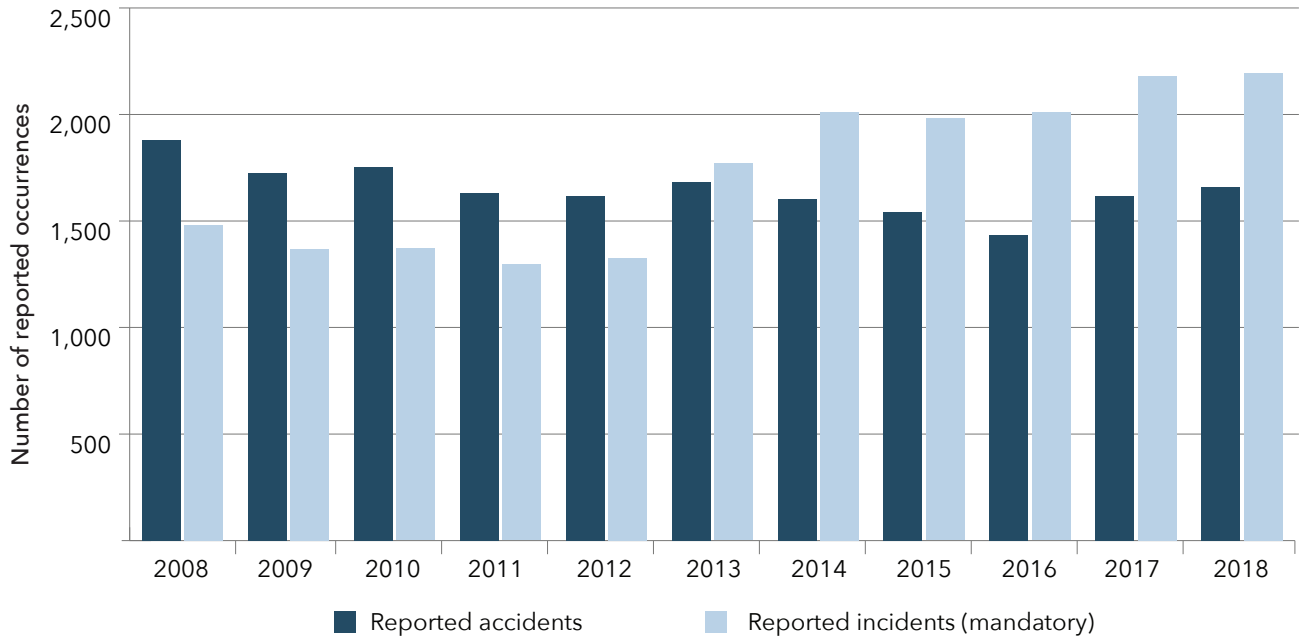
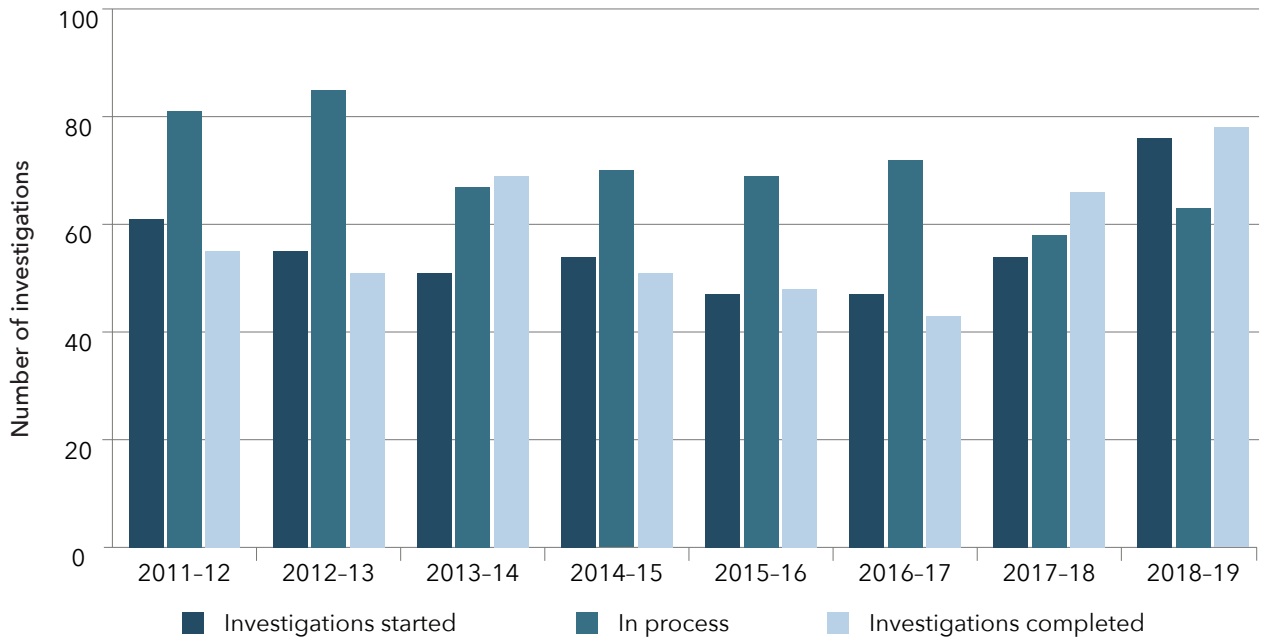


FIGURE 2. TSB caseload, 2011–12 to 2018–19



Investigations

In 2018–19, the TSB began 76 new investigations and completed 78 investigations of various classes. (See the TSB website for the reports issued for each sector.) This is the second consecutive year that the number of TSB investigations completed has increased—by 18% in 2018–19 and by 81% since 2016–17. This is clear evidence that the TSB's ongoing efforts to modernize and streamline its approach—including updating its Policy on Occurrence Classification—are bearing fruit.

Similarly, the TSB noticeably improved its average completion time for certain classes of investigations. In 2018–19, the average completion time of 598 days for the six class 2 investigations was reduced by roughly three months compared to 690 days for the six class 2 investigations completed in 2017–18. For the 23 class 3 investigations completed in 2018–19, the average completion time of 441 days was 43 days fewer than the 484 days for the 60 class 3 investigations completed in 2017–18. The introduction of class 4 investigations explains for the most part the difference in the number of class 3 investigations completed.

This year, 48 limited-scope class 4 investigations were completed in an average of 224 days. This new class of investigations allows the TSB to gather, analyze and report the facts more quickly, freeing up resources for more complex investigations having greater potential for advancing transportation safety.

On average, the 78 investigation reports completed in 2018–19 took 328 days to complete.

In support of TSB investigations, engineers, technicians and human factors specialists began 238 projects and completed 223 technical reports in 2018–19.

Recommendations and other safety communications

As Table 1 indicates, a number of safety communications were issued in 2018–19 as part of TSB investigations.

TABLE 1. Safety communications products issued, 2018–19

Recommendations	Safety concerns	Safety advisories	Safety information letters
10	1	19	33

While investigations are ongoing, the TSB may issue safety advisory letters or safety information letters to notify regulatory or industry stakeholders of unsafe conditions. These safety communications may suggest remedial action to reduce safety risks or share observations to promote greater safety.

Safety concerns, which are usually communicated in final investigation reports, provide a marker to the industry and the regulator that the Board has identified a safety deficiency for which it does not yet have sufficient information to make a recommendation.

The five-member Board issued 10 recommendations: seven as a result of aviation investigations, two in the wake of marine occurrences and one related to a rail accident. The Board makes recommendations when systemic deficiencies pose significant risks to the transportation system and, therefore, warrant the attention of regulators and industry.

Federal ministers have 90 days to respond to the Board's recommendations. Within that timeframe, they must provide a departmental response to the recommendation, including the specific actions that their department plans to take. Board members then review and rate these responses.

Each year, the Board reassesses outstanding recommendations as part of ongoing efforts to urge stakeholders to take action on the safety issues TSB investigations have identified. In 2018–19, it reassessed 19 outstanding recommendations as Fully Satisfactory: 13 in aviation, four in marine and two in rail.

Since 1990, the Board has made 604 recommendations. By the end of 2018–19, it had given 81.5% of the responses to these recommendations the highest rating of Fully Satisfactory (up from 79.6% at the end of 2017–18). This means that stakeholders, including Transport Canada, had taken action to substantially reduce the safety deficiencies the Board identified to support the recommendation.

As of 31 March 2019, there were 102 outstanding recommendations, slightly less than half of which date from 10 years ago or more. The Board is concerned about the slow progress on these older recommendations—an issue that has been on the TSB Watchlist since 2016.

Watchlist 2018

The TSB released the fifth edition of its Watchlist in October 2018. This list of key safety issues requiring government and industry attention, which the TSB has issued every two years since 2010, is grounded in the findings of hundreds of investigations and progress being made in response to outstanding Board recommendations.

"Advancing safety is all about change, and change is all about looking at how things have always been done and then finding ways to do them better. The safety of Canadians everywhere, and the integrity of our infrastructure and environment, depend on it."
—TSB Chair Kathy Fox, in remarks on the release of Watchlist 2018, 29 October 2018

FIGURE 3. Board assessments of responses to recommendations from 29 March 1990 to 31 March 2019

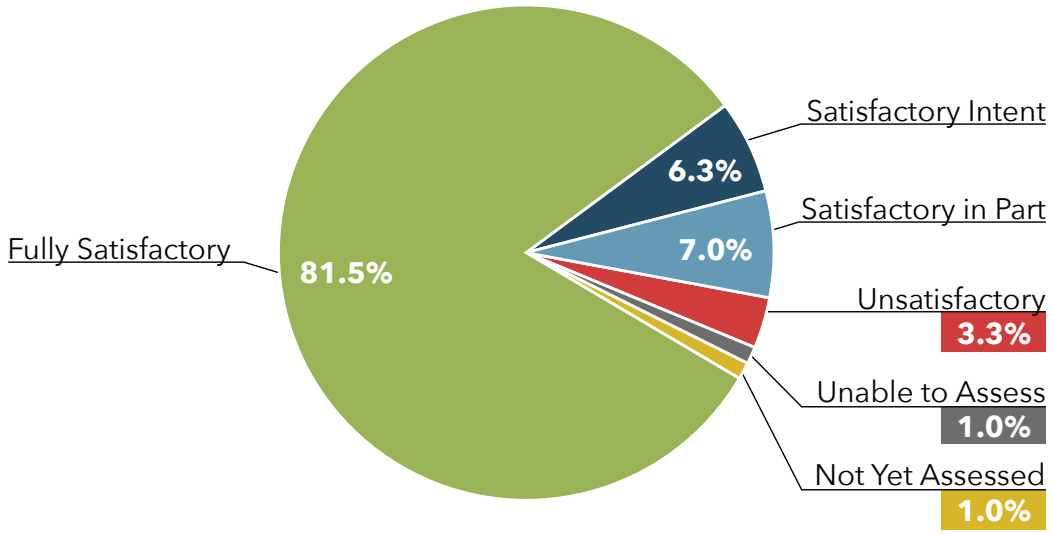


TABLE 2. Age of active recommendations as of 31 March 2019

Age of recommendations	Aviation	Marine	Rail	Total
Less than 1 year	7	2	1	10 (10%)
1 year to less than 7 years	18	8	11	37 (36%)
7 years to less than 10 years	4	2	0	6 (6%)
Sub-total (current recommendations)	29	12	12	53 (52%)
10 years to less than 15 years	12	3	1	16 (16%)
15 years to less than 20 years	13	2	3	18 (17%)
20 years or more	9	5	1	15 (15%)
Sub-total (old recommendations)	34	10	5	49 (48%)
Total	**63**	**22**	**17**	**102 (100%)**

Watchlist 2018 contains seven issues and, for each of them, a list of safety actions that industry and government stakeholders must take to address identified deficiencies.

The TSB periodically reports publicly on what actions, if any, stakeholders have committed to undertake to address a Watchlist issue, and on what actually transpires. In light of satisfactory action taken by stakeholders and/or substantial reductions in safety deficiencies, the Board removed three items from the Watchlist in 2018:

- the transportation of flammable liquids by rail;
- the need for on-board voice and video recorders in main-track locomotives; and
- unstable approaches in aircraft that are continued to a landing at Canadian airports.

The TSB will continue to monitor progress in these areas through its investigations, assessment of progress stakeholders have achieved in response to active recommendations and ongoing interactions with stakeholders.

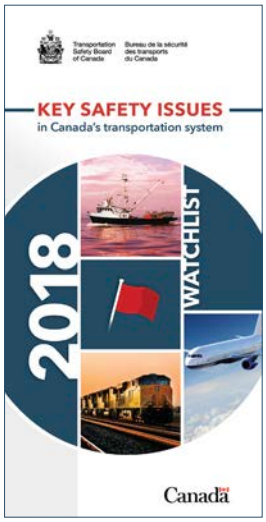
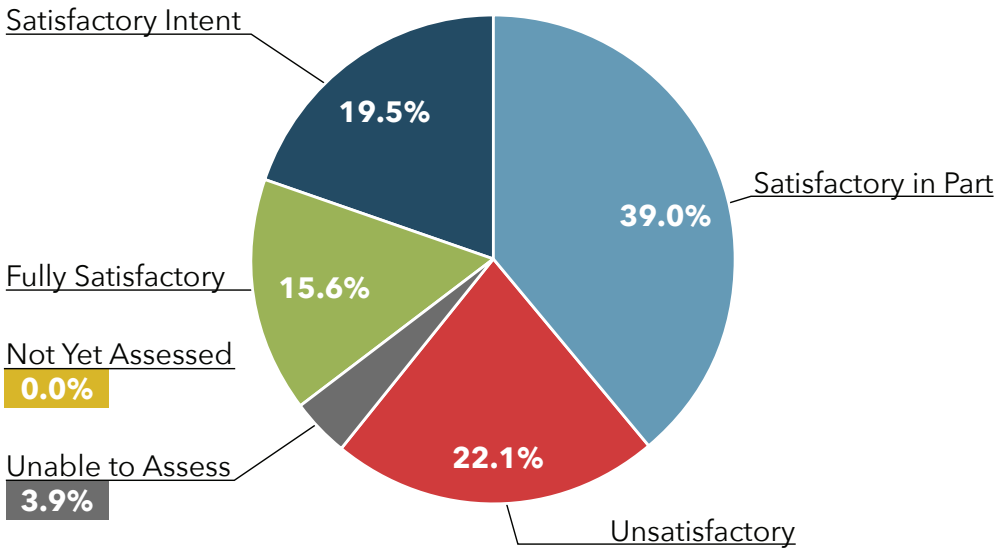


TABLE 3. Watchlist 2018 safety issues

Sector	Watchlist safety issue	Resources
Aviation	Risk of collisions on runways	Factsheet I Video
	Runway overruns	Factsheet I Video
Marine	Commercial fishing safety	Factsheet I Video
Rail	Following railway signal indications	Factsheet I Video
All sectors	Safety management and oversight	Factsheet
	Slow progress addressing TSB recommendations	Factsheet
	Fatigue management in rail, marine and air transportation	Factsheet I Video

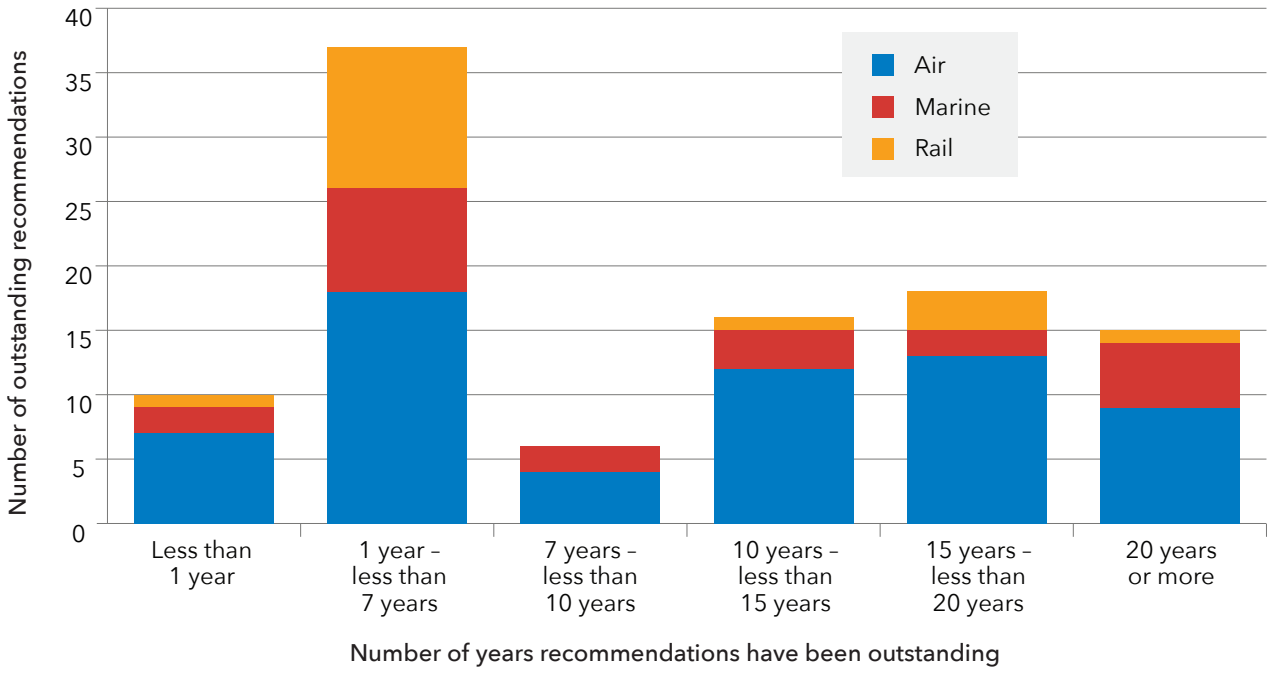
FIGURE 4. Board assessments of responses to recommendations related to Watchlist 2018 safety issues



Slow progress on recommendations

When the TSB issued Watchlist 2018, there were 62 recommendations dating from more than 10 years ago. Throughout the year, the Board reassessed 23 of these recommendations related to aviation, 11 pertaining to the marine industry and three regarding railways. At 31 March 2019, there were 49 outstanding recommendations aged 10 years or more, including three that passed that milestone during the year.

FIGURE 5. Outstanding recommendations as of 31 March 2019*



For progress on the other Watchlist issues, see the corresponding sections of the report:
Aviation | Marine | Rail

* There are no outstanding recommendations regarding pipeline transportation safety.

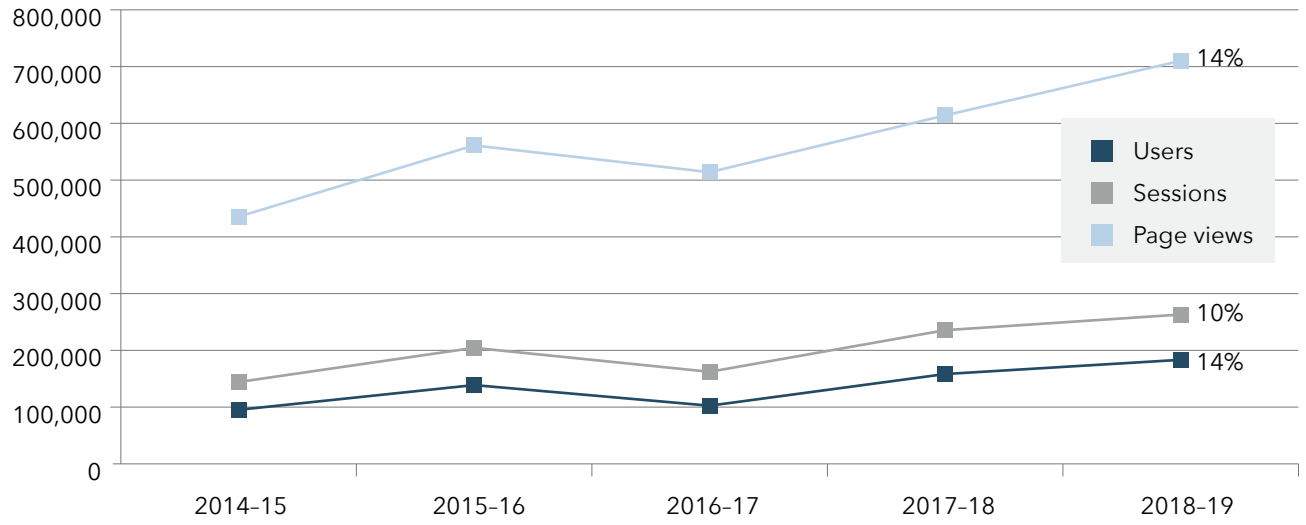
PROVIDING CLEAR, TIMELY AND OPEN INFORMATION

At the core of the TSB's strategy to modernize its operations and serve Canadians even better is its resolve to produce and share more information more quickly and more broadly, while meeting stringent quality standards. The TSB also strives to ensure that its products are accessible to audiences at home and abroad, and that its messages are strong and clear enough to fuel discussions and prompt the actions needed to advance transportation safety. The increase in visits to the TSB website and social media engagement over the last two years speaks to the relevance and usefulness of TSB information products.

A suite of fresh, modern designs was introduced for the investigation reports to reflect the new Policy on Occurrence Classification and make it easier for investigators to write their reports.

This year, the web development team worked between production tasks to finish rebuilding the TSB website in a new format that meets the latest Government of Canada coding standards. Launched on 1 April 2019, the upgraded website, which contains nearly 2000 investigation reports, is mobile-friendly, simpler to navigate, and easier to read.

FIGURE 6. Select website usage, 2014–15 to 2018–19, with indication of percentage increase 2017–18 to 2018–19



Professional and accessible web products

The TSB Publishing team edited, translated, and posted to the website 78 investigation reports in 2018–19. The limited-scope (class 4) reports accounted for most of the 18% increase over the number of reports produced the year before (66).

TABLE 4. Select social media metrics, 2018–19

Social media engagement	Number	Increase since 2017–18
Twitter followers	22,206	8%
Lifetime views on YouTube	1,799,126	86%
Lifetime views on Flickr	7,508,471	12%

More investigation updates to the public

During the year, the Communications Branch created 41 new investigation webpages, generally within one or two days of the investigation being launched, which the TSB widely shared through Twitter.

FIGURE 7. Update notice on an investigation page

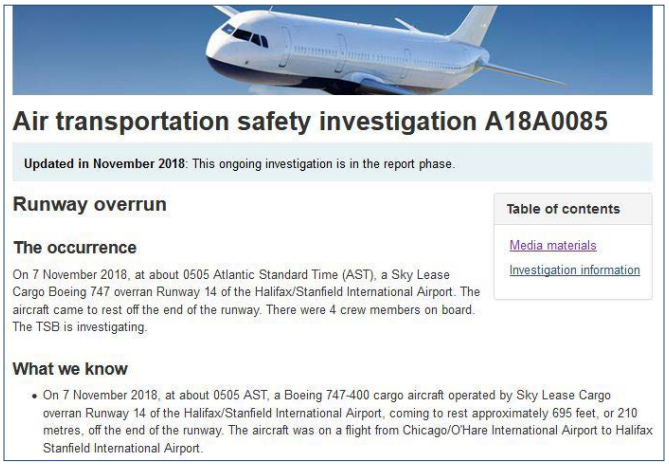


FIGURE 8. Tweets of TSB announcing and providing investigation updates

In keeping with its commitment to keep the public informed of the progress of investigations on a timely and regular basis, the TSB started posting status updates for all active class 1, 2 and 3 investigations indicating the stage they had reached.

Field phase updates were provided on three high-profile occurrences that generated substantial public interest:

- the 4 November 2018 fatal mid-air collision in Carp, Ontario (A18O0150)
- the 7 November 2018 runway overrun at the Halifax Stanfield International Airport, Nova Scotia (A18A0085)
- the 4 February 2019 fatal rail derailment near Field, British Columbia (R19C0015)

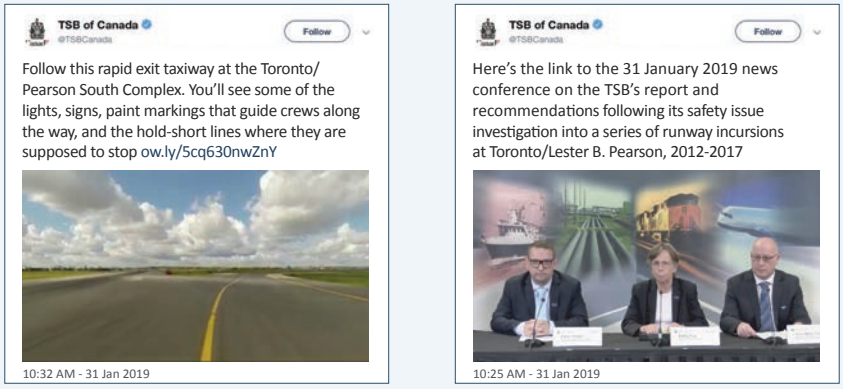
In addition, the TSB provided 10 ad hoc updates on various active investigations to communicate new information or to raise awareness and encourage immediate action on important safety issues. For example, in April 2018, as part of investigation A17C0146 into the fatal 2017 aircraft accident in Fond-du-Lac, Saskatchewan, the investigation team launched a data gathering exercise regarding aircraft operations at remote airports in Canada.

This exercise resulted in two recommendations on measures needed to reduce the likelihood of aircraft taking off with contaminated surfaces; the recommendations were released in an update issued on 14 December 2018 that was bolstered by a news conference and a news release.

Eight more ad hoc updates were issued with new information or safety advisories related to investigations A17C0132, A18W0129, R18D0069, R18E0007, R18M0037, R18T0058, R19H0021 and R19W0050.

FIGURE 9. Watchlist 2018 trailer and webcast shared via Twitter

FIGURE 10. Findings from the safety issue investigation concerning Toronto/Lester B. Pearson International Airport shared via Twitter



Multiplatform engagement with the media

In 2018–19, the TSB posted 74 deployment notices, compared to 68 in 2017–18. It also issued 89 news releases—a 33% increase from the previous year—most of them to announce the publication of new investigation reports (78), explain the findings from the most complex investigations, and highlight any ensuing recommendations. The deployment notices and news releases were widely distributed through news wires and also directly to reporters interested in the related occurrences and topics.

For the release of Watchlist 2018, a series of video trailers were produced and tweeted in the preceding weeks to create and build momentum. On 29 October, the media were invited to an information session with access to embargoed materials, which was followed by a virtual news conference that journalists from across the country were able to attend on site, on the web and via teleconference. The event generated widespread coverage and follow-up interviews, notably on fatigue in transportation and fishing vessel safety.

Prior to the news conference for the release of the safety issue investigation (A17O0038) on runway incursions at the Toronto/Lester B. Pearson International airport, a technical briefing provided an opportunity for investigators and journalists to discuss the methodology used, the data collected, and the factors common to the occurrences under study. Multimedia products were also used to illustrate and explain some of the technical findings from this complex investigation.

The TSB held three other news conferences in 2018–19 to release reports on high-profile investigations containing recommendations from the Board. All news conferences were live webcast and the recordings posted on line for greater public access.

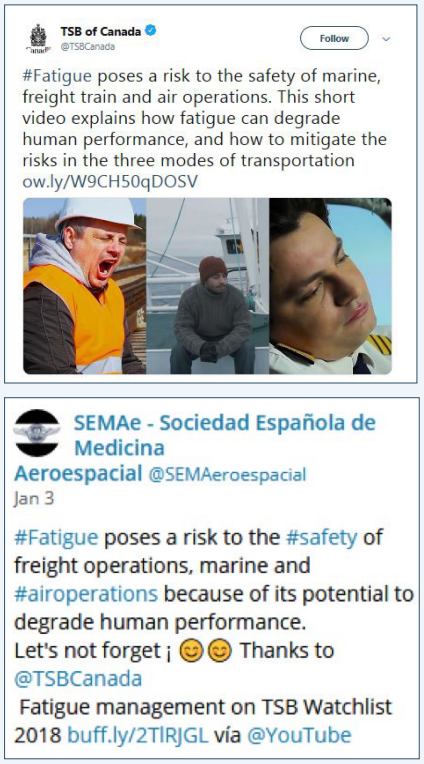
FIGURE 11. Twitter links to news conference webcasts

Throughout the year, the Media Relations team handled 934 media requests, explaining the TSB's mandate and investigation process, sharing information and photos during deployments, providing data and statistical information on occurrences, and facilitating interviews with investigators and Board members on reports and recommendations.

The sheer number of TSB mentions, quotes and tweets embedded in media stories and social media content is an indication that the TSB is seen as a credible and responsive source of information.

FIGURE 12. Tweeted appreciation from media and stakeholders

FIGURE 13. The TSB's video on fatigue management—and a response from Twitter



A diverse approach to influencing change

For the launch of Watchlist 2018, the TSB published and disseminated a series of information materials to support its call for change, including: a brochure summarizing the issues and actions required, fact sheets providing the context and status to date, and backgrounders with data and findings from TSB investigations.

TSB videos this year

Short videos on mode-specific issues and fatigue management were posted to YouTube and promoted via Twitter. They have been largely shared at home by niche media and stakeholders—including Skies Magazine,[1] Western Aviation News,[2] the Air Transport Association of Canada, the National Airlines Council of Canada, the Canadian Transportation Agency—and internationally by various groups like the Marine Accident Investigators' International Forum, the Spanish Society of Aerospace Medicine, and the Finnish Traffic Medicine Association.

[1] *Skies*, "TSB releases Watchlist 2018: a call to action on safety management and fatigue issues" at https://www.skiesmag.com/press-releases/tsb-releases-watchlist-2018-a-call-to-action-on-safety-management-and-fatigue-issues/ (last accessed on 2019-05-13)

[2] Western Aviation News, "Risky runways: incursions pose a threat to the flying public" at https://westernaviationnews.com/2019/01/22/runway-risk-how-incursions-pose-a-looming-threat-to-the-travelling-public/ (last accessed on 2019-05-13)

FIGURE 14. Other Watchlist 2018 videos shared via Twitter

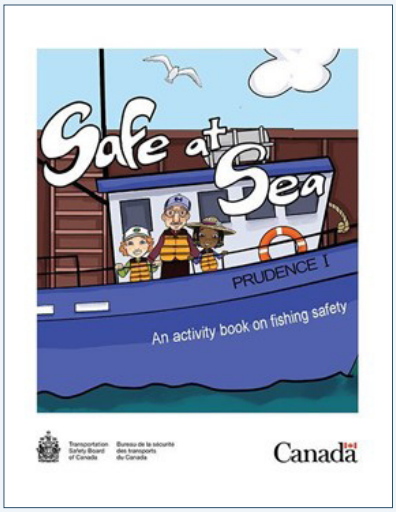
Encouraging discussions at home

The solution to the long-standing safety deficiencies in commercial fishing calls for an industry-wide cultural shift focused on prevention. To contribute to this effort, the TSB created an activity book to encourage children aged 5 to 7 in fishing communities to learn about safety aspects that their parents and relatives must consider before and during fishing expeditions. This product has received a warm reception and has been shared by a large number of stakeholders in Canada and abroad, including fishing and safety associations, unions, elementary schools, marine consultants, provincial and federal organizations, and Indigenous groups.

Reaching out to promote transportation safety

In 2018–19, TSB staff and Board members attended more than 80 outreach events in the various transportation sectors to share safety messages and calls to action, particularly on Watchlist issues. They engaged with stakeholders through a wide range of events, from formal presentations to panel discussions and fireside chats.

FIGURE 15. Cover of the TSB's activity book on fishing safety for kids aged 5 to 7



For example, the TSB hosted a panel discussion on fatigue and substance abuse in commercial fishing in collaboration with the Standing Committee on Quebec Fishing Vessel Safety. The panel, which involved participants from the Quebec, Atlantic and Pacific regions, was live webcast and the recording is on YouTube with subtitles in each official language.

TSB Chair Kathy Fox took part in a fireside chat on the "Role of human and organizational factors in incidents and how to manage them" at the International Pipeline Conference 2018 in Calgary. She attended the Canadian Aviation Safety Collaboration Forum in Montreal, as well as several annual conferences in the air and marine sectors.

Board member Faye Ackermans addressed the Canadian Association of Railway Suppliers in Montreal on Railway Day. Board member Paul Dittmann presented at the Helicopter Association of Canada's Convention in Vancouver and at the November meeting of the Canadian Marine Advisory Council in Ottawa. In June, Board member Joseph Hincke attended the iFish Conference in St. John's to discuss the progress achieved in fishing safety and the safety issues that are still of concern, which call for sustained behavioural changes in the industry and among fish harvesters.

FIGURE 16. Panel on fatigue and substance abuse in fishing

FIGURE 17. Reactions to Board members' conference presentations

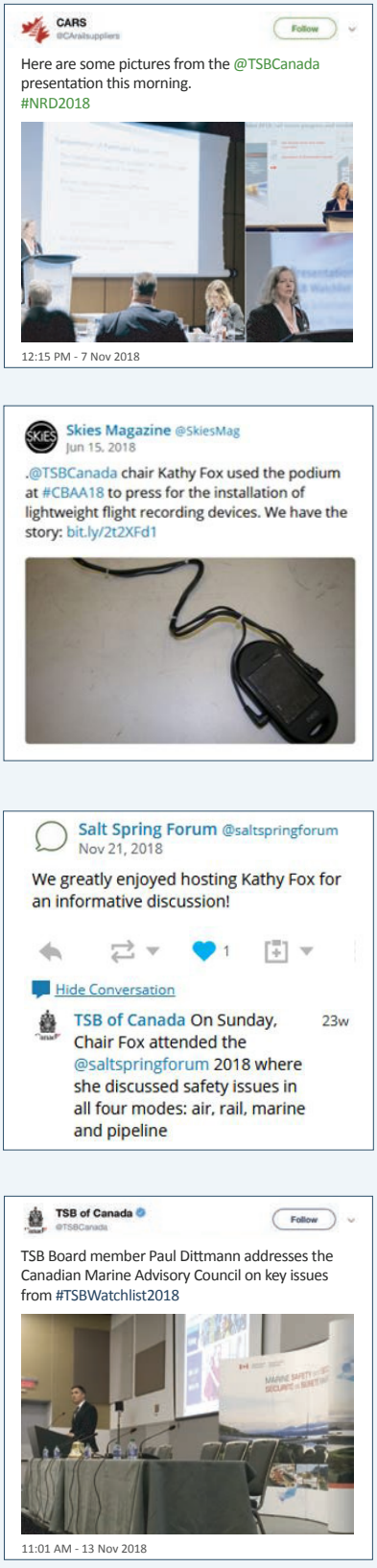
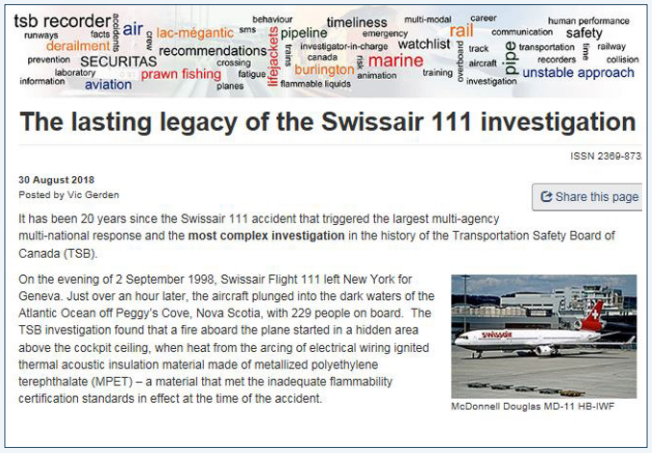


FIGURE 18. Blog contribution by former TSB investigator Vic Gerden on the Swissair investigation



Following the twentieth anniversary of the Swissair 111 accident, the TSB Chair addressed the International Air Safety Summit 2018 in Seattle, Washington, on the impact of this accident on the aviation industry. The TSB's blog *The Recorder* also featured a personal account from former investigator-in-charge Vic Gerden, who led the Swissair investigation, one of the largest and most complex in the TSB's history.

Engaging with parliamentarians

The TSB engages in discussions with Parliamentarians on a broad range of issues related to transportation safety. In 2018–19, TSB officials appeared before the Standing Committee on Government Operations and Estimates; the Standing Committee on Transport, Infrastructure and Communities; the Senate Committee on Legal and Constitutional Affairs; as well as the All-Party Aviation Caucus. An information package on the Watchlist 2018 was also prepared and distributed to all members of Parliament and all Senators.

FIGURE 19. Tweeting the TSB appearances before Parliament

TSB's open data

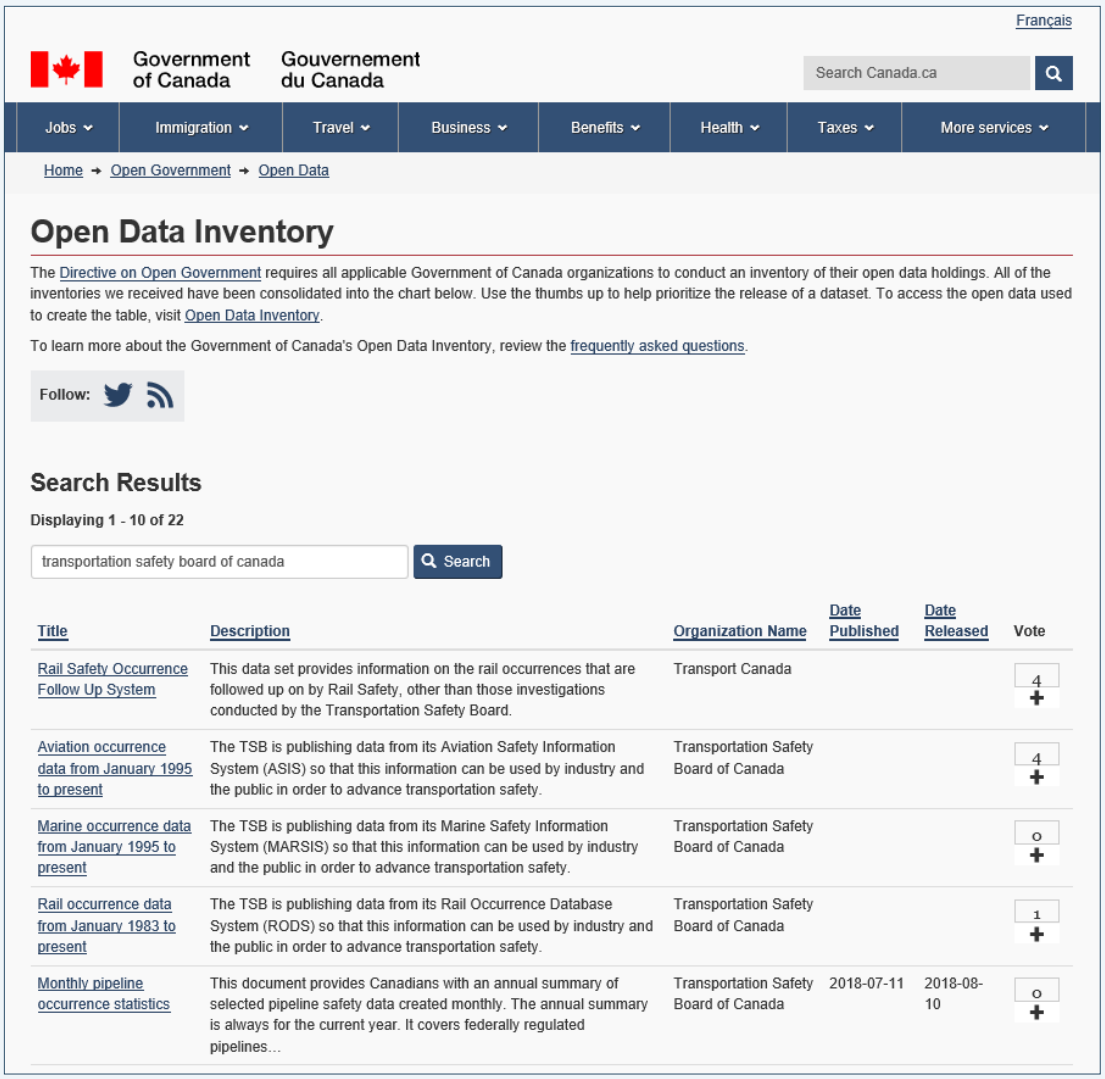
The TSB maintains a safety information system for each transportation mode that contains data about all reported occurrences. It uses the data to analyze safety deficiencies and identify risks.

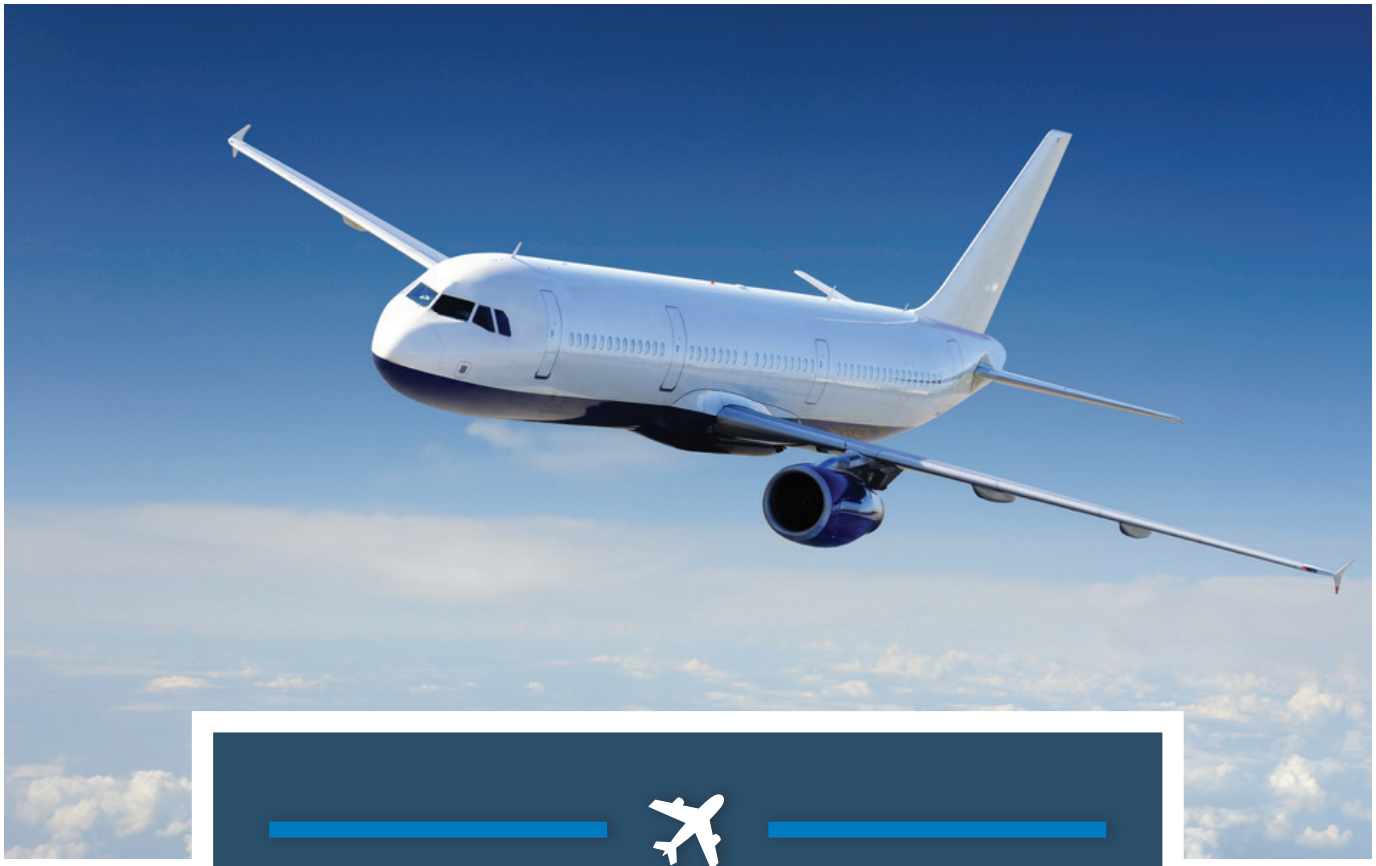
For example, occurrence statistics related to rail level crossings prompted a closer examination of the data by TSB macro-analysts to determine potential causal factors. Results of this study are expected in 2019.

In 2018, the TSB proactively published reportable accident and incident data from the TSB information systems on its website. The datasets are updated on or soon after the 15th of each month; some of the data go as far back as January 1995.

The publication of these data promotes transparency, accountability, and citizen engagement—and meets the TSB's commitment to Open Government.

FIGURE 20. Some of the TSB's holdings in the Open Data Inventory at open.canada.ca





AVIATION SECTOR

Year in review

The downward trend in aviation accidents over the last 10 years continued in 2018. During the year, 201 accidents were reported to the TSB. This number represents a 19% reduction from 2017, and is 25% below the annual average of 267 accidents recorded from 2008 to 2017.

Moreover, the 38 fatalities, which occurred in 23 fatal accidents in 2018, are considerably fewer than the annual averages of 55 fatalities and 32 fatal accidents recorded over the last decade.

Seven accidents in 2018 involved a release of dangerous goods. While this is similar to the eight accidents in 2017 that involved a release of dangerous goods, it is higher than the yearly average recorded over the previous decade of about four per year.

In addition, 863 incidents were reported to the TSB in 2018. This represents a drop from the peak of 939 incidents reported in 2017, but remains above the yearly average of 781 incidents observed between 2008 and 2017.

Nearly 90% of these incidents (772) involved Canadian-registered aircraft, with 611 of them occurring in Canada. However, 161 of these incidents took place outside of Canada. This is a high number in comparison to the corresponding average of 76 incidents per year during the previous 10 years. The TSB continues to monitor this type of incidents to determine if there is a trend developing that may warrant a more detailed analysis.

FIGURE 22. Select aviation occurrence data, 2018

201 aviation accidents involving

- 66 commercial aircraft
- 134 private aircraft
- 2 state aircraft

38 aviation fatalities

863 aviation incidents of which

- 611 were in Canada
- 161 were outside Canada
- 91 involved foreign-registered aircraft

A measure of aviation safety

The accident rate for Canadian-registered aircraft (excluding ultralights) per 100,000 hours flown has followed a downward trend since 2008. These aircraft flew an estimated 4.8 million hours in Canada and abroad in 2018. With 169 accidents over that period, the accident rate is 3.5 accidents per 100,000 hours flown, below the 2017 rate of 4.2, and the 10-year average of 5.2 from 2008 to 2017.

FIGURE 21. Aviation accidents and incidents in Canada, 2008 to 2018

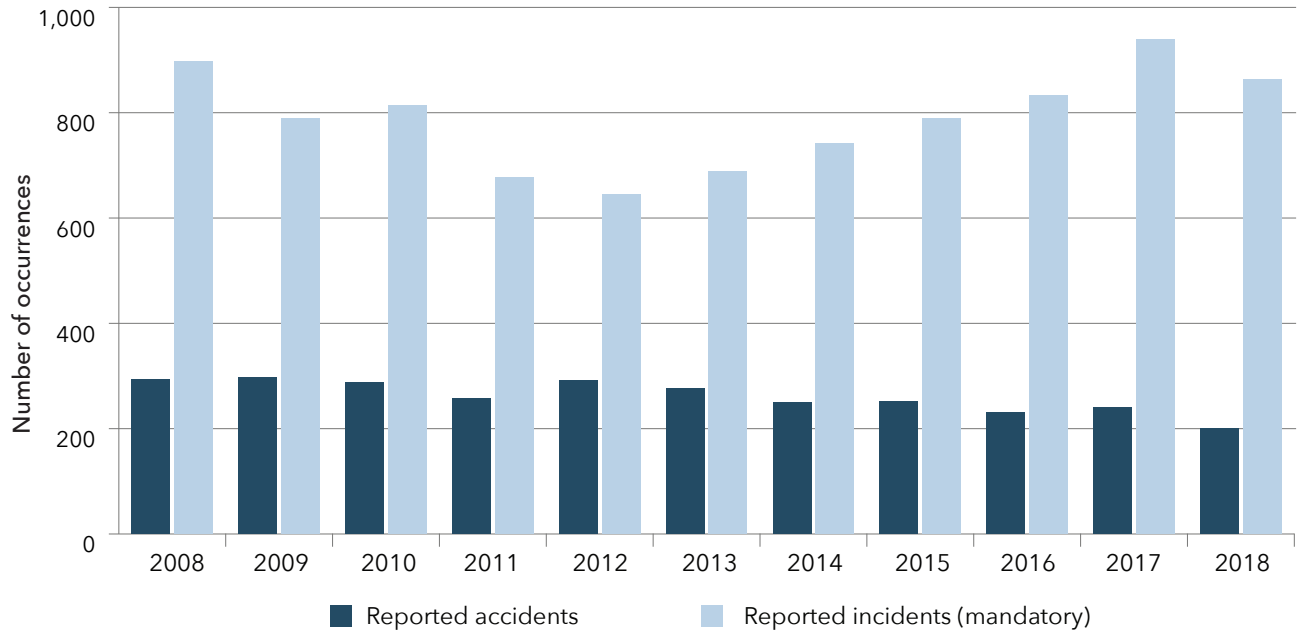
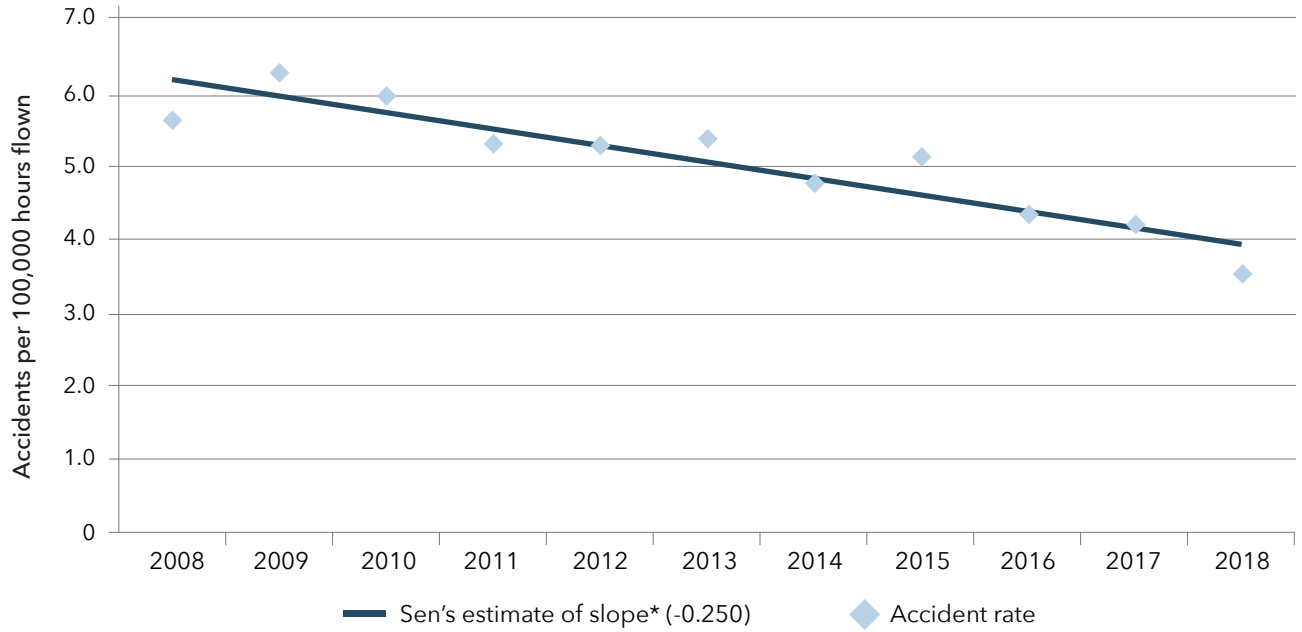


FIGURE 23. Canadian-registered aircraft accident rate, 2008–2018



Source: Transport Canada

* Sen's estimate of slope is a robust, non-parametric estimate that is the median of the slopes of all lines through pairs of points in a time series.

Investigations

As Table 5 indicates, the Air Branch completed 38 investigations in 2018–19, which represents a 31% increase from the 29 investigations that were completed in 2017–18.

TABLE 5. TSB aviation activities, 2017–18 and 2018–19

Activity	2017–18	2018–19
Deployments	31	35
Investigations started	19	36
Investigations completed	29	38
Investigations in progress at year-end	21	22

Table 6 sets out the number of investigations completed, the target timeline and the average duration for each class of occurrences. It shows that all investigation timelines were met or exceeded. The 27 class 4 investigations were completed in 192 days on average. The average completion time of 447 days for class 3 investigations was reduced by 15% compared to the previous year's average of 523 days, and by 29% compared to the 2016–17 average of 632 days. This is the shortest average completion time recorded by the Air Branch in the last seven years.

This increase in efficiency is largely attributable to the implementation of the new Policy on Occurrence Classification and the efforts undertaken to streamline the investigative processes, and has enabled the TSB to report to the industry and the public on aviation occurrences in a more timely manner.

TABLE 6. Completed aviation investigations, target timeline and average duration by investigation type, 2017–18 and 2018–19

Class	Investigation type	Completed		Target timeline (days)		Average duration (days)	
		2017–18	2018–19	2017–18	2018–19	2017–18	2018–19
1	Safety issues	0	1	450	730	0	658
2	Complex	2	2	450	600	841	550
3	Detailed	27	8	450	450	523	447
4	Limited scope	n/a	27	n/a	200	n/a	192

Safety issue investigations: runway safety

When a number of occurrences with common characteristics take place under similar circumstances and form a pattern over a period of time, it may be an indication that their underlying causes or contributing factors are systemic in nature. In these instances, the TSB may launch what is known as a safety issue investigation (a class 1 investigation). In 2018–19, the TSB completed one such aviation investigation and began another.

Risk of runway incursions at Toronto/Lester B. Pearson International Airport

Investigation A17O0038 examined 27 runway incursions that occurred between two closely spaced parallel runways at Toronto/Lester B. Pearson International Airport between June 2012 and November 2017.

FIGURE 24. Example of a possible incursion between two aircraft

The investigation found that all these incursions happened on the inner runway after an aircraft had landed on the outer runway and was taxiing on a rapid-exit taxiway between the two parallel runways. The TSB determined that although flight crews understood they needed to stop, as indicated by lights, signage and paint markings, and knew they were approaching an active runway, they did not stop in time before the runway incursion occurred.

Several characteristics of the rapid exits in this area, known locally as the "south complex," are different from almost every other major airport in North America. The uncommon features include the hold lines, which are not where crews usually expect to see them at other airports. In addition, airport charts and guidance to crews did not help mitigate the risk of incursion. Instead, crews followed standard operating procedures and initiated post-landing actions immediately after exiting the runway. This took their attention away from other critical tasks, such as identifying the hold line.

In light of these findings, the Board made several recommendations, namely:

- that NAV CANADA amend its phraseology guidance so that safety-critical transmissions issued to address recognized conflicts, such as those instructing aircraft to abort takeoff or pull up and go around, are sufficiently compelling to attract the flight crew's attention, particularly during periods of high workload (A18-04);
- that Transport Canada (A18-05) and the U.S. Federal Aviation Administration (A18-06) work with operators to amend standard operating procedures so that post-landing checks are sequenced only after landing aircraft are clear of both active runways when closely spaced parallel runway operations are in effect, rather than the current common practice of sequencing the checks once landing aircraft are clear of the landing surface; and

- that the Greater Toronto Airports Authority make physical changes to the taxiway layout to address the risk of incursion between the parallel runways and, until these changes can be made, make further improvements to increase the conspicuity of the runway holding positions (A18-07).

These recommendations were issued on 31 January 2019. Once stakeholders submit their responses to these recommendations, the Board will evaluate them and publish the assessments.

Risk of collisions from runway incursions is a Watchlist 2018 issue.

Aircraft operations at Quebec and Nunavut airports undergoing repairs

The TSB launched a safety issue investigation (A18Q0140) in 2018 into occurrences related to aircraft operations at Quebec and Nunavut airports that were undergoing runway repaving or reconstruction. Since 2013, the TSB has received 17 reports of aircraft landing or taking off outside the intended limits of those runways because pilots were unable to distinguish the usable section of the runway from the unusable section.

In some of the occurrences, the aircraft struck temporary runway edge lights on landing, and sustained minor to significant damage. Such occurrences could also lead to serious injuries to the aircraft occupants. Among other items, the systemic investigation is looking at regulations and standards that apply to runway construction, the approval process for this type of work, how information is communicated to pilots, and relevant human performance factors.

PHOTO 1. Airport undergoing runway repairs

Flight recorders for commercial and private business aircraft

The fatal 2016 crash of a Cessna Citation 500 (A16P0186) on a flight from Kelowna to Calgary, highlighted once again how the absence of flight data recorders (FDR) and cockpit voice recorders (CVR) onboard aircraft continues to impede the TSB's ability to advance transportation safety. Because the aircraft was not equipped with any type of FDR or CVR, and neither was required, the absence of flight data prevented investigators from fully identifying and understanding the sequence of events, and the accident's underlying causes and contributing factors.

This prompted the Board to recommend to Transport Canada (A18-01) that it require the mandatory installation of lightweight flight recording systems by commercial operators and private operators not currently required to carry these systems.

In its response to the recommendation, Transport Canada committed to taking a number of actions, including the promotion of the voluntary installation of flight recorders in Canadian aircraft that fall outside the scope of the current *Canadian Aviation Regulations* requirements, and the introduction of new regulations requiring the installation of recorders in all newly-manufactured aircraft. However, the Board is concerned that there are no timelines attached to this commitment. It has assessed the response as Satisfactory in Part and has asked Transport Canada to provide a timeline for the various actions it proposes to take. See the full assessment of progress related to Recommendation A18-01 on the TSB's website.

This investigation further revealed that the operator of the aircraft had never been inspected by Transport Canada, thus allowing unsafe practices to emerge and persist. At the time of the occurrence, Transport Canada's approach to oversight for private operators relied entirely on reactive rather than planned oversight. By excluding private operators from its planned surveillance, Transport Canada exempted the entire business aviation sector from basic oversight mechanisms designed to mitigate individual and systemic safety risks, and prompt the correction of unsafe practices and conditions.

The Board therefore issued a safety concern regarding the oversight of private operators, noting that a reactive approach to oversight, in which private operators are excluded from Transport Canada's national planned surveillance program, may expose the business aviation sector to higher risks that could lead to other accidents. In response, Transport Canada, with the support of the Canadian Business Aviation Association, has begun an inspection program that was forecast to inspect

PHOTO 2. Investigator-in-charge Isabelle Langevin examines the wreckage

one quarter of the private operators over the course of 2018–19, with a particular emphasis on safety management system implementation.

Limitations to the see-and-avoid principle

A mid-air collision in March 2017 occurred between two Cessna 152 aircraft involved in local training flights near the Montréal/St. Hubert Airport. The sole occupant of one aircraft was seriously injured and the sole occupant of the other aircraft sustained fatal injuries.

The investigation (A17Q0030) found that a number of factors had contributed to the occurrence, including that the pilots did not have sufficient time to see and avoid one another once they realized their proximity. In addition, the density and variety of operations at the airport increased the complexity of air traffic controller workload, as did the varying levels of flying skills and language proficiency among the student pilots at the four flying schools based at the same airport.

The TSB also determined that oversight of Transport Canada's aviation language proficiency test was limited to administrative verifications. Consequently, it was not possible for Transport Canada to assess whether and to what extent approved examiners administered the test in a manner that ensured national validity, reliability and standardization.

Following this accident, Transport Canada published a Civil Aviation Safety Alert (No. 2017-04) on the risks associated with student pilots conducting solo flights when they have not yet achieved the minimum operational level on the aviation language proficiency test.

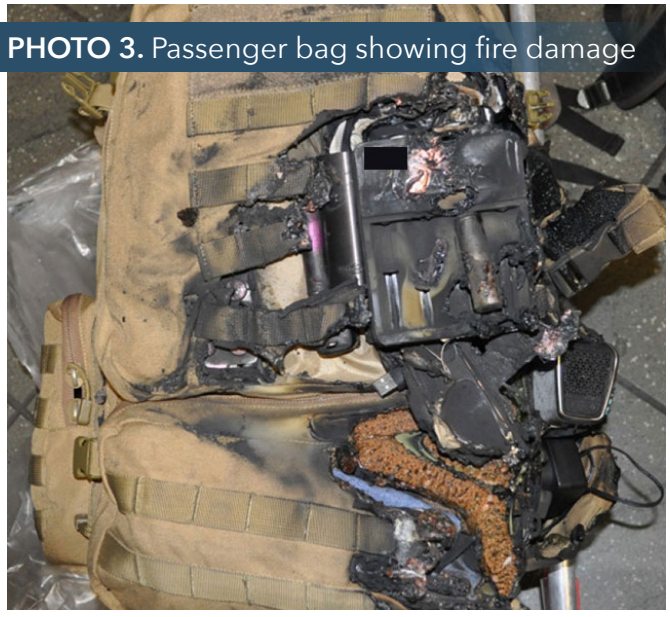
For its part, NAV CANADA undertook a nation-wide risk assessment and recommended six corrective measures to address the risks faced by air-traffic controllers at airports with extensive flight training activities, which are scheduled to be implemented by the end of 2019-20. In addition, NAV CANADA will implement several remedial measures to improve its air traffic management at the airport where the collision occurred. For instance, the responsibilities of all positions in the airport's control tower were reviewed, with a new shift and a new position added to better manage traffic fluctuations. Consultations were also held with the local flight schools about implementing air traffic management initiatives, including the publication of new visual flight rules entry and exit points.

Passenger awareness for checked luggage and dangerous goods

The investigation (A18W0081) into a cargo hold fire on a Boeing 737-700 flight from Calgary to Vancouver determined that two lithium-ion batteries in a passenger's checked luggage likely started the fire. This occurrence is a good reminder to passengers that they should not pack this type of battery in their checked luggage. The *Transportation of Dangerous Goods Regulations* and Transport Canada's safety advisory on the transportation of electronic cigarettes on aircraft aim to reduce the risk of lithium-ion batteries being placed in checked luggage, which can pose a hazard to the safety of aircraft.

Following this occurrence, the operator's safety investigations team conducted an event review under its safety management system. Upon completion, the team issued a report recommending corrective actions, including communication to front line teams on vigilance with regard to dangerous goods, and in particular informing passengers about lithium-ion batteries at check-in.

PHOTO 3. Passenger bag showing fire damage

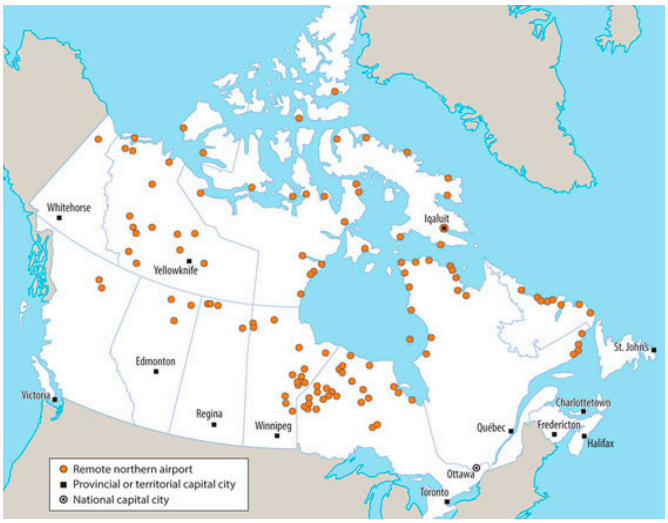


Consultation on aircraft operations at remote airports in Canada

Through an ongoing investigation (A17C0146) into a December 2017 accident in Fond-du-Lac, Saskatchewan, the TSB identified a key safety issue, namely aircraft taking off from remote northern airports with frost, ice or snow adhering to critical surfaces.

To learn more about the exposure of the industry to this risk, the TSB sent out a questionnaire in the summer of 2018 to pilots employed at 83 Canadian operators that fly out of many of Canada's remote northern airports. The questions focused on pre-flight aircraft inspections, de-icing and anti-icing equipment, pilot training and decision-making, and operational demographics.

FIGURE 25. Remote northern airports



Source: Office of the Auditor General, 2017 Spring Reports, Report 6—Civil Aviation Infrastructure in the North—Transport Canada

The TSB received valuable insight into these issues in more than 650 responses from pilots flying many types of aircraft across a wide spectrum of commercial operations. Pilots reported frequently taking off with critical aircraft surfaces coated with frost, ice or snow, and that aircraft de-icing equipment was often inadequate at remote northern airports. In fact, almost 40% of respondents said they were "rarely" or "never" able to have their aircraft effectively de-iced at remote airports. The consultation revealed that the lack of adequate de-icing equipment and the frequency of flights taking off without removing frost, ice or snow from critical aircraft surfaces were widespread issues that exposed passengers and crews to unnecessary and substantial risks.

The questionnaire responses also underlined that better compliance with the *Canadian Aviation Regulations*, which prohibit takeoffs with contaminated aircraft surfaces, is warranted.

Based on the information gathered during this consultation, the Board issued two recommendations, namely

- that the Department of Transport collaborate with air operators and airport authorities to identify locations where there is inadequate de-icing and anti-icing equipment and take urgent action to ensure that the proper equipment is available to reduce the likelihood of aircraft taking off with contaminated critical surfaces (A18-02); and
- that the Department of Transport and air operators take action to increase compliance with *Canadian Aviation Regulations* subsection 602.11(2) and reduce the likelihood of aircraft taking off with contaminated critical surfaces (A18-03).

Once Transport Canada submits its responses to these recommendations, the Board will evaluate the responses and publish the assessments.

Safety advisories

When the TSB is concerned with safety deficiencies or unsafe conditions that pose a low to medium risk to aviation safety, it may issue a safety advisory addressed to regulators and/or industry stakeholders to encourage such stakeholders to take remedial actions. In 2018–19, the TSB issued four aviation safety advisories which are summarized below.

Low oil pressure indication

A safety advisory issued in June 2018 (A17C0132-D1-A1) noted that the emergency procedures for a low oil pressure indication in the Fairchild SA227-AC Metro III aircraft flight manual instructed aircrews to monitor engine instruments, rather than shutting down the affected engine. The investigation into the occurrence (A17C0132) that prompted the advisory revealed that the left engine had sustained a near total loss of engine oil due to a leak. This leak, combined with the continued operation of the engine with a low oil pressure, led to the loss of propeller control that caused the aircraft to veer to the right upon landing and exit the runway. The advisory encouraged Transport Canada to work with the aircraft manufacturer to amend the emergency procedures whenever a low oil pressure indication is received.

Landings on closed portions of runways under repair

In July 2018, the TSB issued a safety advisory (A18Q0094-D1-A1) as part of its investigation into an occurrence (A18Q0094) involving an aircraft that landed on a closed portion of a runway under repair and that struck a temporary landing light, causing the tire to puncture. The TSB encouraged Transport Canada to review the requirements for runway markings used during repair and maintenance work, and encouraged stakeholders to take additional safety measures to reduce the risks related to partial runway closures.

Guidance for bracket inspections

The fatal accident that occurred when a wing separated from an ultralight aircraft while airborne (A18O0106) prompted the TSB to issue an aviation safety advisory (A18O0106-D1-A1) in November 2018. The advisory noted that the aircraft manufacturer's guidance for inspecting the type of bracket that failed in this instance did not specify the extent of the inspection that was to be performed on such brackets. In response to this advisory, Transport Canada issued a Civil Aviation Safety Alert (No. 2019-02) informing owners of the possible failure of the brackets and the need for disassembly, inspection and part replacement.

Cessna 206 emergency exit

The TSB issued a safety advisory (A18W0129-D1-A1) in February 2019 following an accident in which the pilot of a float-equipped Cessna U206G aircraft lost control while attempting to land on a lake (A18W0129). The pilot and one passenger were able to escape the submerged aircraft, but three other occupants were not. The advisory warned that, when deployed, the flaps on this aircraft model prevent the forward portion of the rear cargo doors from opening completely.

Progress on outstanding recommendations

Of the 31 aviation recommendations that the Board reassessed this year, 18 were closed. Among these, 13 were closed as Fully Satisfactory and three as Satisfactory in Part. The 13 Fully Satisfactory responses touched on issues such as mandatory seaplane training, seaplane training qualifications and minimum weather conditions for visual flight rules flights in uncontrolled airspace.

FIGURE 26. Aviation recommendations: 31 reassessed in 2018–19

18 now closed

- 13 as Fully Satisfactory
- 3 as Satisfactory in Part
- 1 as Unsatisfactory
- 1 as Unable to Assess

13 still active

- 7 as Satisfactory Intent
- 3 as Satisfactory in Part
- 3 as Unsatisfactory

The recommendation (A13-01) that was closed as Unable to Assess was replaced with a similar recommendation that encompasses a larger group of operators (A18-01).

The final recommendation, which was closed with an Unsatisfactory rating, was first published 27 years ago (A91-13). It called for Transport Canada to expedite legislation for upgrading the requirements for flight data and cockpit voice recorders. Transport Canada is no longer in a position to either address or fulfill the intent of this recommendation, and its underlying safety deficiency is now addressed in more recent, open recommendations (A94-04, A99-02 and A99-03) that the Board reassesses regularly.

PHOTO 4. Runway under repair

Watchlist 2018

In addition to slow progress on outstanding recommendations, Watchlist 2018 features four key safety issues that must be addressed by various stakeholders in the aviation sector in order to make Canada's air transportation system even safer. The following section illustrates those issues as they were identified and analyzed through investigations completed in 2018–19, and highlights some of the safety actions required to reduce the underlying risks. In the coming year, the TSB will continue to work with industry stakeholders to influence changes, monitor safety trends and encourage appropriate actions.

Risk of collisions from runway incursions

This Watchlist item was studied as part of the safety issues investigation into runway incursions between the parallel runways at Toronto/ Lester B. Pearson International Airport in Ontario.

Following earlier studies conducted by NAV CANADA and the Greater Toronto Airports Authority, all parties took a number of actions aimed at risk mitigation that are described in the TSB safety issue investigation report A17O0038. Although these changes were followed by a reduction in the number of runway incursions on the south complex, this decrease was not permanent and the number began to rise again. This is why the TSB conducted a safety issue investigation and why the Board made the four recommendations discussed previously. Once responses to these recommendations are received, the Board will evaluate them and publish the assessments.

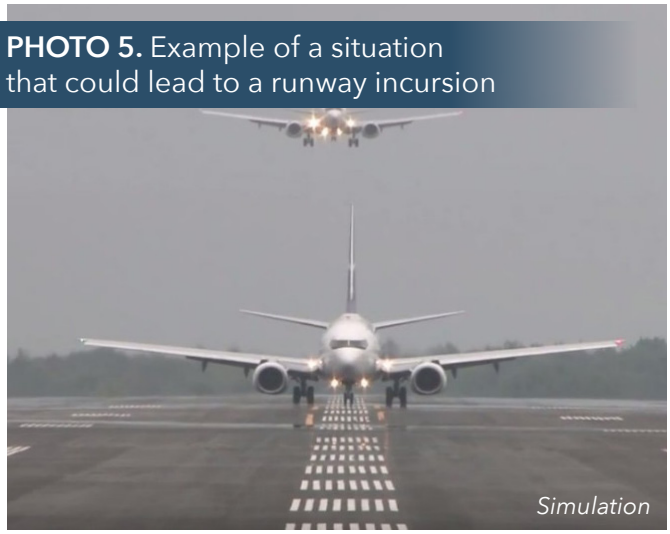
The risk posed by runway incursions is not unique to the Toronto/Lester B. Pearson International Airport south complex. In 2018–19, three separate investigations were launched following incursions that happened at the Trail Regional Airport in British Columbia (A18P0177), at the Montreal/Pierre Elliott Trudeau International Airport in Quebec (A19Q0015) and once again at Toronto's Pearson International Airport (A19O0006). The results will shed additional light on the various risk factors at play and specific actions that would be needed to reduce the risk of incursions.

Runway overruns

Recommendation A07-06 calls upon Transport Canada to require all Code 4 runways to have a 300 m runway end safety area (RESA) or a means of stopping aircraft that provides an equivalent level of safety. In 2017, the House of Commons Standing Committee on Transport, Infrastructure and Communities also recommended the implementation of 300 m RESAs, as supported by the TSB and the International Civil Aviation Organization. That year, Transport Canada announced options to implement RESAs at Canadian airports and engaged in public consultation. Given ongoing delays in implementing appropriate solutions, runway overrun occurrences continue to happen, exposing commercial air travellers in Canada to unnecessary risks.

For example, in 2018, an overrun occurred at the Halifax/ Stanfield International Airport involving a Boeing 747 cargo flight. The aircraft came to rest 210 m off the end of the runway and was substantially damaged, with minor injuries to four crew members. While having launched an investigation (A18A0085) into this occurrence, the TSB continues to monitor progress on its recommendation and uses every opportunity to encourage airport operators with runways longer than 1,800 m to conduct formal runway-specific risk assessments and take appropriate action.

PHOTO 5. Example of a situation that could lead to a runway incursion



Simulation

Safety management and oversight

Transport Canada has undertaken a number of activities to improve its oversight, including regular assessments of whether operators can effectively manage safety. The department has also adopted and implemented the requirements of the Annex 19 to the Convention on International Civil Aviation, Safety Management, and is examining how best to expand safety management systems (SMS) to other commercial aviation sectors (i.e., commuter, air taxi and specialty aerial work). However, it has not yet extended mandatory SMS coverage beyond those large scheduled operators originally required to have it.

As a result, several aviation investigations in 2018 found that air carriers did not proactively identify hazards or effectively manage the safety risks within their operation, either because they were not required to have an SMS or because their system was not imple-

mented effectively. In addition, recent occurrences have highlighted issues in Transport Canada's approach to oversight, namely its ability to effectively identify safety deficiencies in the course of its surveillance activities.

For instance, the investigation into the fatal accident of a Kelowna to Calgary flight (A16P0186) raised a safety concern related to oversight and SMS in the business aviation sector. The investigation into a mid-air collision near the Montréal/St-Hubert Airport (A17Q0030) highlighted issues with the oversight of language proficiency testing in the context of flight training operations. Another investigation into the nose gear failure of an aircraft (A16W0092) also identified issues regarding Transport Canada's oversight with respect to SMS. The investigation found that if Transport Canada does not adopt a balanced approach that combines inspections for compliance with audits of SMS, there is a risk that safety deficiencies will not be identified.

Fatigue management

Since the early 1990s, the TSB has identified fatigue-related impairment as a contributing factor or a risk in at least 34 aviation occurrences.

For instance, the investigation into an accident that occurred in April 2017 near the Quebec/Schefferville Airport (A17Q0050) highlighted the specific risks associated with mental fatigue. On the day of the accident, the crew had conducted two survey flights of nearly five hours each, and were likely suffering from mental fatigue, a factor that may have contributed to their decision to descend to a very low altitude, which led to the accident.

In September 2018, following the investigation into the near-landing of a major Canadian airline on a San Francisco taxiway, the U.S. National Transportation Safety Board released a final report in which pilot fatigue was identified as a factor. One recommendation was that Transport Canada revise current regulations to address the potential for fatigue for pilots on reserve duty who are called to operate evening flights that would extend into the pilots' window of circadian low.

Transport Canada worked for several years on modernizing its flight and duty-time regulations, taking into account modern fatigue science and international standards. In December 2018, the department announced new fatigue regulations with staggered implementation dates depending on the type of air carrier (within two years for airline and aerial work operators, and within four years for commuter and air taxi operators). The Board will monitor the implementation of the new regulations.

SECURITAS

In 2018–19, the TSB received 76 reports of aviation-related concerns through its confidential reporting program. This is an increase of 8.5% from the previous year. The trusted agents who handle SECURITAS reports on behalf of the TSB's Air Branch closed 73 reports in 2018–19 and were following up on the eight reports outstanding at year-end.

Reports to SECURITAS tend to cover common issues such as possible violations of the *Canadian Aviation Regulations*, maintenance issues, and crew-related issues, such as airline employees working beyond flight and duty-time limitations, and instances of substance abuse.

However, reports often focus on issues not covered by the TSB mandate, such as passenger rights and noise complaints during air shows. In 2018-19, the TSB received 24 such reports (nearly one third of the total). The trusted agents directed most of them to another organization, such as the operator or Transport Canada, or advised the reporter do so.

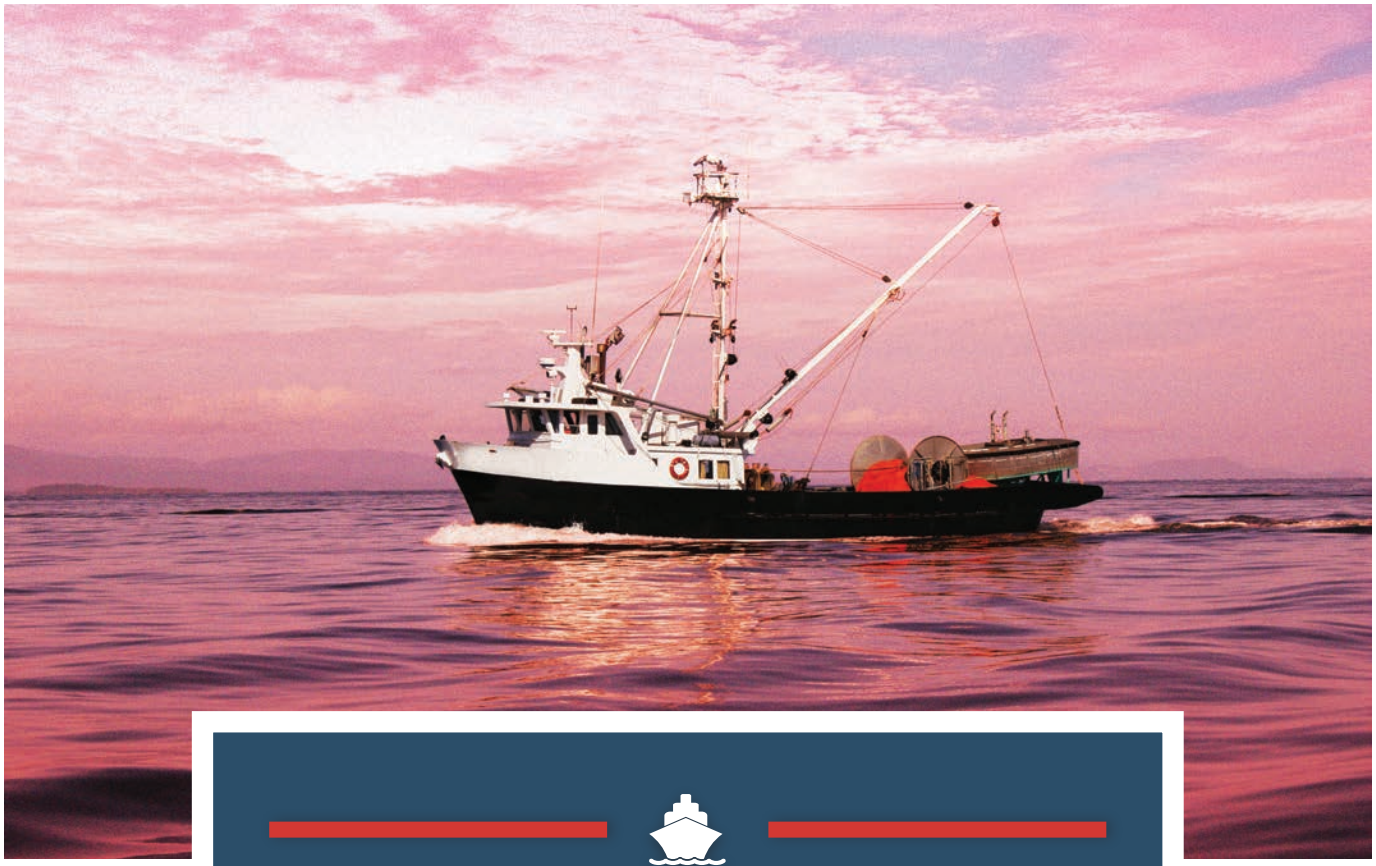
The following are two notable examples of reports closed by the trusted agents in 2018–19.

Landing in excessive wind

After a turbulent flight, an individual reported that the pilot had made a second attempt to land at an airport that, in their view, should not have been attempted due to a strong crosswind. The trusted agent verified with air traffic control the exact wind direction and speed at the time of the landing. The trusted agent also contacted the aircraft manufacturer to obtain the limitations for the aircraft involved. The data received from both sources confirmed that the landing took place within acceptable conditions. The trusted agent communicated these conclusions to the individual who had made the confidential report.

Unreliable radar equipment

A person alleged that the radar equipment in a control tower was not reliable and was unsafe because, after a change in software, radar targets would disappear from the screen. The individual had informed their employer of the problem; however, the issue persisted. SECURITAS trusted agents provided the information to Transport Canada for follow-up.



MARINE SECTOR

Year in review

There were 282 marine accidents reported to the TSB in 2018, just above the 2017 total of 279, but below the 10-year average of 307. In 2018, as over the past decade, 83% of marine accidents were shipping accidents, while the remaining 17% were accidents aboard ship. Of those, accidents on fishing vessels (38%) and on cargo vessels (34%) were the most common.

In 2018, 20 marine fatalities were reported, nearly twice the total of 11 fatalities reported in 2017, and well above the 10-year average of 16. Only two of those fatalities were not fishing-related.

Although the number of fishing vessels involved in accidents was lower in 2018 than in the previous year, all eight fatal shipping accidents and the 14 related fatalities involved Canadian-flagged commercial fishing vessels. Four of the six fatal accidents aboard ship involved Canadian fishing vessels, as did the four related fatalities. These fatalities underline why commercial fishing safety remains on the Watchlist.

The number of marine incidents reported to the TSB in 2018 increased over previous years. Some 937 marine incidents were reported to the TSB in 2018, a 6% increase from 2017 and an 84% increase from the 10-year average of 509. The higher number of incidents reported can be traced largely to changes in reporting requirements that were introduced in 2014 for those involving a total failure of any machinery or technical system. In 2018, most (78%) reportable incidents were related to this type of event.

FIGURE 28. Select marine occurrence data, 2018

282 marine accidents

- 233 shipping accidents
- 49 accidents aboard ship

20 marine fatalities

- 18 fishing-related:
  - › 14 shipping,
  - › 4 aboard ship
- 2 non-fishing

937 marine incidents

- 78% due to machinery or technical failure

Accident rate

According to Transport Canada, marine activity for Canadian commercial non-fishing vessels over 15 gross tons (excluding passenger vessels and cruise ships) was 47% above the 10-year average in 2018. The 2018 accident rate was 2.0 accidents per 1,000 movements, lower than the 10-year average of 2.8. There has been a significant downward trend in the accident rate for Canadian commercial non-fishing vessels from 2008 to 2018.

FIGURE 27. Marine accidents and incidents in Canada, 2008 to 2018

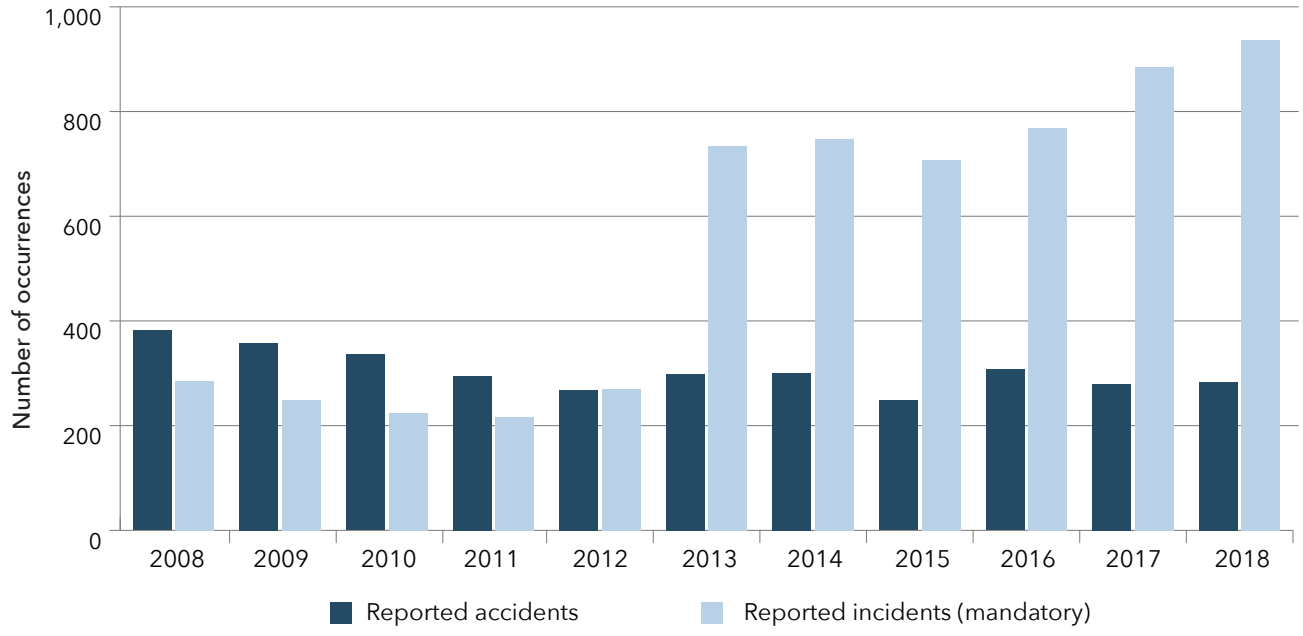


TABLE 7. TSB marine activities, 2017–18 and 2018–19

Activity	2017–18	2018–19
Deployments	21	26
Investigations started	20	17
Investigations completed	16	22
Investigations in progress at year-end	19	17

Marine activity for foreign commercial non-fishing vessels was 16% above the 10-year average. This yielded an accident rate of 1.0 accident per 1,000 movements, below the 10-year average of 1.5.

Investigations

As Table 7 indicates, the Marine Branch completed 22 investigations in 2018–19, which represents a 37% increase from the 16 investigations that were completed in 2017–18. Most of this increase can be attributed to class 4 investigations.

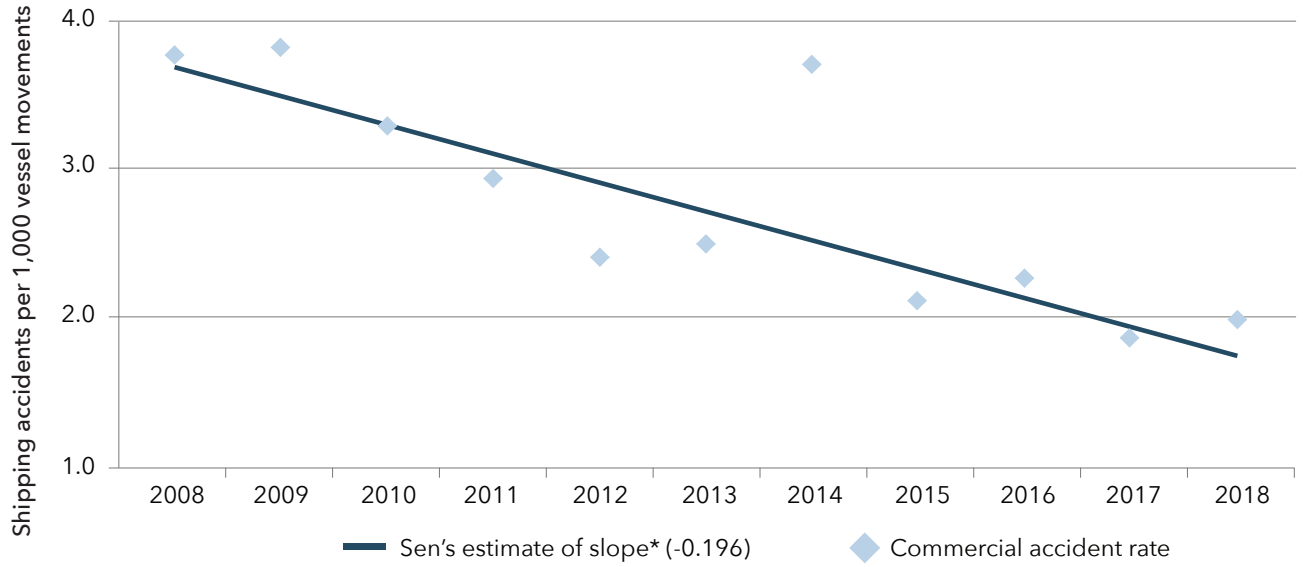
Table 8 sets out the number of investigations completed for each class of occurrences, the target timeline and the average duration.

The reports into various marine occurrences shed light on a number of important issues. Two reports underscored the need for Transport Canada to implement fatigue mitigation measures. Another revisited the need for better passage planning. Several investigations found mechanical failures, including one that resulted in a

TABLE 8. Completed marine investigations, target timeline and average duration by investigation type, 2017–18 and 2018–19

Class	Investigation type	Completed		Target timeline (days)		Average duration (days)	
		2017–18	2018–19	2017–18	2018–19	2017–18	2018–19
2	Complex	2	2	450	600	503	574
3	Detailed	14	7	450	450	461	417
4	Limited scope	n/a	13	n/a	200	n/a	294

FIGURE 29. Accident rate, Canadian commercial non-fishing vessels, 2008 to 2018



Source: Transport Canada

* Sen's estimate of slope is a robust, non-parametric estimate that is the median of the slopes of all lines through pairs of points in a time series.

TSB marine safety information letter (04/18)[3] that was published worldwide, notably on the Marine Accident Investigators' International Forum website.

Fatigue

Fatigue management represents a significant challenge in all sectors of the transportation system in Canada, including marine. Two investigations that were closed in 2018–19 underlined the consequences of falling asleep while working alone.

In October 2016, the tug *Nathan E. Stewart* and the tank barge it was pushing went aground west of Bella Bella, British Columbia (M16P0378), and subsequently sank. The second mate had fallen asleep and missed a planned course alteration. The tug's hull was eventually breached, with approximately 110,000 L of diesel oil being released into the environment.

Safety actions taken

The Pacific Pilotage Authority (PPA) amended its system of pilotage waivers pursuant to the Nathan E. Stewart occurrence. All vessels must have two people on the bridge at all times while operating in confined waters.

In addition, the PPA revoked the pilotage waiver for the master of the Ocean Monarch, requiring him to become informed of the waiver requirements. The PPA published an article in a trade publication to increase awareness of the pilotage waiver system and informed masters of vessels that currently hold pilotage waivers of the conditions of a pilotage waiver.

PHOTO 6. The tug *Nathan E. Stewart* prior to sinking in 2016

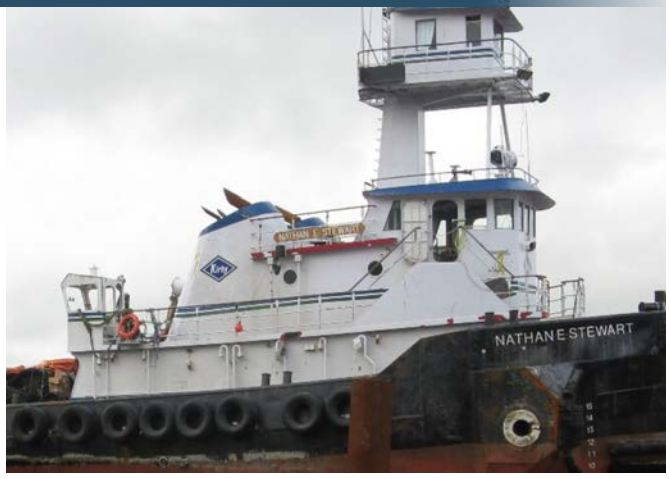


PHOTO 7. The tug *Ocean Monarch* undergoing repairs

Similarly, in July 2017, the tug *Ocean Monarch* made bottom contact while towing a loaded cement barge in British Columbia's Princess Royal Channel after the watchkeeper had fallen asleep (M17P0244). The tug's hull and starboard propeller nozzle were damaged.

In both instances, the watchkeeper had been working alone in the early hours of the morning.

To address the issue of fatigue for watchkeepers whose work and rest periods are regulated by the *Marine Personnel Regulations*, the Board made two recommendations following the first occurrence and repeated them after the second, namely

- that Transport Canada require such watchkeepers to receive practical fatigue education and awareness training in order to help identify and prevent the risks of fatigue (M18-01); and
- that Transport Canada require vessel owners who employ such watchkeepers to implement a comprehensive fatigue management plan tailored specifically for their operation, to reduce the risk of fatigue (M18-02).

Fatigue management is a Watchlist 2018 issue. The section below on the Watchlist summarizes the progress achieved pursuant to those two recommendations.

Passage plans

A pilot was navigating the bulk carrier *SBI Carioca* towards the pier at the Chaleur Bay Port of Belledune, New Brunswick, when it ran aground in October 2017

[3] Marine Accident Investigators' International Forum, "TSB Canada – Revised Safety Alert (MSI 04/18 -Rev2) Steering Gear Failure" at https://maiif.org/safety-bulletins/tsb-canada-revised-safety-alert-msa-04-18-rev2-steering-gear-failure/ (last accessed on 2019-05-13).

(M17A0390). The pilot, who was operating by visual means, did not have a formal passage plan for the journey to the pier. Nor did he request or receive feedback on the vessel's progress from the bridge team. Consequently, there was no shared mental model among bridge team members on how the approach should proceed, which increased the risk—realized in this case—that bridge team members would be unable to effectively monitor the pilot's actions.

This report highlighted that the Atlantic Pilotage Authority (APA) had not yet published passage plans as per Recommendation M94-34, which the Board issued more than 20 years ago. In light of the 2017 occurrence, the Board reaffirmed that close and continuous monitoring of a vessel's progress along its pre-planned track is essential for safe conduct. Knowledge of the pilot's passage plan provides a focus for the officer of the watch to effectively monitor the intentions of the pilot, the track and the progress of the vessel.

Safety actions taken

At the APA's request, the Canadian Hydrographic Service has added a pilot boarding station symbol to its chart for the Port of Belledune. The TSB then sent marine safety advisories to Fisheries and Oceans Canada and the United Kingdom Hydrographic Office informing them of the addition, so that these organizations could update their respective sailing directions.

The Board's rating of the APA's response remains Unsatisfactory.

Mechanical failures

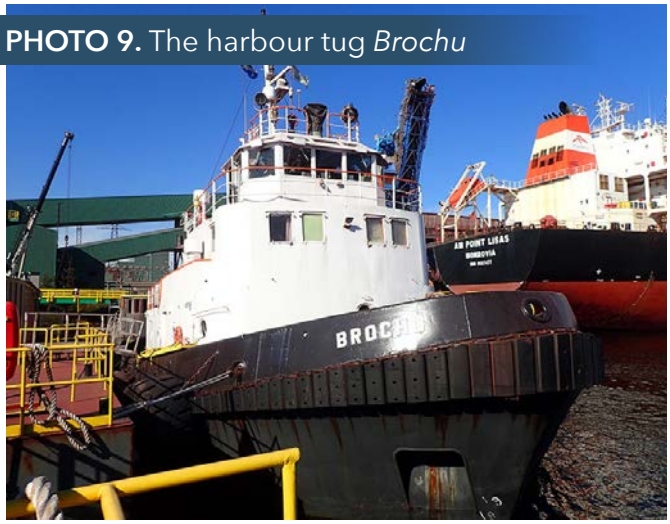
More than three quarters of the marine incidents reported to the TSB in 2018 were related to total failure of machinery or technical systems. A number of investigations the TSB closed in 2018–19 related to this ongoing problem.

For example, the investigation into a September 2017 fire on the tug *Brochu* (M17C0220) revealed a number of unsafe conditions on board that affected the crew's health and safety and the tug's operation, rendering it vulnerable to extensive damage in case of a coupling malfunction, as happened in this occurrence:

- The engine was kept at maximum power after the high-temperature coupling alarm sounded.
- Crew members were not aware of the significance of the alarm, nor were they provided with specific training on what to do when it rang.
- The operational temperature—the principal indicator of the condition of the starboard fluid coupling, whose failure had caused the fire—was neither automatically nor manually monitored.
- The machinery compartment's gastight devices were not maintained in accordance with regulations, causing smoke to enter the wheelhouse and crew accommodation.

PHOTO 8. The bulk carrier *SBI Carioca*

PHOTO 9. The harbour tug *Brochu*



Over the course of the investigation, the TSB sent a marine safety advisory letter (04/17) to Transport Canada and several foreign agencies; it also published the letter on the Marine Accident Investigators' International Forum website. The TSB took these steps to reach out to the world fleet and inform them of the unsafe conditions of the occurrence, since it was understood that nearly 800 vessels worldwide used similar couplings. It also issued an advisory letter (01/18) about the non-gastight devices. In turn, Transport Canada issued a FLAGSTATENET notice (03-2018) advising Canadian inspectors and surveyors to closely observe fittings intended to make accommodation spaces and the wheelhouse gastight, as well as openings in watertight decks and bulkheads, during inspections.

The May 2018 running aground of the product/chemical tanker *Chem Norma* off Morrisburg, Ontario (M18C0105), also highlighted a mechanical failure and, again, demonstrated the TSB's international reach in matters of marine safety.

During the investigation, the TSB sent a safety information letter to the vessel owner, warning the company that the same loss of steering control that led to this incident might occur on any of the *Chem Norma*'s 4 sister vessels fitted with a similar steering gear control arrangement. The vessel's Flag State Authority, the Marshall Islands, recommended that the vessel owner review procedures in the company's safety management system regarding emergency steering and loss of steering, with a focus on loss of steering in a narrow waterway and loss of steering with hazards in close proximity to the planned route.

The investigation (M18C0030) into the April 2018 failure of a remotely operated valve in the liquefied natural gas fuel supply and storage system of the ferry *F.-A.-Gauthier* determined that vibrations likely caused a stainless steel stud that is part of the valve to fail and break apart, which resulted in a small gas leak. This valve plays a critical role in the system—for example, allowing crew members to vent the storage tank when it is purged with nitrogen before maintenance is carried out. Following this occurrence, the system manufacturer and the valve manufacturer initiated a joint study to prevent the particular valve failure from happening again.

Professional fish harvesting industry

A number of investigations the TSB completed in 2018–19 put the spotlight once again on the need for improved safety measures in the professional fish harvesting industry. Three of those investigations followed occurrences in which crew members died when their vessels sank (M18P0073), capsized (M17P0052) or ran aground (M18A0002).

PHOTO 10. The product/chemical tanker *Chem Norma*

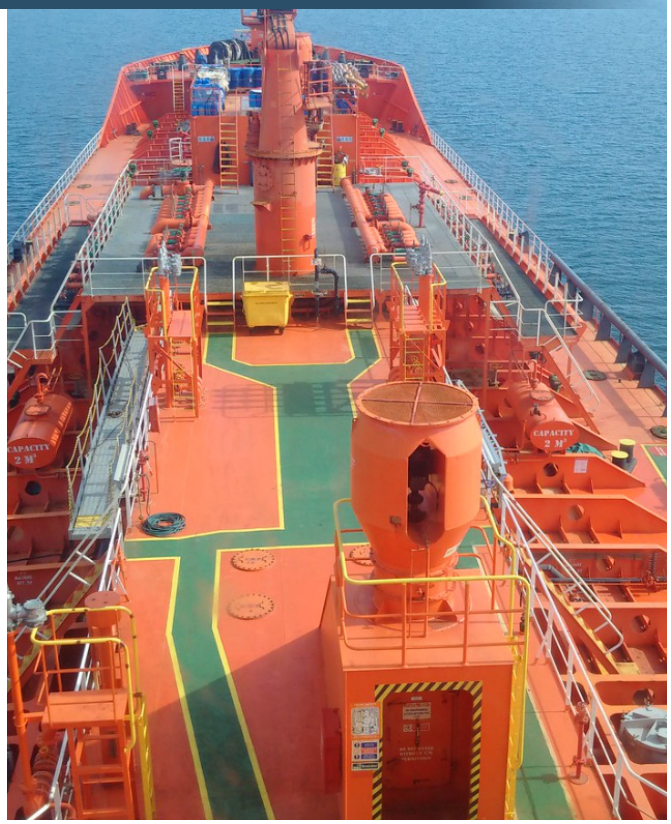


PHOTO 11. The ferry *F.-A.-Gauthier*

The investigation into the sinking of the *Western Commander* and subsequent loss of life (M18P0073) in April 2018 revealed that uneven distribution of the vessel's cargo of sea urchins from various harvesters may have caused the vessel to become unstable. This is an area of considerable concern to the TSB, since it has investigated accidents involving 21 stability-related fatalities over the last five years. Most of these accidents were due in part to the fact that fishing vessel operators did not have information about their vessel's stability or the information they had was not current.

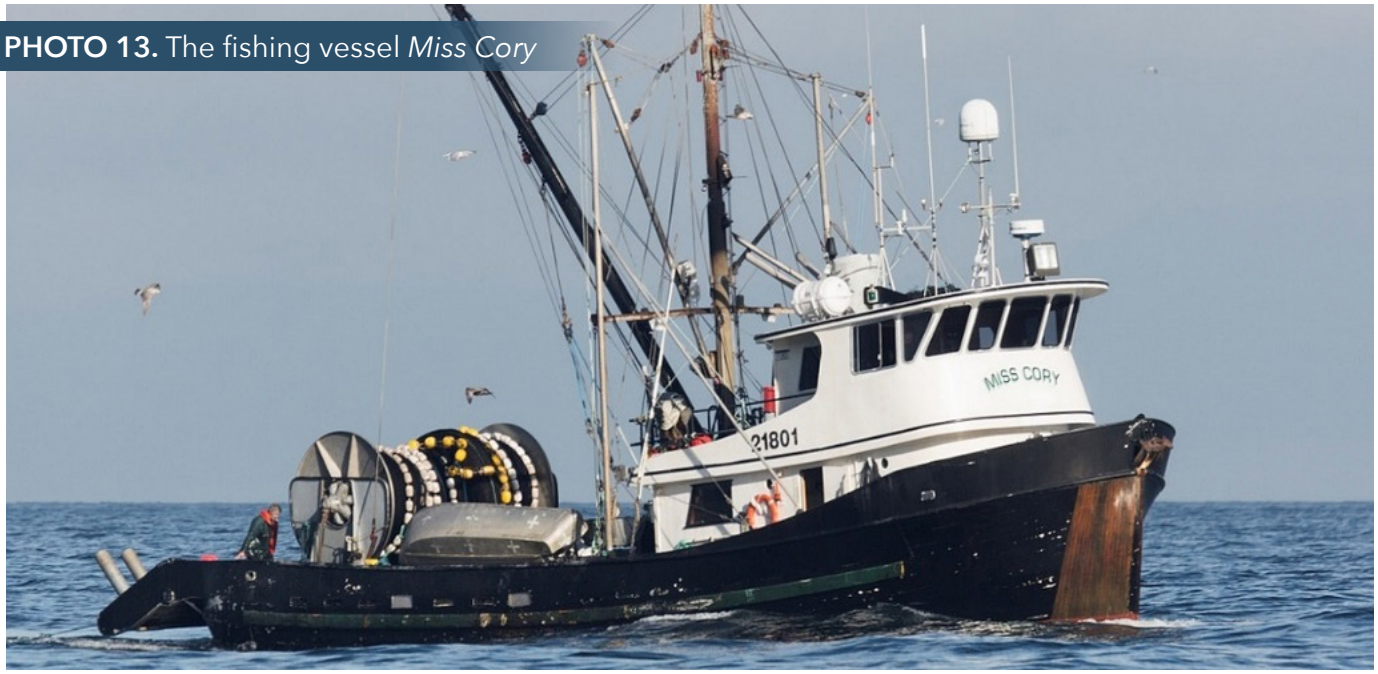
In response to an earlier occurrence (M15P0286), the TSB issued a recommendation (M16-02) calling on Transport Canada to address the issue of inadequate information about fishing vessel stability. The department proposed providing owners with stability notice templates and guidelines along with instructions on how to complete them, and to renew emphasis on stability booklets during inspections. These actions should increase the likelihood that fishing vessel operators will have access to stability information that is current, reflective of the vessel and its operations, and user-friendly. The Board considers the response to this recommendation to show Satisfactory Intent.

This recommendation also became relevant in the investigation into the capsizing and sinking of the fishing vessel *Miss Cory* in British Columbia in March 2017 (M17P0052). The TSB found that the vessel had not undergone a stability assessment for operations using its boom. As such, there were no means for the master to recognize that the vessel would rapidly capsize with a boom load of 5–7 long tons, as it did.

This investigation also found that there were no procedures for the safe operation of the vessel or for dealing with emergencies. The crew did not practise emergency drills on board the vessel, although they discussed the muster list and associated emergency duties. Following the occurrence, Fish Safe BC facilitated the development of a code of best practices for the roe herring fishery to address unsafe work practices that continue to put fishermen and vessels at risk. For its

PHOTO 12. The fishing vessel *Western Commander sinking*

PHOTO 13. The fishing vessel *Miss Cory*



part, WorkSafeBC has committed to enhancing inspections in the commercial fishing industry, focusing on vessel stability documentation, emergency drills and procedures.

Alarms necessary with no watchkeeping at anchor

The TSB investigation (M17C0035) into the April 2017 flooding of the fishing vessel *L.K.C.*'s engine room while it was anchored east of Sept-Îles, Quebec, found that the failure of the stern tube mechanical seal led to the occurrence. The high bilge-water alarm sounded only in the unmanned engine room, so the crew was unaware of the water coming in. In addition, crew members had not detected the presence of water during an earlier engine room inspection. Consequently, the water rose to a level that rendered the vessel's bilge pumps inoperative. Following the occurrence, the vessel owner installed an additional warning device to sound in the wheelhouse when the high bilge-water alarm is triggered.

Other investigations of note

- M18A0075: grounding of fishing vessel *Roping the Wind*, Hardys Channel, Prince Edward Island
- M17C0061: capsizing of small fishing vessel *Emma Joan*, Grosse-Île, Îles-de-la-Madeleine, Quebec

Progress on outstanding recommendations

Of the 24 marine recommendations that the Board reassessed this year, four were closed as Fully Satisfactory.

Three of them marked some progress on fishing vessel safety. Recommendation M94-33 called for the Department of Transport to establish guidelines for stability booklets so that the information they contain is presented in a simple, clear and practicable format for end-users. Recommendation M03-07 touched on the production and promotion of a code of best practices

PHOTO 14. The fishing vessel *L.K.C.*

FIGURE 30. Marine recommendations: 24 reassessed in 2018–19

4 now closed

- all Fully Satisfactory

20 still active

- 8 as Satisfactory Intent
- 7 as Satisfactory in Part
- 4 as Unsatisfactory
- 1 Unable to Assess

for small fishing vessels, including loading and stability. M16-04 was also closed in recognition of WorkSafeBC's requirement that suitable personal flotation devices be worn at all times on the deck of a commercial fishing vessel or on board a commercial fishing vessel without a deck or deck structure.

The fourth Fully Satisfactory recommendation (M05-06) addressed the need for Canadian passenger vessels over 500 gross tonnage to meet a standard of structural fire protection that ensures a level of safety equivalent to SOLAS-compliant vessels.

Watchlist 2018

In addition to slow progress on outstanding recommendations, Watchlist 2018 features three key issues that must be addressed by various stakeholders in the marine sector to reduce the risks to people, property and the environment. These issues relate to safety practices in the commercial fishing industry, fatigue management, and safety management systems and procedures.

Commercial fishing safety

The fact that 18 of the 20 marine fatalities in 2018 occurred in the fishing industry underlines the TSB's ongoing concern about safety in this industry. What is needed is an industry-wide cultural shift focusing on prevention.

Some fishing associations have taken increasing leadership in developing guidelines for vessel modifications and stability. Some workers' compensation boards have imposed fines to encourage safe work practices, and various organizations have launched education initiatives. As a result, there are signs of behavioural change among fish harvesters, but it is not consistent across regions and fisheries.

In 2018, TSB officials gave media interviews and appeared before parliamentary committees to comment on recent investigation reports into fatal accidents involving small fishing vessels and to discuss improvements needed to make Canada's commercial fishing industry safer.

This issue will remain on the Watchlist until there are sufficient indications that a sound safety culture has taken root throughout the industry and in fishing communities across the country. The TSB will continue to monitor progress through its investigations, its assessment of progress achieved in response to active recommendations and ongoing interactions with stakeholders.

Fatigue management

In response to the two recommendations the Board issued this year to improve fatigue management in the marine sector, Transport Canada proposed to amend the *Marine Personnel Regulations* to clarify that commuting time cannot be considered as part of hours of rest. It also committed to issuing a Ship Safety Bulletin to raise awareness of the International Maritime Organization (IMO) Guidelines on Fatigue. However, the regulatory changes were dependent on research and industry engagement and the department's review of the findings of an IMO sub-committee studying the issue.

With regard to implementing comprehensive fatigue management plans, Transport Canada has proposed a number of individual actions but, in the Board's view, these do not amount to a comprehensive and integrated approach to reducing the risks associated with crew members worked while fatigued.

These recommendations remain active, with the current rating for the response of Unsatisfactory.

SECURITAS

In 2018–19, the TSB received 31 reports of marine-related concerns through its confidential reporting program. This represents a 24% increase from the previous year. The trusted agent responsible for handling SECURITAS matters on behalf of the Marine Branch closed 28 of those reports and 8 more that carried over from the previous year.

Nearly half (14) of the 31 reports made to SECURITAS on marine issues in 2018–19 were outside the TSB's mandate. These included reports related to pleasure craft or other modes of transportation.

In each case, the trusted agent contacted the person making the report to explain the TSB's mandate and/or to direct the individual to another organization.

Of the three reports that remained open at the end of 2018–19, one forms part of an active investigation and will be closed once the investigation report is published. The trusted agent is following up with the individuals who made the other two reports that remain open.

Four of the 2018–19 reports dealt with regulatory matters and were resolved in collaboration with Transport Canada. Six of the reports contained confidential information related to occurrences that had been reported to the TSB and were under investigation. Those reports were closed upon publication of the investigation reports.

Safety on board a ferry

This is a notable example of the reports the trusted agent closed in 2018–19.

An individual reported concerns about the maintenance of the machinery onboard a ferry, and the safety of the vessel and crew. The trusted agent sent the details of the concerns to Transport Canada, which carried out an inspection. A number of deficiencies and action items were identified and a Compliance Inspection Report was given to the owners and to the classification society, which carries out inspection and certification activities of commercial vessels.

PIPELINE SECTOR

Year in review

The TSB received 111 reports of pipeline transportation occurrences in 2018 (10 fewer than in 2017), including one accident. These figures are below the 10-year average of 133 occurrences, including seven accidents.

Once again, there were no serious injuries or fatalities arising directly from the operation of any federally regulated pipeline, as has been the case since the TSB's inception in 1990.

Of all occurrences in 2018, 42 involved a release of product:[4]

- The one accident, which occurred in British Columbia, released a quantity of hydrocarbon gas following a pipeline rupture.
- Similarly, 35 incidents resulted in hydrocarbon gas being released.
- Four other incidents involved the release of crude oil or diesel fuel.
- One incident released some propane.
- The last incident involved the release of brine.

FIGURE 32. Select pipeline occurrence data, 2018

111 pipeline occurrences, including 1 accident

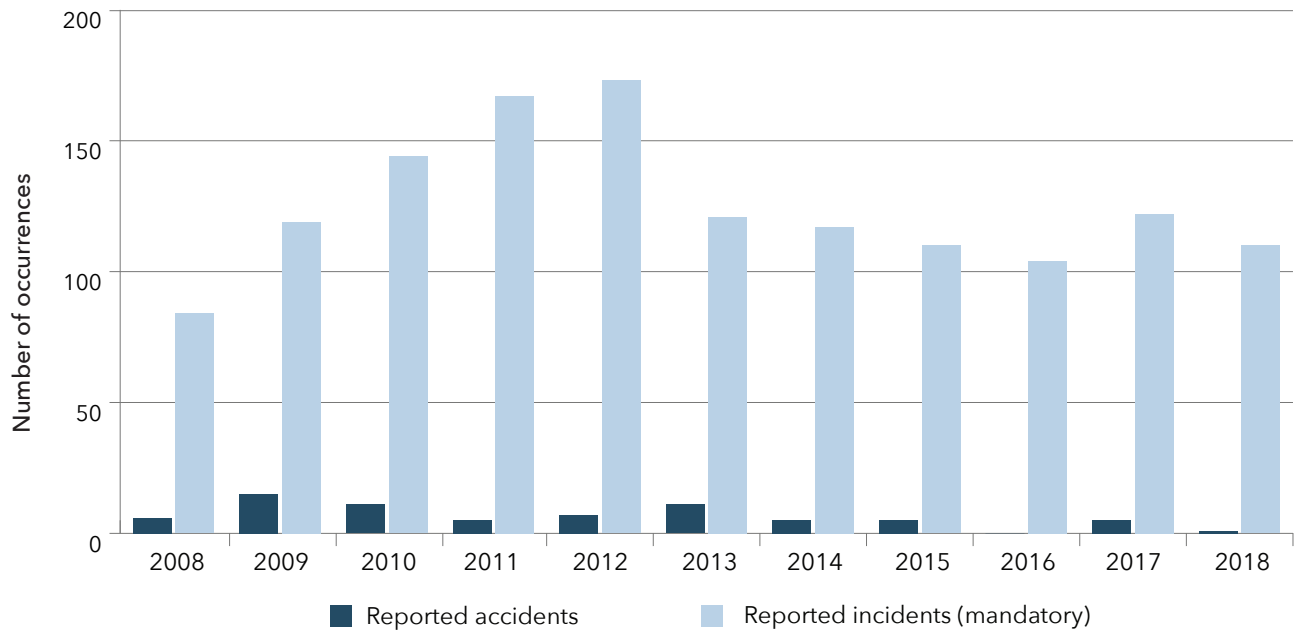
42 instances of product release

These 42 occurrences are considerably fewer than the average of 99 per year over the previous 10 years. The difference is mostly due to changes that were introduced in 2014 to the occurrence reporting criteria.

In 2018, 44 incidents (40%) involved geotechnical, hydrotechnical or environmental activity—slope movements or river erosion, for example. This is a significant increase from 16 reports of this type in 2017 and is well above the average of three such events per year over the previous 10 years. The surge may be related to increased regulatory enforcement, combined with increased company inspections and reporting, as well as changes to weather patterns and hydrotechnical activity.

British Columbia accounted for the most occurrences (48 out of 111), while Alberta had 31 occurrences and Ontario 20 occurrences. The remaining 12 occurrences were spread across five provinces: Nova Scotia, New Brunswick, Quebec, Manitoba, and Saskatchewan.

FIGURE 31. Pipeline accidents and incidents in Canada, 2008 to 2018



[4] For more details on product release, consult the TSB's *Statistical Summary of Pipeline Occurrences in 2018*

Occurrence rate

There were 70,686 km of federally regulated pipeline operating in Canada in 2018, according to the National Energy Board. The 111 pipeline-related occurrences reported to the TSB for the year result in an occurrence rate per 1,000 km of operating pipeline of 1.6. This is down from the 2017 rate of 1.8 and continues the downward trend since 2011. The 2018 rate is also below the average of 1.9 occurrences per 1,000 km since 2011.

Typically, occurrences happen at facilities more often than at locations along pipeline away from facilities. However, in 2018 more than half of occurrences (69 of 110) did not occur at facilities. This is due in part to the unusually high number of reports of geotechnical, hydrotechnical or environmental activity that affected sections of pipeline during the year. Of 41 incidents at facilities, 18 occurred at compressor stations, seven were at gas processing plants, six at meter stations, four at pump stations, and six at terminals.

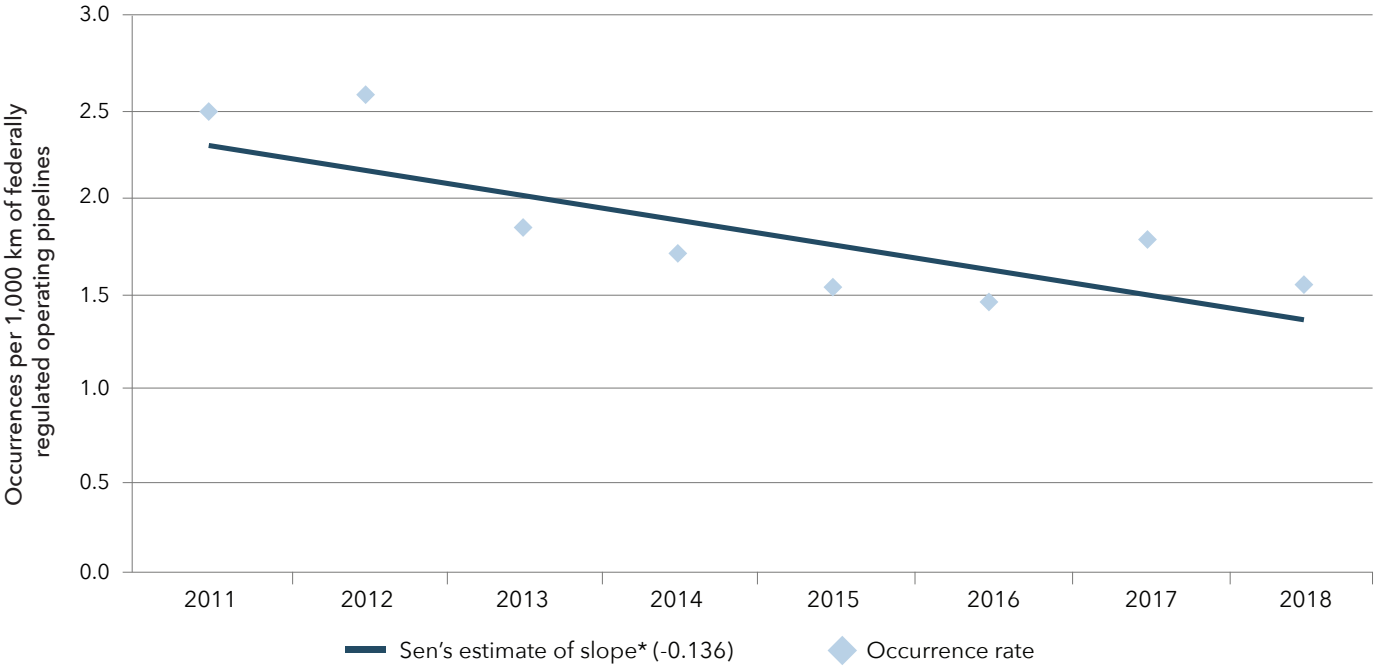
Investigations

As Tables 9 and 10 indicate, the Pipeline Branch completed two investigations in 2018–19: one class 3 investigation completed in 522 days, and one class 4 investigation completed in 264 days.

TABLE 9. TSB pipeline activities, 2017–18 and 2018–19

Activity	2017–18	2018–19
Deployments	0	1
Investigations started	0	2
Investigations completed	1	2
Investigations in progress at year-end	1	1

FIGURE 33. Pipeline occurrence rate, 2011 to 2018



Source: National Energy Board

* Sen's estimate of slope is a robust, non-parametric estimate that is the median of the slopes of all lines through pairs of points in a time series.

TABLE 10. Completed pipeline investigations, target timeline and average duration by investigation type, 2017–18 and 2018–19

Class	Investigation type	Completed		Target timeline (days)		Average duration (days)	
		2017–18	2018–19	2017–18	2018–19	2017–18	2018–19
3	Detailed	1	1	450	450	275	522
4	Limited scope	n/a	1	n/a	200	n/a	264

Information sharing essential to preventing pipeline punctures when crossing pipelines

The TSB's investigation (P17H0011) into the 2017 puncture of a 610-mm (24-inch) pipeline operated by Enbridge Pipelines Inc. found that when critical information about the location of pipelines being crossed is not obtained and shared with all relevant parties, an incorrect drill path may be set. This increases the risk of damage to the pipeline during horizontal directional boring.

PHOTO 15. TSB investigator on site of the Sherwood Park pipeline occurrence

In this case, the boring had gone ahead without a confirmed location for the Enbridge pipeline, and without removing a rig matting for an access ramp that extended over the pipeline. In addition, a non-standard process was used to mark the depth of cover on the project cut sheet indicating that the measurement was not confirmed (in contrast to comments accompanying the cut sheet that indicated that the measurement was confirmed). The ground disturbance checklist incorrectly indicated that visual depth confirmation had been performed for all pipelines to be crossed.

In response to the occurrence, Enbridge Pipelines Inc. reviewed company procedures, processes and internal communications, and clarified and harmonized technical terminology related to pipeline crossings. Grand Rapids Pipeline GP Ltd., the company whose pipeline was being installed when the Enbridge line was struck, took a number of steps to prevent future incidents of this type. Ledcor Pipeline Limited, the contractor, commissioned an independent buried pipeline- and utility-locating service company to review its ground disturbance program.

Progress on outstanding recommendations

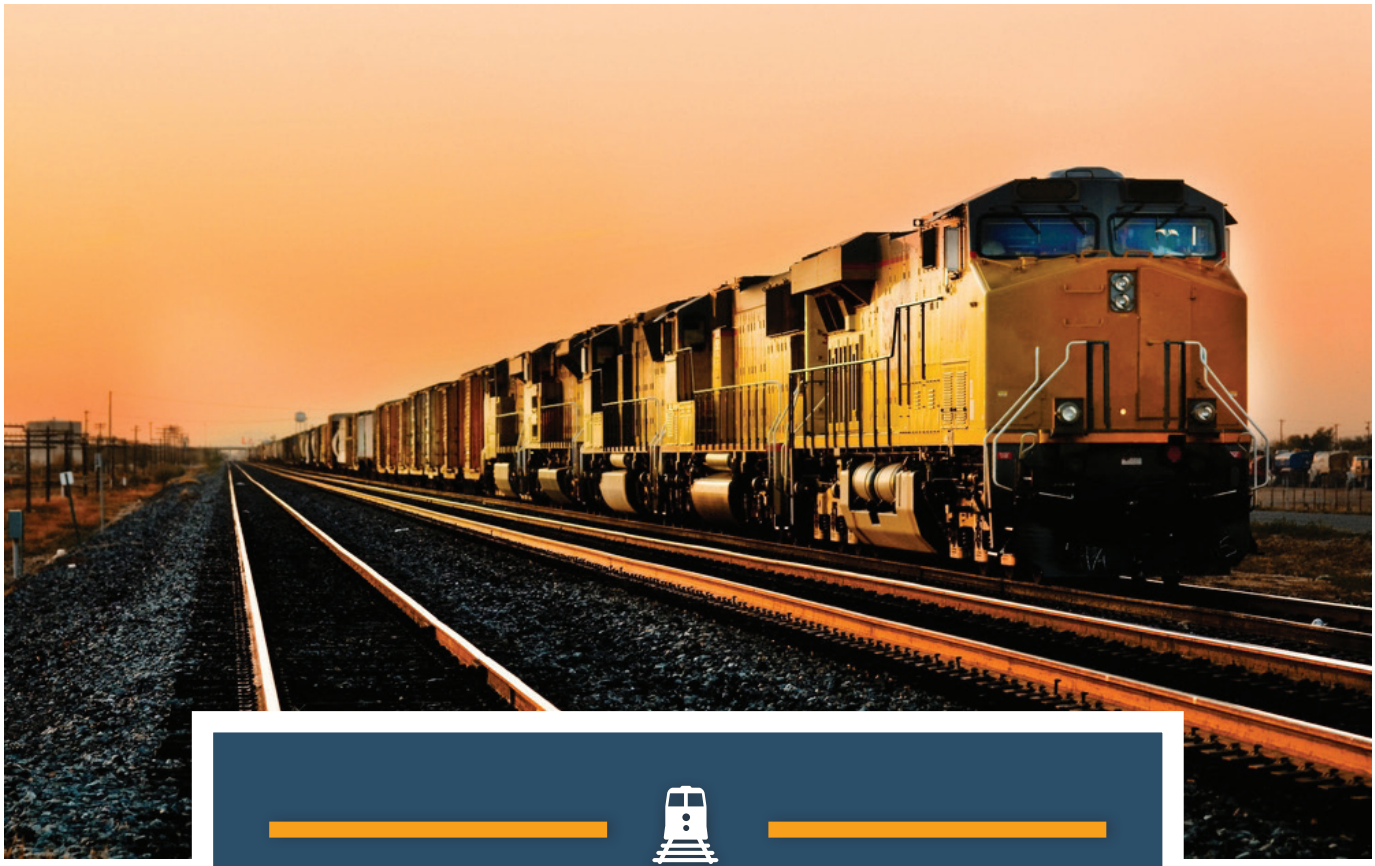
The Board issued no pipeline safety recommendations in 2018–19 and had previously assessed all pipeline recommendations as Fully Satisfactory.

Watchlist 2018

There are no Watchlist issues pertaining to pipeline transportation.

SECURITAS

No safety issues related to pipelines were reported to SECURITAS in 2018–19.



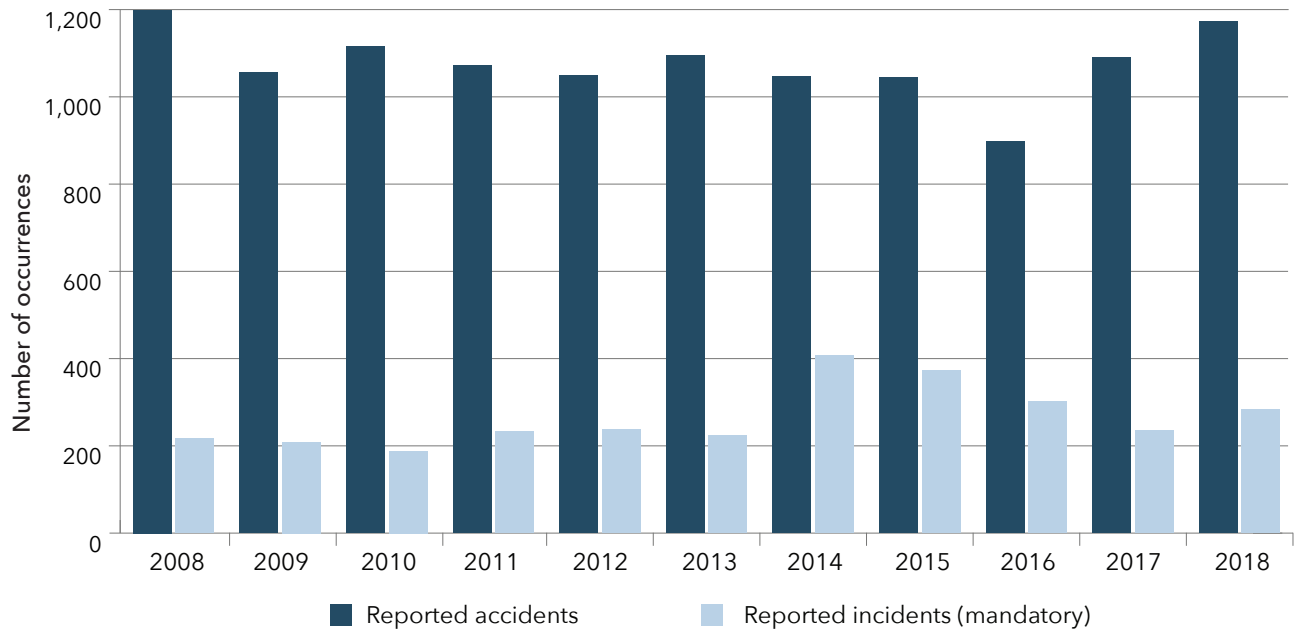
RAIL SECTOR

Year in review

Overall, 1,172 railway accidents were reported to the TSB in 2018, a 7% increase over 2017 and a 10% increase from the 10-year average of 1,067. Most of the increase relates to non-main-track derailments of five or fewer cars.

There were 57 rail-related fatalities reported in 2018, 19 fewer than the previous year and below the 10-year average of 75. Among the 2018 fatalities, 34 involved trespassers, compared to 53 in 2017 and to the 10-year average of 44.

FIGURE 34. Rail accidents and incidents in Canada, 2008 to 2018



Crossing accident fatalities remained stable in 2018 (19) relative to 2017 (19) and were below the 10-year average of 23. However, the number of serious injuries due to crossing accidents nearly doubled in 2018 (42) compared to 2017 (22) and were above the 10-year average (26).

FIGURE 35. Select rail occurrence data, 2018

1,172 rail accidents

- a 7% increase due to non-main-track derailments of five or fewer cars
- 6 of these accidents resulted in a dangerous goods release

57 rail fatalities

- trespassing: 34
- crossing accidents: 19
- other accidents: 4

To better understand these data, the TSB has been examining cyclical variations in 2007 to 2017 Canadian level-crossing accident data. Data from December to February typically show an increase of approximately 5.8 additional accidents per month compared to the rest of the year. The analysis so far indicates that the cyclical pattern is due primarily to weather-related factors rather than to differences in the number of hours of darkness between seasons. The examination is ongoing.

Among all railway accidents reported to the TSB in 2018, 125 involved dangerous goods. This is up from 115 in 2017, but down slightly from the 10-year average of 129. Six accidents in 2018 resulted in a dangerous goods release.

There were 283 railway incidents reported to the TSB in 2018, a 20% increase from 2017 (235), and an 8% increase from the 10-year average (263). Almost half (137) of these incidents were due to trains exceeding limits when moving. Compared to the previous year, this number was higher by 15 and was above the 10-year average of 118.

TABLE 11. TSB rail activities, 2017–18 and 2018–19

Activity	2017–18	2018–19
Deployments	16	17
Investigations started	19	21
Investigations completed	20	16
Investigations in progress at year-end	18	23

In 2018, the TSB retroactively applied a June 2016 regulatory change by Transport Canada that revised the criteria for a dangerous goods leaker from a volume-based threshold to outcome-based consequences, resulting in the re-categorization of a number of occurrences. Consequently, almost all of dangerous goods leaker incidents between June 2016 and December 2018 did not meet the outcome-based threshold and were deemed to be non-reportable.

Accident rate

According to Transport Canada data, 2018 main-track (non-yard) rail activity increased by 6% from 2017. The main-track accident rate in 2018 was 2.6 accidents per million main-track train-miles, up from 2.5 in 2017 and above the 10-year average of 2.3.

Investigations

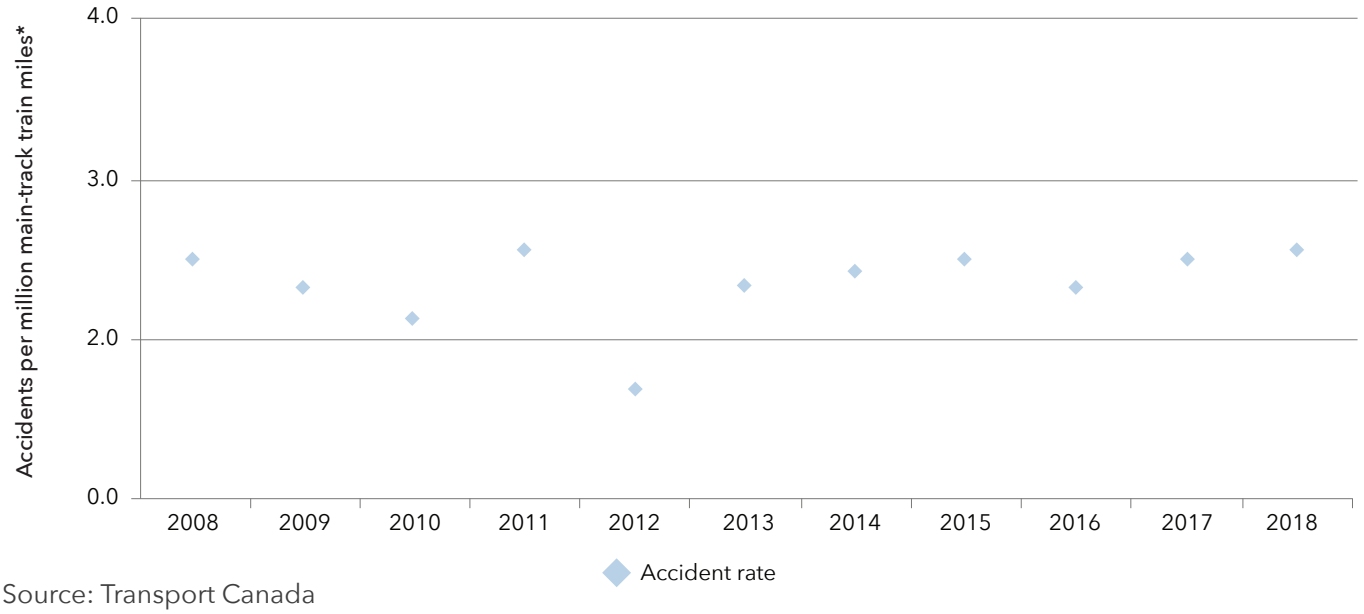
As Table 11 indicates, the Rail Branch completed 16 investigations in 2018–19, similar to the number completed the previous year.

Table 12 sets out the number of investigations completed for each class of occurrences, the target timeline and the average duration.

TABLE 12. Completed rail investigations, target timeline and average duration by investigation type, 2017–18 and 2018–19

Class	Investigation type	Completed		Target timeline (days)		Average duration (days)	
		2017–18	2018–19	2017–18	2018–19	2017–18	2018–19
2	Complex	2	2	450	600	725	672
3	Detailed	18	7	450	450	454	447
4	Limited scope	n/a	7	n/a	200	n/a	214

FIGURE 36. Main-track accident rate, 2008 to 2018



Source: Transport Canada

* Main-track train-miles are estimated.

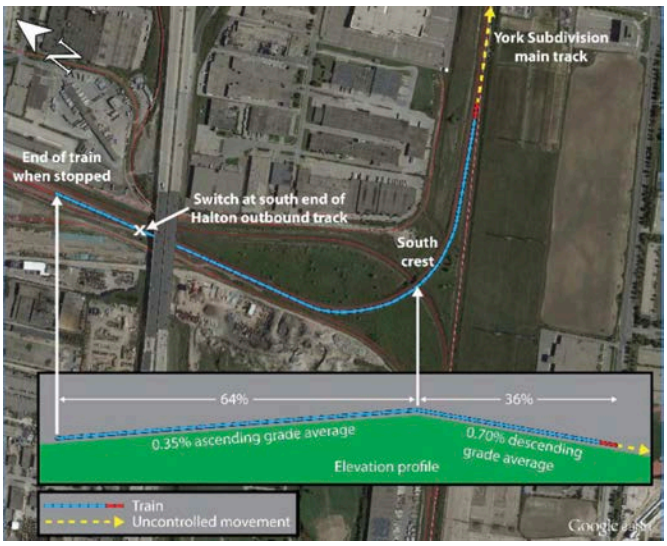
A number of investigations examined uncontrolled movement occurrences, and in many cases, they highlighted gaps in employee training and qualification standards, and in the communication of procedures.

Uncontrolled movements

In 2018, there was a total of 63 occurrences involving uncontrolled movement of rolling stock, which is fewer than the total of 65 occurrences in 2017. The 2018 occurrences included 44 accidents involving an uncontrolled movement, 15 incidents of uncontrolled movement of rolling stock, and four incidents of other types, also involving an uncontrolled movement.

The TSB investigation (R16T0111) into the uncontrolled movement of a train for about three miles (reaching speeds of up to 30 mph) away from the Canadian National Railway Company's (CN) MacMillan Yard north of Toronto, determined that the braking force the crew applied was insufficient to stop the train, which was on a descending grade. The crew was attempting to manoeuver a long heavy train with only the independent brake. The crew's training, experience, and guidance did not equip them with the knowledge to safely perform the tasks assigned to them.

FIGURE 37. Elevation profile of MacMillan Yard



Following the incident, CN conducted a risk assessment that included a review of topography and air brake use in all its switching yards in Canada. Based on the review, CN implemented new minimum braking requirements for each yard including how many cars require charged air brakes prior to accessing main track.

Gaps in employee qualification standards

Findings from the MacMillan Yard investigation (R16T0111) indicated that further safety action was required. The TSB noted significant gaps in the *Railway Employee Qualification Standards Regulations*, particularly with respect to training. For example, conductors, who receive little training in locomotive operation or train handling, can operate transfers on the main track for distances of up to 20 miles at speeds of up to 15 mph, with no tonnage or train length restrictions.

Since 2002, the TSB has conducted five other investigations that were directly related to deficiencies in operating crew training and/or related gaps in the regulations (R16W0074, R15V0046, R13W0260, R04W0035 and R02W0060). While Transport Canada has recognized the need to update the regulations on several occasions, regulations have not kept pace with the significant changes in railway operations over the years.

The TSB issued a recommendation (R18-02) requiring Transport Canada to update the *Railway Employee Qualification Standards Regulations* to address the existing gaps for railway employees in safety-critical positions related to training, qualification and re-qualification standards, and regulatory oversight. If these gaps remain, Transport Canada will not be able to conduct effective regulatory oversight and enforcement of training programs for safety-critical positions.

> "Since the *Railway Employee Qualification Standards Regulations* came into force in 1987, the rail industry has changed tremendously and the technology has evolved, but qualification standards and training requirements have not. Consequently, railway employees in safety-critical positions may not be sufficiently trained or experienced to perform their duties safely." –Board member Faye Ackermans, in opening remarks at the 27 June 2018 news conference on investigation report R16T0111

In its response, Transport Canada indicated it was developing policy options to update the regulatory framework in consultation with industry representatives to address the gaps identified in training and qualification standards. The department expects to pre-publish a regulatory proposal in the *Canada Gazette*, Part I in 2020. The Board supports the use of regulations to establish specific training and qualification standards for railway employees in safety-critical positions to ensure consistent application and use across the railway industry. The Board assessed the response to the recommendation as having Satisfactory Intent.

Procedures must be clear and clearly communicated

While investigating an uncontrolled movement of a Quebec North Shore and Labrador Railway train (R17Q0061), the TSB found that the locomotive engineer had not properly applied the automatic brake before

uncoupling locomotives from the consist. As a result, the brake released and the cars began to roll. The braking force from the hand brakes that were applied on some head end cars was not sufficient to stop the cars.

Following the occurrence, the railway company clarified its operating procedures regarding brake pipe uncoupling and the minimum number of hand brakes to be applied. Training regarding these changes was delivered to all locomotive engineers.

In light of a TSB investigation (R17W0190) into the collapse of a boom crane that seriously injured the crane operator, Canadian Pacific Railway undertook inspections of all boom cranes that had not already been inspected. The company also revised its crane inspection procedures relating to the operator's seat to include daily, quarterly, and annual inspections, since both the operator's seatbelt and the seat-locking mechanism were inoperative at the time of the accident.

PHOTO 16. Derailment location, showing a backhoe buried under logs

The TSB also conducted an investigation into an uncontrolled movement and fatal derailment of a B.C. train at the request of the British Columbia Ministry of Transportation and Infrastructure (R17V0096). Among other things, the investigation found that the uncontrolled movement had separated from the rest of the cars after a knuckle inadvertently released, and that reload staff had not been formally trained on the use of any visual check to verify the coupling was secure. In addition, the derail mechanism, which had not been properly installed or maintained, was damaged by the rolling stock and rendered ineffective.

As part of the investigation, the TSB issued two rail safety advisories (05/17 and 05/18) to stakeholders on the installation, maintenance and inspection of derails at the location where the cars were being loaded, and on the visual verification method to ensure secure coupling of rail cars. The TSB also issued a rail safety information letter (20/18) to the British Columbia Ministry of Transportation and Infrastructure on the need to reference the most recent federal railway safety regulations, rules and standards in its own regulations.

Misapplication of planned protection procedures

A Canadian Pacific Railway (CP) train collided with a backhoe near Fraine, British Columbia, seriously injuring the operator and damaging the backhoe's boom and windshield. The investigation into this occurrence (R17V0220) found that the train was authorized to operate on this track, and that the foreman had received confirmation from both the subforeman and the supervisor that all workers and track equipment had been cleared off the track. However, there was a different understanding of the track on which the train would operate, the location of the backhoe and the protection required for the backhoe operator.

The TSB issued a rail safety advisory (14/17), indicating that, given the inherent risks to track workers when trains are operated through track work locations, Transport Canada may wish to review the manner in which track workers, particularly third-party contractors, are protected.

For its part, CP issued a Safety Flash stating that all employees must ensure there is clear communication when clearing a movement through protected limits. This includes validating that all parties understand the direction and are aware of the limits being provided.

Wheel-climb derailment—a combination of multiple factors

The TSB investigated (R17T0164) the derailment of 14 cars of a Canadian National (CN) freight train, including one that had previously contained liquefied petroleum gas, over a level crossing in the town of Strathroy, Ontario.

The derailment was triggered by one wheel of a car climbing over the rail on the high side of a curve. However, the investigation determined that there were numerous "non-condemnable" factors that contributed to the wheel climb, including a number of mechanical conditions and various track conditions.

Following the occurrence, CN purchased specialized tools and equipment to repair stabilized trucks on freight cars. CN also ensured that the importance of

the condition of coupler and truck components when performing safety inspections is being discussed with mechanical staff during daily job briefings.

The TSB investigation (R17W0175) into the derailment of 22 covered hopper cars loaded with corn while they were exiting a bridge near Dominion City, Manitoba, found that the presence of recurring track geometry defects had introduced higher than usual forces into the rail during normal train operations leading to the development of a transverse fracture originating in a thermite weld. Following the occurrence, Canadian Pacific Railway installed 5,022 feet of 136-pound continuous welded rail near the site of the occurrence.

Progress on outstanding recommendations

The Board reassessed 17 rail recommendations this year and closed two of them as Fully Satisfactory. These recommendations touched on installation guidelines for in-vehicle video monitors (R15-01) and rail surface condition data for risk-based planning (R17-02).

Recommendations on bus safety

Following its investigation into the 2013 VIA Rail-OC Transpo accident in Ottawa, the TSB made three recommendations on bus safety. The Board reassessed the responses to these recommendations in 2018–19.

Recommendation R15-01 suggested that Transport Canada, in consultation with the provinces, develop comprehensive guidelines for installing and using vehicle video monitor displays to reduce the risk of driver distraction. In February 2019, Transport Canada published Guidelines to Limit Distraction from Visual Displays in Vehicles. The Board reassessed the progress on this recommendation as Fully Satisfactory and closed the file.

However, the two other recommendations relating to bus safety stemming from that same accident remain open:

- R15-02: that Transport Canada develop and implement crashworthiness standards for commercial passenger buses to reduce the risk of injury. Following reassessment, the Board considers that the progress accomplished in response to this recommendation is Satisfactory in Part.
- R15-03: that Transport Canada require commercial passenger buses to be equipped with dedicated, crashworthy event data recorders. The Board has reassessed the response to this recommendation as indicating Satisfactory Intent.

PHOTO 17. August 2017 derailment near Dominion City, Manitoba

In light of subsequent bus crashes in Canada that have resulted in significant loss of life and serious injury, the Board remains concerned that more needs to be done to address these recommendations. While Transport Canada has taken a number of important steps with regard to the crashworthiness of buses, they are not being carried out quickly enough. Consequently, the Board downgraded its initial rating of the department's response to Recommendation R15-02 from Satisfactory Intent to Satisfactory in Part.

Finally, the Board closed its recommendation (R17-02) that Transport Canada acquire rail surface condition data, including information on localized surface collapse, rail end batter and crushed heads, and incorporate it into its risk-based planning approach for targeted regulatory track inspections. The lack of such information could mean that a track joint or rail failure would not be detected. This recommendation resulted from a large main-track derailment near Gogama, Ontario, in March 2015 (R15H0021), the sixth occurrence since May 2014 to take place under similar circumstances.

FIGURE 38. Rail recommendations: 17 reassessed in 2018–19

2 now closed

- Fully Satisfactory

15 still active

- 11 as Satisfactory Intent
- 4 as Satisfactory in Part

Watchlist 2018

Notable for the rail sector in 2018 was the removal of two issues from the Watchlist: the transportation of flammable liquids by rail and the requirement for on-board voice and video recorders in main-track lead locomotives.

Transportation of flammable liquids by rail

After the Lac-Mégantic accident, Watchlist 2014 called on Transport Canada to ensure flammable liquids were being safely transported by requiring railway companies to properly classify these products, ship them in safe containers, and conduct route risk assessments to proactively mitigate risks.

The Board kept the transportation of flammable liquids by rail on Watchlist 2016 to ensure these measures were taken but then removed the issue from Watchlist 2018. Based on its evaluation, the Board is of the view that Transport Canada—and the industry—have taken the actions the TSB had called for.

Transport Canada has provided Fully Satisfactory responses to the TSB recommendations for better route planning and analysis as well as the implementation of emergency response assistance plans. Railway companies have increased targeted track inspections and conducted more route planning and risk assessments. As directed by Transport Canada, they have phased out the older "legacy" cars so they now use more robust tank cars when transporting large quantities of flammable liquids, thereby reducing the likelihood of a dangerous-goods release during accidents. The number of single-product (unit) trains carrying crude oil has also been reduced over this period.

The TSB continues to monitor closely the transportation of flammable liquids by rail through its assessment of outstanding recommendations and reported occurrences and during its investigations and interactions with industry stakeholders.

Implementation of on-board voice and video recorders in locomotives

Transport Canada announced in May 2017 that it would be amending the *Railway Safety Act* to require the installation of on-board voice and video recorders in main-track lead locomotives as recommended by the TSB in 2003 (R03-02) and in 2013 (R13-02). Amendments to the legislation received Royal assent in May 2018. Since then Transport Canada has been working on the development of supporting regulations.

Railway signal indications

This issue remains on the Watchlist in light of two long-standing recommendations that have yet to receive Fully Satisfactory responses from Transport Canada and industry.

The first (R00-04), which recommended that Transport Canada and the railway industry implement additional backup safety defences to help ensure that signal indications are consistently recognized and followed, stemmed from the rear-end collision in 1998 of two trains. Since it was issued in February 2001, the Board has reassessed responses to this recommendation many times, with the latest response assessed as Satisfactory in Part.

The VIA Rail train derailment with three fatalities near Burlington, Ontario, in 2012 led to the second recommendation (R13-01). In it, the Board recommended that Transport Canada require major Canadian passenger and freight railways to implement physical fail-safe train controls, beginning with Canada's high-speed rail corridors. The Board has reassessed the latest response to this recommendation as Satisfactory in Part.

Safety management and oversight

As the 2016 occurrence (R16V0195) in Delta, British Columbia, clearly demonstrated, gaps in training, supervision, and efficiency testing of employees can point to an ineffective implementation of a company's safety management system.

A switching crew was shoving 66 empty intermodal platforms onto the east leg track at Roberts Bank Yard when the movement struck and seriously injured a track worker clearing snow from a switch.

The investigation determined that inadequate safety watch training contributed to the accident. Safety watch is a form of track protection that requires one crew to perform the sole task of monitoring the work site for any rolling stock. In this occurrence, no one was solely performing the duties of safety watch. The track workers had not been adequately trained in its use and did not have an accurate understanding of how to apply such protection. The safety watch processes were not specifically audited; therefore the inadequate application of the safety watch was not apparent.

The TSB issued two rail safety advisories (03/17 and 07/17), advising that Transport Canada review how safety watch protection was being implemented and how point protection was being provided at Roberts Bank Yard.

Transport Canada conducted a comprehensive safety management system audit of the operations at Roberts Bank Yard.

Technical Safety BC issued a Safety Advisory to notify all provincially certified railways operating in British Columbia of the risks associated with shoving equipment. It recommended that railways review their processes to ensure compliance with all applicable rules and regulations regarding shoving equipment.

BCR Properties Ltd., the owner of the Roberts Bank Yard, completed a risk assessment and incorporated a number of protection measures into its safety management system. BCR also followed up with the contractor to ensure its employees receive appropriate training and certifications.

SECURITAS

In 2018–19, the TSB received 65 rail-related reports through its confidential reporting program. This is a 48% increase over the previous year. Eleven of the reports were outside the TSB mandate. By the end of the year, all 65 cases had been closed, in addition to the three open cases that were carried over from the previous year.

In the railway sector, the TSB issued 27 safety communication products as a direct result of the reports to SECURITAS. The trusted agent communicated directly with Transport Canada for 16 of these cases, and directly with the operator for the remaining 11.

Among the common issues reported were fatigue of train crew members, the inspection and maintenance of locomotives, the safety of vehicle drivers at rail crossings, and training for operating employees.

The following are two examples of cases resolved by the trusted agent that led to follow-up and safety action.

Inspection and maintenance of locomotives

An individual alleged that some locomotives at a railway's terminal were not being inspected and/or maintained in a timely manner, describing three instances in which maintenance issues had not been fully addressed prior to their operational use. The TSB issued a rail safety information letter to the railway. In response, the company reviewed the descriptions of the defects and repaired the three locomotives at issue at the next opportunity in accordance with the *Railway Locomotive Inspection and Safety Rules*.

Train crew working outside during severe weather

An individual reported that a train crew setting out cars in a yard was instructed to continue working during an electrical storm with several lightning strikes. The TSB issued a rail safety information letter to Transport Canada with a copy to the railway. Shortly after receiving the letter, the company issued a system notice providing general safety guidelines for employees working outside when an electrical storm is approaching.

The Transportation Safety Board of Canada (TSB) advances transportation safety related to aviation, marine, pipeline and rail activities in Canada:

- It conducts independent investigations into selected occurrences and makes findings about their causes and any contributing factors.
- It identifies safety deficiencies arising in transportation occurrences and makes recommendations to eliminate or reduce them.
- It reports publicly about its investigations and findings.

As part of its investigations, the TSB also reviews developments in transportation safety and identifies safety risks that governments and the transportation industry must address in order to reduce the risk of injury and loss.

Role of the Board

The Board, which comprises up to five members, including the Chair, approves all investigation reports, makes findings and issues recommendations.

In making findings, the Board does not assign fault or determine civil or criminal liability for an occurrence. Rather, it seeks to find out what happened and why in an objective manner, independent from government, and all other departments and agencies involved in transportation, and free from any conflict of interest. It also draws impartial conclusions and makes recommendations to those best placed to take action.

About the TSB

A staff of 220, led by the Chief Operating Officer and senior management, supports the Board. The work of the organization is guided by a five-year strategic plan and five core values:

- Respect: We are committed to treating all individuals and organizations with consideration, courtesy, discretion and fairness.
- Openness: We actively share and exchange information to advance transportation safety.
- Safety: We maintain and promote a positive and proactive safety culture.
- Integrity: We are guided by honesty, impartiality, propriety and accountability for our actions and decisions.
- Excellence: We maintain a highly skilled and knowledgeable team of professionals through leadership, innovation, and commitment to continuous improvement in the delivery of our products and services.

The Board

Kathleen Fox
Chair

Joseph Hincke
Board member

Faye Ackermans
Board member

Hélène Gosselin
Board member

Paul Dittmann
Board member

The TSB website contains biographies of each Board member.

TSB investigators are professionals with years of experience in the various transportation modes the TSB covers. They work in collaboration with engineering and technical specialists, human factors investigators, and industry analysts, all of whom are supported by small teams of communications specialists, corporate services professionals and administrative officers.

The TSB's headquarters are in Gatineau, Quebec. There is also a laboratory in Ottawa, and regional offices in Vancouver, Edmonton, Calgary, Winnipeg, Toronto, Montreal, Quebec City and Halifax.

The investigation process

There are three main phases of the investigation process. During the field phase, investigators collect data and assess the occurrence. This generally involves travelling to the scene of the occurrence, securing the site and documenting it, conducting interviews and selecting wreckage for further examination. Unless the investigation is limited to data collection, an investigation page is created and posted to the website and is updated periodically as the investigation progresses.

During the examination and analysis phase, investigators examine and analyze the data to determine the sequence of events leading to the occurrence and the underlying causes and contributing factors.

In the report phase, investigators draft a report on the investigation, which then goes through a review and approval process, prior to public release.

FIGURE 39. The TSB investigation process from occurrence to report

APPENDIX: INVESTIGATION REPORTS RELEASED IN 2018–19 AND RELATED SAFETY ACTIONS

The following is a list of the investigation reports the **Transportation Safety Board of Canada (TSB)** released during 2018–19 and some of the safety actions taken following each occurrence. The list is organized by transportation sector, by region and in the order in which the occurrences took place; it includes links to the investigation reports.

Aviation sector

Investigation report A16P0186

Occurrence	Collision with terrain, Norjet Inc., Cessna Citation 500 (C-GTNG), Kelowna Airport, British Columbia, 4.5 nautical miles NE, 13 October 2016
Safety actions	Through its Partners-in-Safety program, the **Canadian Business Aviation Association** (CBAA) will further promote the fitment of flight data recorders and analysis of data derived from them. Furthermore, the CBAA has signed an agreement with Plane Sciences to provide nationally coordinated and proactive flight data analysis services to CBAA members as part of this program. In its response to TSB Recommendation A18-01, **Transport Canada** committed to taking a number of actions, including introducing regulations to promote the installation of flight recorders in Canadian aircraft that fall outside the scope of the current *Canadian Aviation Regulations* requirements. In response to a TSB safety concern noted in the investigation report, Transport Canada, with the support of the Canadian Business Aviation Association, began an inspection program that was forecast to inspect one quarter of the private operators over the course of 2018-19, with a particular emphasis on safety management system implementation.

Investigation report A16W0092

Occurrence	Nose landing gear failure to extend, Air Georgian Limited Beechcraft 1900D (C-GORF), Calgary International Airport, Alberta, 12 July 2016
Safety actions	In September 2016, **Air Georgian** carried out a fleet campaign to address the greasing and bolt issue associated with this occurrence. Many bolts, including the pivot/stop bolts, were found to need replacement and servicing. Air Georgian then advised Transport Canada that it had added an inspection item to the company's maintenance tracking system, reducing the bolt inspection interval from 1200 hours to 600 hours. In January 2017, Air Georgian hired a manager of maintenance training. In August 2017, Air Georgian launched a communication and awareness campaign called "Flag It, Tag It and Snag It!" on the need to track and document steps in the workflow.

Investigation report A17C0132

Occurrence	Loss of control on landing and runway excursion, Perimeter Aviation LP, Fairchild SA227-AC Metro III (C-FLRY), Thompson, Manitoba, 02 November 2017
Safety actions	The **TSB** issued Aviation Safety Advisory A17C0132-D1-A1, suggesting that Transport Canada review the Fairchild SA227-AC Metro III AFM's emergency procedures regarding low engine oil pressure indication. **Perimeter Aviation** implemented a number of safety actions, including installing secure digital memory cards that store flight data on all aircraft equipped with the Garmin 950 integrated flight instrument system and providing awareness training on, among other points, the effects of low oil pressure during flight operations and the importance of a minimum 3-minute cool down period prior to engine shutdown. As part of this training, the company now shows a video of the actual event to demonstrate what happens when reverse thrust is selected when there is low-oil pressure. The company's initial and annual Technical Ground School Training now includes enhanced aircraft walk-around training. Flight crew members must take additional time to examine the exhaust stack for any signs of oil residue or leakage in this area. Perimeter is investing more than $200,000 in the refurbishment, upgrade, and enhancement of its flight training device.

Investigation report A17C0147

Occurrence	Collision with terrain, Piper PA-23-250 Aztec (C-FIPK), Baldur, Manitoba, 5 nautical miles E, 15 December 2017
Safety actions	The TSB is unaware of any safety action having been taken as a result of this occurrence.

Investigation report A17F0052

Occurrence	Risk of collision with terrain, WestJet Boeing 737-800 (C-GWSV), Princess Juliana International Airport, Sint Maarten, 7 March 2017
Safety actions	**WestJet** conducted a company investigation and carried out a number of corrective actions: • sent a safety communication letter to all pilots explaining the incident and providing information about possible challenges approaching the Princess Juliana International Airport and reminding crews of procedural requirements when there are no visual references; • updated its route qualification guidance with information highlighting the visual illusion presented by buildings north of the approach path that may be confused with the runway in low visibility resulting in lower approach angles; • updated the operations manual to clarify the reporting requirements for significant safety events; • provided a flight safety briefing on the incident to all crews at the annual ground school; • provided training related to the approach involved in this occurrence to all B737 pilots during annual recurrent simulator training; • provided threat and error management training to all crew members during annual recurrent crew resource management training; and • designed a required navigation performance instrument approach for the airport that would provide vertical guidance to the threshold of the runway and submitted it to the Sint Maarten Civil Aviation Authority for approval. The **Sint Maarten Civil Aviation Authority** instructed the Sint Maarten Air Traffic Services department to include guidance on airport lighting system management in its operations manual. **Boeing** reported that it would be reviewing its procedures to ensure crews have the appropriate procedures at hand to respond to Enhanced Ground Proximity Warning System PULL UP alerts. **Honeywell Aerospace** updated the Pilot Guide for the MKV and MK VII Enhanced Ground Proximity Warning System.

Investigation report A17O0025

Occurrence	Runway excursion, Air Canada, Airbus Industrie A320-211 (C-FDRP), Toronto/Lester B. Pearson International Airport, Ontario, 25 February 2017
Safety actions	**Air Canada** applied PPG SurfaceSeal to all aircraft types except the B787, which has a permanent hydrophobic coating. In addition, it expanded current testing of hydrophobic coatings to two narrow-body Airbus aircraft. In May 2017, the airline's maintenance group instituted a windshield wiper tension inspection program. A drift training scenario has been developed in the simulator, which now provides pilots with examples of approaches that become unstable in the flare. One of the scenarios requires the pilot monitoring to use the priority takeover button to commence the go-around. Pilots began receiving this training in June 2017. The airline published a number of bulletins for pilots and a 90-day crew alert, providing information to flight crews to straddle the centreline on landing. **Airbus Industrie** has developed safety awareness materials for its annual flight safety conference. These materials cover lessons learned and associated operational recommendations on the following: • weather-related incidents during final approach and landing; • descent, approach and landing events; and • lateral excursion upon landing.

Investigation report A17O0038

Occurrence	Safety Issue Investigation: Runway incursions between parallel runways Toronto/Lester B. Pearson International Airport, Ontario, June 2012–November 2017
Safety actions	Since the first incursion covered in this investigation, all parties involved have been taking safety actions. These safety actions are described throughout the report.

Investigation report A17O0209

Occurrence	Collision with water, Cessna 150J, C-FHPU, Goderich, Ontario, 20 September 2017
Safety actions	The **Brampton Flying Club**'s Chief Flight Instructor met with instructional staff and reviewed all policies and procedures related to night flying in visual flight rules conditions. The Chief Flight Instructor also added a discussion point about the black hole effect and nighttime cross-country flights to his regularly scheduled one-on-one meetings with individual instructors.

Investigation report A17O0243

Occurrence	Hard landing, Jazz Aviation LP, Bombardier DHC-8-402 (C-GYJZ), Toronto/Billy Bishop Toronto City Airport, Ontario, 09 November 2017
Safety actions	**Jazz Aviation** took a number of actions, including providing additional training on how to recognize hard landings and conducting a review of flight data analysis practices and effectiveness as they relate to preventing a departure when the aircraft's airworthiness is concerned. The company also introduced robust management processes to ensure management pilots are contacted following a suspected or actual hard landing event to ensure proper maintenance inspections are completed. In addition, Jazz Aviation conducted specialized analysis of operations at the airport and provided senior management with findings and recommendations resulting from flight data recorder analysis.

Investigation report A17P0149

Occurrence	Loss of control and collision with terrain, ASAP Avionics Services Ltd., Robinson R44 Astro (C-FMBO), Campbell River, British Columbia, 1 October 2017
Safety actions	**Robinson Helicopter** is currently developing three separate and independent recording devices for use on the Robinson R22, R44 and R66 model helicopters: • One will record parameters such as rotor and engine RPM, manifold pressure, temperature and pressure, and other parameters. This recording device is intended to record data for use by maintenance personnel, and will be retained in memory for the life of the aircraft. • The second is a camera-based device that will capture GPS position, rotor RPM, and the position of the control tubes that relate to cyclic and collective control. This device is intended for accident investigation purposes, and the data it collects will only be maintained for a short time/number of flights. • The third device is a cockpit video recorder, which captures video that will include the instrument console and warning lights, the view looking out the windshield, and a small portion of the occupants of the front two seats. This device will record for a small number of hours, and then over-write the existing video.

Investigation report A17P0170

Occurrence	Visual flight rules flight into deteriorating weather and collision with terrain, Mooney M20D (C-FESN), Revelstoke, British Columbia, 26 nautical miles NE, 25 November 2017
Safety actions	The TSB is unaware of any safety action having been taken as a result of this occurrence.

Investigation report A17Q0030

Occurrence	**Mid-air collision,** Cargair Ltd., Cessna 152 (C-GPNP) and Cargair Ltd., Cessna 152 (C-FGOI), Montréal/St-Hubert Airport, Quebec, 1.7 nautical miles ESE, 17 March 2017
Safety actions	**Cargair Ltd.** installed altitude reminders in its aircraft to remind pilots of their last approved altitude. During flight training, the company continues to emphasize that pilots must comply with altitude restrictions and should rely on these altitude reminders to do so. The company also inspected the radio communications equipment in all its planes and found no issues. It continues to monitor similar events through its safety management system and undertakes immediate corrective action, as required. **Transport Canada** published a Civil Aviation Safety Alert highlighting the risks associated with sending student pilots on solo flights prior to being able to demonstrate an operational level on the aviation language proficiency test. **NAV CANADA** undertook, as part of a larger assessment of risks faced by air-traffic controllers at airports with numerous student pilots, to publish guidance on phraseology associated with instrument flight rules (targeted for Spring 2019). There will also be new visual flight rules routes at the airport. In addition, the responsibilities of all positions in the control tower were reviewed, with a new shift and a new position added to better manage traffic fluctuations. Consultations were also held with the local flight schools about implementing air traffic management initiatives, including publishing new visual flight rules entry and exit points.

Investigation report A17Q0050

Occurrence	Collision with terrain, Exact Air Inc. Piper PA-31 (C-FQQB), Schefferville Airport, Quebec, 3.5 nautical miles NW, 30 April 2017
Safety actions	**Exact Air Inc.** conducted an awareness campaign and held meetings with all company staff about the causes of the accident and the risks associated with low-altitude flying. Company officials also held a meeting with the client to explain the situation and to emphasize the necessity of teamwork to prevent other dangerous behaviours. The company also tightened its internal policies regarding minimum flight altitude, which has now been set to 500 feet above ground unless otherwise required for the purpose of the flight. Exact Air also enhanced its policies on seat belt use and mandatory disclosure of any dangerous behaviour or attitude observed. The contract with the company's survey client now includes a clause to ensure that real-time flight tracking is performed at all times and not only when company aircraft are conducting survey flights.

Investigation report A17Q0059

Occurrence	Collision with runway lights on landing, Zetta Jet USA Inc. BD-700-1A10 (N888ZJ), Montréal/St-Hubert Airport, Quebec, 15 May 2017
Safety actions	**Développement Aéroport Saint-Hubert de Longueuil** reported this occurrence in its safety management system, and carried out an assessment of the event. As a corrective measure, the organization will add a popup window to its website whenever construction work is underway featuring pictograms and details of the maintenance activity. The popup message will also specify that flight crews must read the notices to airmen in effect at the airport. Air crews can now also download a diagram of the construction work. **NAV CANADA** revised the Canadian Notices to Airmen Procedures Manual to include new wording related to reduced runway length and width, and displaced threshold.

Investigation report A17W0172

Occurrence	Loss of control and collision with terrain, Springbank Air Training College, Piper PA-34-200T Seneca II (C-GCCM), Calgary/Springbank Airport, Alberta, 0.8 nautical miles S, 26 October 2017
Safety actions	**Springbank Air Training College** published updated standard operating procedures that specified the following: • minimum initiation altitudes for simulated engine failure exercises; • procedures for simulated engine failure after takeoff; and • procedures for simulated single-engine failure on approach.

Investigation report A18A0018

Occurrence	In-flight electrical arcing, Porter Airlines Inc., Bombardier DHC-8-402 (C-GLQG), Fredericton, New Brunswick, 45 nautical miles SW, 10 March 2018
Safety actions	**Porter Airlines** began a campaign to carry out the inspections and repairs at a rate of two aircraft per month until the entire fleet has been completed. **Bombardier** is currently reviewing the design of the connectors and expects to introduce some changes in the near future.

Investigation report A18A0053

Occurrence	Loss of control and collision with water for de Havilland DHC-2 Beaver aircraft, on Terrington Basin near the Goose (Otter Creek) Seaplane Base, Newfoundland and Labrador, 11 July 2018
Safety actions	The TSB is unaware of any safety action having been taken as a result of this occurrence.

Investigation report A18C0018

Occurrence	Brake failure and ground collision, Private Cessna Citation Bravo 550 (N4AT), and Morningstar Partners Ltd., Bombardier CL-600-2B16 (C-FXWT), Winnipeg/James Armstrong Richardson International Airport, Manitoba, 15 April 2018
Safety actions	The **Winnipeg Airports Authority** has reminded tenants of the importance of calling the appropriate emergency number for all airport-related emergencies. It also created posters to be placed around the airport to remind staff of these numbers. **Fast Air Jet Centre** senior managers took part in a Winnipeg Airports Authority information session focused on the emergency response and communication surrounding the incident, or were debriefed afterwards. The company has posted the emergency contact phone numbers more prominently so they are visible to all staff at all times, and added the numbers to its contingency manual. Current employees have been briefed on emergency procedures and protocol, and this content is now part of the company's onboarding training program.

Investigation report A18C0064

Occurrence	**Stall and collision with terrain**, Clayton Air Service, Cessna A188B AGtruck (crop sprayer) (C-GMXO), Carrot River, Saskatchewan, 3.5 nautical miles E, 12 July 2018
Safety actions	The TSB is unaware of any safety action having been taken as a result of this occurrence.

Investigation report A18O0002

Occurrence	Ground collision, fire, and evacuation, WestJet Airlines Ltd., Boeing 737-800 (C-FDMB) and Sunwing Airlines Inc., Boeing 737-800 (C-FPRP), Toronto/Lester B. Pearson International Airport, Ontario, 5 January 2018
Safety actions	**WestJet Safety Investigations** conducted an event review under WestJet's safety management system, leading to a number of recommendations for follow-up actions, which were implemented by December 2018: • guidance on situational awareness with running engines during evacuations was added to the 2019 Recurrent Flight Attendant CRM training program; • aircraft safety demonstration was updated with guidance to leave belongings behind and follow crew instructions; and • the 2019 annual crew resource management training for all pilots included a briefing on this event.

Investigation report A18O0093

Occurrence	Collision with terrain, Champion 7GCAA (C-FXTJ), Deer Lake, West Nipissing, Ontario, 8 July 2018
Safety actions	The TSB is unaware of any safety action having been taken as a result of this occurrence.

Investigation report A18O0096

Occurrence	Impact with terrain, Bellanca 8KCAB (C-GDLP), Toronto/Buttonville Municipal Airport, Ontario, 12 July 2018
Safety actions	The TSB is unaware of any safety action having been taken as a result of this occurrence.

Investigation report A18O0107

Occurrence	Loss of control and collision with water, Georgian Bay Airways, Found Aircraft Canada FBA-2C1 Bush Hawk-XP (C-FKNS), Lake Muskoka, Ontario, 30 July 2018
Safety actions	The TSB is unaware of any safety action having been taken as a result of this occurrence.

Investigation report A18O0134

Occurrence	**Controlled flight into terrain,** Essential Helicopters, Robinson R44 Raven II (helicopter) (C-GMCT), Toronto/Buttonville Municipal Airport, Ontario, 9 nautical miles N, 25 September 2018
Safety actions	The TSB is unaware of any safety action having been taken as a result of this occurrence.

Investigation report A18P0042

Occurrence	In-flight emergency due to smoke in cockpit and cabin, WestJet Encore Ltd., Bombardier DHC-8-402 (C-GJEN), Nanaimo Airport, British Columbia, 20 March 2018
Safety actions	**Pratt & Whitney Canada** (P&WC) has developed a new oil analysis technology to detect chemical elements and alloys in the engine oil, and to analyze its concentration and particulate characteristics to determine the source (component) of the material. The oil analysis technology program, which has been available to operators on a trial basis since 2016, is currently available to all operators. So far, the company has upgraded about 60% of the fleet and expects to complete the retrofit in the next two years. Following the occurrence, **WestJet Encore Ltd.** implemented P&WC's recommended oil analysis technology program on its Q400 fleet. Although not a factor in this occurrence, crews had been cleaning oxygen masks with the sani-wipes provided in the flight deck. This leaves the masks cloudy and difficult to see through. Company management issued a communications to flight operations to stop this practice.

Investigation report A18P0090

Occurrence	Visual flight rules flight into deteriorating weather and collision with terrain, Cessna 182P (C-GKKU), Hope, British Columbia, 19 nautical miles NE, 28 June 2018
Safety actions	**Edmonton Flight Information Centre** is going to add this occurrence as an example in its local recurrent training.

Investigation report A18P0091

Occurrence	Collision with trees after takeoff, Piper PA-28-140 (C-GVZP), Sechelt Aerodrome, British Columbia, 5 July 2018
Safety actions	The TSB is unaware of any safety action having been taken as a result of this occurrence.

Investigation report A18P0108

Occurrence	Loss of control and collision with water, Fort Langley Air Ltd., Cessna 180H (C-FCDQ), Tyaughton Lake, British Columbia, 1 August 2018
Safety actions	**Fort Langley Air Ltd.** made several changes to its training program, focused on the following: • awareness of fuelling procedures and the importance of confirming that fuel caps are replaced after fuelling; • procedures and action to be taken if a fuel cap is found to have been left off while the aircraft is in flight; and • cockpit distraction.

Investigation report A18P0115

Occurrence	Loss of control on initial climb and impact with the runway, Historic Flight Foundation, de Havilland DH-89A MKIV Dragon Rapide (biplane) (N683DH), Abbotsford Airport, British Columbia, 11 August 2018
Safety actions	The TSB is unaware of any safety action having been taken as a result of this occurrence.

Investigation report A18Q0016

Occurrence	Collision with terrain at night, Robinson R44 Raven I (helicopter) (C-GYMG), Saint-Joachim-de-Courval, Quebec, 1 February 2018
Safety actions	The TSB is unaware of any safety action having been taken as a result of this occurrence.

Investigation report A18Q0100

Occurrence	Collision with terrain, Air Saguenay (1980) Inc., de Havilland DHC-2 (Beaver) (C-FYYT) Manic-Cinq, Quebec, 44 nautical miles WSW, 1 July 2018
Safety actions	The TSB is unaware of any safety action having been taken as a result of this occurrence.

Investigation report A18W0025

Occurrence	Collision with terrain, Sahtu Helicopters Ltd., Airbus Helicopters AS 350 B2 (C-FWCR), Tulita, Northwest Territories, 3 nautical miles WNW, 15 February 2018
Safety actions	**Great Slave Helicopters Ltd.** management reminded all company pilots and aircraft maintenance engineers by email of the requirement to enter blade removal and installation in the aircraft journey log. In recent training, pilots were reminded of the requirement to record any sudden changes in vibration levels in the aircraft journey log. The company added an audit cycle to monitor blade removal and installation.

Investigation report A18W0052

Occurrence	Loss of nose wheel on touchdown, Air Georgian Ltd., Beechcraft 1900D (C-GZGA), Calgary International Airport, Alberta, 9 April 2018
Safety actions	**Air Georgian** has taken the following actions in response to this occurrence: • The work card has been modified to provide clearer guidance and additional notes referencing the bearing-cleaning methodology. • A general (all maintenance employees) Maintenance Technical Bulletin was published describing cleaning, inspection, and lubrication best practices. The bulletin was to be posted for 6 months and required that all maintenance employees sign off after having read it. The aircraft maintenance engineer who performed the work was coached on the proper procedure to follow.

Investigation report A18W0054

Occurrence	Engine power loss and forced landing, Super T Aviation, Piper PA-31-350 Navajo Chieftain (C-FCWW), Calgary, Alberta, 25 April 2018
Safety actions	**Super T Aviation** made several changes to its Piper Navajo standard operating procedures, quick reference handbook, and normal procedures checklist for the aircraft, and submitted them to Transport Canada. These changes include adding a step to set a timer when the outboard tanks are selected, moving the step to switch from the outboard tanks to the inboard tanks from the before landing checklist to the descent checklist on the company-generated normal procedures checklist, and adding guidance to the standard operating procedures on accepting runway changes. In addition, the company amended the training syllabus for new crew members and its emergency response plan, and scheduled an industry-supplied course on fatigue management and human factors.

Investigation report A18W0081

Occurrence	Baggage compartment fire, WestJet, Boeing 737-700 (C-GWJT), Calgary, Alberta, 14 June 2018
Safety actions	**WestJet Safety Investigations** conducted an event review under WestJet's safety management system, leading to a number of recommendations for follow-up actions, which were implemented by September 28, 2018: • communicating to front-line teams about the need for additional awareness about dangerous goods and adding a question about lithium-ion batteries at check-in; • creating dangerous goods signage and tools to support airport stations; and • engaging airport authorities in hubs to support alternative communication methods for dangerous goods signage and tools.

Investigation report A18W0098

Occurrence	Collision with wires, Mosquito XE (C-FHEZ), Okotoks, Alberta, 5.5 nautical miles NE, 15 July 2018
Safety actions	The TSB is unaware of any safety action having been taken as a result of this occurrence.

Investigation report A18W0111

Occurrence	Collision with obstacle on takeoff, Piper PA-28-161 Warrior II, C-GVZJ, Black Diamond, Alberta, 29 July 2018
Safety actions	The TSB is unaware of any safety action having been taken as a result of this occurrence.

Investigation report A18W0113

Occurrence	Collision with terrain, Kasper Kootenay Wings MS Special (basic ultralight) (C-ITMF), Grande Prairie, Alberta, 31 July 2018
Safety actions	The TSB is unaware of any safety action having been taken as a result of this occurrence.

Marine sector

Investigation report M16P0378

Occurrence	Grounding and subsequent sinking, articulated tug-barge *Nathan E. Stewart* and tank barge *DBL 55*, Seaforth Channel, 10 nautical miles west of Bella Bella, British Columbia, 13 October 2016
Safety actions	The **Pacific Pilotage Authority Canada** (PPA) revoked all British Columbia coast pilotage waivers held by all Kirby Offshore Marine Operating LLC vessels and marine officers. The PPA also amended its waiver system, requiring, among other things, that all vessels have two people on the bridge at all times while operating in confined waters, and that one of those must be the waiver holder. The **Canadian Coast Guard** implemented a training and engagement process with coastal and Indigenous communities to outline personal safety issues, provide exposure to the incident command system, and offer equipment and training to assist with first response. After consultations with the PPA, **Transport Canada** issued Ship Safety Bulletin No. 07/2017 to remind all foreign and Canadian vessel owners and operators of the deck watch requirements that are to be observed on their vessels, as stipulated by the *Marine Personnel Regulations*. **Kirby Offshore Marine Operating LLC** took numerous safety actions after this occurrence, including the following: • installing a bridge navigational watch alarm system on all of its vessels; • ensuring that all of its tugs that transit British Columbia coastal waters have a Ship Membership Agreement and Confirmation of Arrangement with the Western Canada Marine Response Corporation; • requiring crew members to complete a five-day navigation simulator training program before being promoted to officer of the watch; • hiring three additional personnel dedicated to providing oversight of vessel crewing issues; • amending its common procedures manual.

Investigation report M17A0390

Occurrence	Grounding, bulk carrier *SBI CARIOCA*, Belledune, New Brunswick, 11 October 2017
Safety actions	At the request of the **Atlantic Pilotage Authority**, a pilot boarding station symbol was added to Canadian Hydrographic Service charts for the Port of Belledune. The **TSB** sent marine safety advisories to Fisheries and Oceans Canada and the United Kingdom Hydrographic Office to inform them of additions to the chart so that these organizations could update their respective sailing directions.

Investigation report M17C0035

Occurrence	Flooding of fishing vessel *L.K.C*, Sept-Îles, Quebec, 45 nautical miles E, 21 April 2017
Safety actions	The **vessel owner** installed an additional device that will sound in the wheelhouse when the bilge high water alarm is triggered.

Investigation report M17C0053

Occurrence	Inadvertent lowering of ship arrester and closing of lock gates on vessel, bulk carrier *Federal Kumano*, Beauharnois, Quebec, 17 May 2017
Safety actions	The **St. Lawrence Seaway Management Corporation** implemented the following safety actions: • introduced a handover checklist that included practices and procedures for all handovers of lock controls and trained operational staff on handovers and the conditions that need to be met; • redistributed the lock operators' tasks and identified 1 operator per shift for surveillance and access control; • added a traffic management system display to each lock operator's console to provide the position of all vessels in the vicinity of the lock structures; • deployed an enhanced vessel display within the traffic management system at all high-lift locks; and • added (for the Montréal/Lake Ontario region only) an alarm to the traffic management system graphic screen that is triggered when a vessel is approaching a lock, increasing lock operators' spatial awareness.

Investigation report M17C0060

Occurrence	Mooring occurrence, bulk carrier *Nord Quebec*, Trois-Rivières, Quebec, 22 May 2017
Safety actions	**Dampskibsselskabet Norden A/S** sent a safety information letter to all its vessels, and a formal safety bulletin to the fleet. The company carried out a safety campaign focusing on risk assessment, including preparing and implementing a mooring operation risk assessment, and this occurrence was discussed during the company's 2017 annual officers' seminar. Additionally, the company's on board computer-based training program now includes a specific chapter on mooring. **The Singapore Transport Safety Investigation Bureau** issued a safety flyer for the industry, highlighting the presumed causes for this occurrence and advising the industry to note the risk of serious injuries caused by mooring ropes, even without those ropes failing when put under strain. **The Trois-Rivières Port Authority** had the address for the main entrance gate to its facilities added to the city's 911 dispatch database. The **TSB** sent Marine Safety Information Letter 01/18 to Transport Canada, with a copy to the Marshall Islands and the United Kingdom, sharing various statistics collected by the TSB and other Member States of the International Maritime Organization (IMO). **Transport Canada** officials then attended sessions of an IMO working group on safe mooring operations and shared a summary of the group's recent activities with the TSB. These included amended regulations to the International Convention for the Safety of Life at Sea and drafted guidelines on the inspection and maintenance of mooring equipment, on the design of mooring arrangements, and on the selection of appropriate mooring equipment and fittings for safe mooring.

Investigation report M17C0061

Occurrence	Capsizing of lobster vessel *Emma Joan*, Grosse-Île, Îles-de-la-Madeleine, Quebec, 20 May 2017
Safety actions	The TSB is unaware of any safety action having been taken as a result of this occurrence.

Investigation report M17C0108

Occurrence	Grounding, tanker *Damia Desgagnés*, St. Lawrence Seaway, near Morrisburg, Ontario, 15 June 2017
Safety actions	The TSB is unaware of any safety action having been taken as a result of this occurrence.

Investigation report M17C0205

Occurrence	Grounding, chemical product carrier *Bro Anna*, Beauharnois, Quebec, 29 August 2017
Safety actions	All breakers on the bow thruster and generators on the *Bro Anna* were set to the manufacturer's recommended trip and time delay settings by a contracted technician. The ship managers issued a fleet-wide notification instructing all vessels to check breaker trip and time delay settings on bow thrusters.

Investigation report M17C0220

Occurrence	Mechanical failure and subsequent engine room fire, tug *Brochu*, Port-Cartier, Quebec, 15 September 2017
Safety actions	The **TSB** issued two marine safety advisory letters to inform Transport Canada and other stakeholders of the unsafe conditions of the occurrence. Transport Canada issued FLAGSTATENET 03-2018, advising inspectors and surveyors to closely observe fittings intended to make accommodation spaces and the wheelhouse gastight, as well as openings in watertight decks and bulkheads, during inspections.

Investigation report M17C0232

Occurrence	Person overboard and subsequent loss of life, general cargo vessel *Amazoneborg*, Trois-Rivières, Quebec, 29 September 2017
Safety actions	The **flag state's recognized organization** reviewed the audit reports for the *Amazoneborg*, the *Reestborg* and the company, and conducted an International Safety Management office audit of the company. The company's incident investigations for the vessels *Laganborg*, *Amazoneborg* and *Nassauborg* were evaluated and found to be adequate. Follow-up, communication, and incident reporting to the fleet were verified.

Investigation report M17C0292

Occurrence	Fall overboard, bulk carrier *Federal Champlain*, Thunder Bay, Ontario, 8 December 2017
Safety actions	**FedNav** conducted an internal investigation into the occurrence and shared the lessons learned with the officers of the fleet. Crew members underwent a detailed briefing and training session in which they were advised of the importance of following cold-weather precautions. This occurrence was discussed during subsequent briefings for relief crew members.

Investigation report M17P0052

Occurrence	Capsizing and sinking of fishing vessel *Miss Cory*, Strait of Georgia, British Columbia, 06 March 2017
Safety actions	A committee of nine experienced fish harvesters undertook to work with **Fish Safe BC** and created a code of best practices in time for distribution before the 2018 roe herring fishery. **WorkSafeBC** is implementing a marine strategy for 2018-20 that focuses on the fishing industry. Future inspections will include ensuring stability documentation is in place, and assessing worker knowledge of content and applicability to the work activities and fishery taking place, and evaluating how the required procedures for emergency drills have been implemented and whether drills have been conducted.

Investigation report M17P0098

Occurrence	Partial sinking with loss of life, commercial sport fishing vessel BC1329967 (*Catatonic*), Tofino, British Columbia, 30 April 2017
Safety actions	The TSB is unaware of any safety action having been taken as a result of this occurrence.

Investigation report M17P0244

Occurrence	Bottom contact, tug *Ocean Monarch*, Princess Royal Channel, British Columbia, 09 July 2017
Safety actions	**Mercury Launch & Tug Ltd.** installed a bridge navigational watch alarm system on the *Ocean Monarch*. New safe operating procedures were developed and implemented on the vessel. As well, the company informed all of its masters that navigation watch alarms are to be enabled and monitored at all times. The **Pacific Pilotage Authority** (PPA) revoked the pilotage waiver for the master and required the master to become informed of the waiver requirements before reinstating his waiver. The PPA published an article in a trade publication to increase awareness of the pilotage waiver system within the marine community and sent authorized representatives of vessels that currently hold pilotage waivers an information package to inform masters of the conditions of a pilotage waiver.

Investigation report M17P0400

Occurrence	Striking of No. 2 berth, roll-on/roll-off ferry *Seaspan Swift*, Tilbury Island, Delta, British Columbia, 15 November 2017
Safety actions	**Seaspan Ferries Corporation** took a number of actions, including the following: • repaired the loose connection in the 120V switch that triggered the momentary power interruption to the radar displays; • created pre-arrival checklists specific to each terminal, including specific details about when the steering control should be set to the wheel and when it should be set to the pod handles; • modified the steering control system design so that when the steering control is set to the wheel, the pod handles must be set to the ahead position; and • launched an investigation into why the vessel's voyage data recorder had not recorded certain data.

Investigation report M17P0406

Occurrence	Collision between barge and dredger *FRPD 309,* Fraser River, British Columbia, 5 December 2017
Safety actions	**Fraser River Pile and Dredge (GP) Inc.** took the following safety actions: • revised the safety management system documentation related to emergency checklists and loss of propulsion; • revised familiarization and training and briefed the crew on these changes; • implemented training for all deck and engine room crew concerning safe parameters for air clutches and air telegraph; • conducted emergency drills related to failure and maintenance of the control air systems; and • fitted a control air compressor with auto-start capability. In addition, the company is working on enhancing its training as well as developing a competency evaluation program.

Investigation report M18A0002

Occurrence	Vessel grounding and subsequent fatality, fishing vessel *Fisherman's Provider II,* Canso, Nova Scotia, 6 February 2018
Safety actions	The TSB is unaware of any safety action having been taken as a result of this occurrence.

Investigation report M18A0075

Occurrence	Grounding of fishing vessel *Roping the Wind,* Hardys Channel, Prince Edward Island, 30 April 2018
Safety actions	**Small Craft Harbours Prince Edward Island Area** now monitors channels each year to gather information for future decisions, and to be aware of infilling.

Investigation report M18C0030

Occurrence	Liquefied natural gas fuel equipment failure, roll-on/roll-off passenger ferry *F.-A.-Gauthier,* Matane, Quebec, 8 April 2018
Safety actions	The **system and valve manufacturers** initiated a joint study to prevent this particular failure from happening again. Specifically, the manufacturers are focusing on either redesigning the support stud with a different material or redesigning the supporting arrangement of the pneumatic actuator, using three studs instead of two.

Investigation report M18C0105

Occurrence	Steering gear failure and grounding, product/chemical tanker *Chem Norma,* Morrisburg, Ontario, 29 May 2018
Safety actions	The **vessel's Flag State Authority, the Marshall Islands**, recommended that the vessel owner review procedures in the company's safety management system on emergency steering and loss of steering, with a focus on loss of steering in a narrow waterway and loss of steering with hazards in close proximity to the planned route. The vessel owner also contacted the steering system manufacturer to request a type of control relay that is designed to better handle the severe conditions produced by the inductive loads found in the vessel's steering system.

Investigation report M18P0073

Occurrence	Sinking of fishing vessel *Western Commander,* Triple Islands, Dixon Entrance, British Columbia, 9 April 2018
Safety actions	The TSB is unaware of any safety action having been taken as a result of this occurrence.

Investigation report M18P0144

Occurrence	Uncontrolled fall of *Spirit of Vancouver Island* rescue boat No. 3, Swartz Bay, Vancouver Island, British Columbia, 19 June 2018
Safety actions	**Palfinger Marine** instructed all of its technicians to conduct service or repairs only after confirming that the rescue boat has been removed from its davit fall. **British Columbia Ferry Services Inc.** carried out a risk assessment that resulted in rescinding the restriction on personnel in the rescue boats during non-emergencies.

Pipeline sector

Investigation report P17H0011

Occurrence	Third-party damage to a crude oil pipeline, Enbridge Pipelines Inc., Sherwood Park, Alberta, 17 February 2017
Safety actions	**Enbridge Pipelines Inc.** reviewed company procedures and processes; reviewed internal communications; and clarified and harmonized technical terminology related to pipeline crossings. **Grand Rapids Pipeline GP Ltd.** raised awareness to prevent future incidents related to ground disturbances; issued a company-wide hazard advisory regarding ground disturbances and foreign line crossings; revised the ground disturbance and foreign line-crossing checklist; and revised procedures to ensure that all contractors meet the requirements of the checklist. **Ledcor Pipeline Limited** held safety stand-down meetings to ensure that identification and awareness of preventative actions have been communicated; commissioned an independent buried pipeline– and utility–locating service company to review their ground disturbance program; revised their existing ground disturbance checklist; developed a foreign line crossing checklist; developed a procedure deviation process; and implemented a subcontractor management standard. **The National Energy Board** monitored the initial cleanup and remedial actions; verified compliance with regulatory requirements; ensured adequacy of corrective, preventive, and safety actions already taken and will monitor those to be implemented.

Investigation report P18H0034

Occurrence	Release of crude oil, Trans Mountain Pipeline ULC, Darfield, British Columbia, 27 May 2018
Safety actions	**Trans Mountain Pipeline ULC** developed a revised configuration design for piping associated with flow meters, intended to reduce the effects of bending loads that can contribute to vibration-induced fatigue at small-diameter threaded connections. The revised configuration was applied at the Darfield Pump Station. Trans Mountain also conducted inspections of all wedge flow meters and associated piping nipples across the Trans Mountain pipeline, and repaired any that were deficient. Also, Trans Mountain initiated a system-wide inspection at other installations to identify and address situations where threaded connections are subjected to bending loads and vibrations.

Railway sector

Investigation report R16T0111

Occurrence	Uncontrolled movement of railway equipment, Canadian National Railway, Mile 23.9, York Subdivision, MacMillan Yard, Vaughan, Ontario, 17 June 2016
Safety actions	**Transport Canada** issued a notice to Canadian National Railway Company citing the fact that company did not ensure that yard movements at MacMillan Yard have sufficient operative brakes when movements are entering the main track to take head room. Transport Canada officials interviewed yard crews and supervisors at MacMillan Yard to verify their knowledge, and reviewed CN's risk assessment. The **Canadian National Railway Company** issued an operating bulletin specifying the minimum number of cars that must be on air, the tonnage, and the speed, when making headroom moves on the Halton Subdivision inbound/outbound tracks and the York Subdivision tracks 1, 2 and 3. CN conducted a risk assessment that resulted in minimum brake requirements being implemented for each of the yards.

Investigation report R16V0195

Occurrence	Employee injury, BCR Properties Ltd., Roberts Bank Yard, Mile 16.8, Port Subdivision, Delta, British Columbia, 18 December 2016
Safety actions	The **TSB** issued Rail Safety Advisory 03/17 to Transport Canada indicating that it might wish to review how safety watch protection is being implemented. **PNR Railworks** retrained its employees and provided BCR with an updated quarterly list detailing the qualifications for all employees working on the BCR Port Subdivision. PNR also took steps to ensure that its employees are fully qualified on all rules and standards as outlined in BCR's revised safety management system. The safety watch was reinstated for use by qualified employees within Roberts Bank Yard. A new Safety Watch Job Briefing Form was developed and is now included in the training and used in the field.

Investigation report R17Q0061

Occurrence	Uncontrolled movement of railway equipment, train PH651, Mile 128.6, Wacouna Subdivision, Mai, Quebec, 25 July 2017
Safety actions	**Transport Canada** issued a notice to Quebec North Shore and Labrador Railway stating that train crews do not have the tools or clear procedures to properly assess the average grade when they have to secure equipment.

Investigation report R17T0164

Occurrence	Main-track derailment, Canadian National Railway Company, freight train M39731-18, Mile 18.70, Strathroy Subdivision, Strathroy, Ontario, 19 July 2017
Safety actions	The **TSB** issued Rail Safety Advisory (RSA) 13/17 to Transport Canada concerning the lack of a requirement in the Railway Locomotive Inspection and Safety Rules to record the end-of-train air brake pipe pressure and stated that Transport Canada may wish to review and update the Railway Locomotive Inspection and Safety Rules. The **Canadian National Railway Company** has purchased tools and equipment to repair stabilized trucks.

Investigation report R17T0170

Occurrence	Employee injury, Canadian Pacific Railway, freight train 141-30, Mile 113.0, Galt Subdivision, London, Ontario, 31 July 2017
Safety actions	**Canadian Pacific Railway** immediately sent out a system bulletin to warn operating crews of the vegetation obstruction. Brush was then cleared in the area of the accident. The **TSB** issued a Rail Safety Advisory letter (RSA 11/17) indicating that Transport Canada may wish to review CP's brush-cutting practices to ensure that vegetation along the railway right-of-way does not encroach upon the track and become a safety hazard.

Investigation report R17V0096

Occurrence	Non-main track uncontrolled movement, collision and derailment, cut of cars, Englewood Railway, Western Forest Products Inc., Woss, British Columbia, 20 April 2017
Safety actions	**The TSB** issued Rail Safety Advisory 05/17 to the British Columbia Ministry of Transportation and Infrastructure on the installation, maintenance, and inspection of derails at Western Forest Products Inc.

Investigation report R17V0220

Occurrence	Main-track train collision, Canadian Pacific Railway, Mile 68.4, Connaught Track, Mountain Subdivision, British Columbia, 31 October 2017
Safety actions	The **TSB** issued Rail Safety Advisory 14/17 to Transport Canada indicating that, given the inherent risks to track workers when trains are operated through track work locations, it may wish to review the manner in which track workers, particularly third-party contractors, are protected. **Transport Canada** issued a letter of concern to Canadian Pacific Railway regarding this incident, stating that it was concerned that "providing clearance for a train to enter into a foreman's limits when equipment is being operated foul of the track could compromise the safety of railway operations and lead to a serious collision and injury." **Canadian Pacific Railway** issued a Safety Flash emphasizing that all employees must ensure there is clear communication when clearing a movement through protected limits. This includes validating that all parties understand the direction and are aware of the limits being provided.

Investigation report R17W0175

Occurrence	Main-track train derailment, Canadian Pacific Railway, freight train 369-377, Mile 53.57, Emerson Subdivision, Dominion City, Manitoba, 11 August 2017
Safety actions	**Canadian Pacific Railway** installed 5,022 feet of 136-pound continuous welded rail between Mile 52.9 and Mile 53.8, and 568 ties between Mile 53.0 and Mile 54.0.

Investigation report R17W0190

Occurrence	Employee injury, Canadian Pacific Railway, hi-rail crane boom failure, south service lead track, Mile 0.0, Broadview Subdivision, Brandon, Manitoba, 2 September 2017
Safety actions	**Canadian Pacific Railway** undertook inspections of all boom cranes that had not already been inspected. No defects were reported. The company also revised its crane inspection procedures relating to the operator's seat to include daily, quarterly, and annual inspections.

Investigation report R18C0076

Occurrence	Main-track derailment, Canadian Pacific Railway, freight train A13-31, Mile 50.7, Montana Subdivision, Stirling, Alberta, 30 July 2018
Safety actions	**Canadian Pacific Railway** repaired the track damage at the occurrence location and completed its scheduled tie program through the area.

Investigation report R18D0020

Occurrence	Crossing collision, PNR RailWorks Quebec Inc., Track unit PNR 728, Mile 12.15, Canadian Pacific Railway Vaudreuil Subdivision, Beaconsfield, Quebec, 13 February 2018
Safety actions	**PNR RailWorks Quebec Inc.** reminded employees to comply with the applicable rules when approaching grade crossings and to record all daily inspections in logbooks and on appropriate documents.

Investigation report R18D0067

Occurrence	Main-track derailment, Canadian Pacific Railway, Mile 35.83, Adirondack Subdivision Delson, Quebec, 9 July 2018
Safety actions	**Canadian Pacific Railway** increased the frequency of rail flaw inspection testing of the CC Long Siding track to twice per year.

Investigation report R18T0032

Occurrence	Crossing accident, VIA Rail Canada Inc., passenger train No. 85, Mile 57, Guelph Subdivision, Breslau, Ontario, 8 February 2018
Safety actions	The TSB is unaware of any safety action having been taken as a result of this occurrence.

Investigation report R18V0016

Occurrence	Main-track derailment, Canadian National Railway, Mile 49.07, Bulkley Subdivision, New Hazelton, British Columbia, 19 January 2018
Safety actions	The TSB is unaware of any safety action having been taken as a result of this occurrence.

Investigation report R18W0133

Occurrence	Main-track train derailment, Canadian Pacific Railway, freight train 112-27, Mile 13.4, Carberry Subdivision, Rosser, Manitoba, 29 May 2018
Safety actions	**Canadian Pacific Railway** implemented a new loading configuration for moving large numbers of empty containers to help lessen the impact of high wind events.

Investigation report R18W0168

Occurrence	Main-track derailment, VIA Rail Canada Inc., passenger train P69341-04, Mile 23.60, Turnberry Subdivision, Hudson Bay, Saskatchewan, 5 July 2018
Safety actions	The **Canadian National Railway Company** modified its SkyGuard warning system to identify weekly accumulation of precipitation and to communicate warnings when water capacity thresholds are reached for a specific area. When rainfall occurs over multiple days and sustained accumulation occurs, the company increases the number of patrols in front of trains. In addition, when continuous rain is expected to exceed 40 mm or when a severe weather advisory is issued, additional track patrols will continue for four hours after the rain stops to monitor drainage along the railway right-of-way.