



Data Tables and Appendices

| PUBLIC SAFETY REPORT 2023

Contents

Enhancements	4
Appendix A: Cross-Program Data	5
Incidents, Injuries and Risk Prediction	5
Risk of Facilities or Devices	7
Inspection Results – Compliance Rate	7
Inspection and Re-Inspection Results	8
Appendix B: Amusement Devices	9
Incidents, Injuries and Risk Prediction	9
Risk of Devices	12
Inspection Results - Compliance Rate	13
Inspection and Re-Inspection Results	15
Legislation and Regulatory Information	16
Appendix C: Boilers and Pressure Vessels	17
Incidents, Injuries and Risk Prediction	17
Compliance	19
Inspection and Re-Inspection Results	19
Legislation and Regulatory Information	20
Appendix D: Elevating Devices – Elevators	21
Incidents, Injuries and Risk Prediction	21
Risk of Devices	24
Inspection and Re-Inspection Results	26
Legislation and Regulatory Information	27
Appendix E: Elevating Devices – Escalators and Moving Walks	28
Incidents, Injuries and Risk Prediction	28
Risk of Devices	30
Inspection Results – Compliance Rate	31
Inspection and Re-Inspection Results	32
Legislation and Regulatory Information	32
Appendix F: Elevating Devices – Passenger Ropeways and Ski Lifts	33
Incidents, Injuries and Risk Prediction	33
Risks Due to All Causes	34
Risk of Devices	36
Inspection Results – Compliance Rate	37
Inspection and Re-Inspection Results	39
Legislation and Regulatory Information	40

Appendix G: Fuels	41
Incidents, Injuries and Risk Prediction	41
Pipeline Strikes	45
Licensed Liquid Fuels Sites	45
<i>Risk of Sites</i>	45
<i>Inspection Results – Compliance Rate</i>	46
Licensed Propane Sites	48
<i>Risk of Sites</i>	48
<i>Inspection Results – Compliance Rate</i>	49
Heating Contractors	50
<i>Audit Results</i>	50
Petroleum Contractors	51
<i>Audit Results</i>	51
Inspection and Re-Inspection Results	52
Legislation and Regulatory Information	53
Appendix H: Operating Engineers	55
Incidents, Injuries and Risk Prediction	55
Inspection Results – Compliance Rate	58
Inspection and Re-Inspection Results	59
Legislation and Regulatory Information	60
Appendix I: List of Acronyms	61
Appendix J: Glossary of Terms	62
Appendix K: Outcome-Based Regulator	65
Introduction	65
Outcome-Based Regulator	65
Appendix L: Metrics	66
Disability-Adjusted Life Year (DALY)	66
Injury Burden	67
<i>Risk of Injury or Fatality</i>	67
<i>Statistical Methods</i>	71

Enhancements

In keeping with its commitment to continuous improvement and based on feedback from stakeholders (e.g., feedback obtained from board and advisory council presentations), TSSA continues to enhance the structure and style of its reporting.

Based on new information and data, TSSA also enhances its processes and methodologies in analysis and reporting. Changes to this year's **Public Safety Report** affecting the results of the analysis are discussed below. Structural changes are not identified, as they are considered as enhancements to the readability of the report and do not impact the analysis.

Updates:

- The **Risk of Injury or Fatality (RIF) Calculation** has fully migrated to the new calculation. This fiscal year, TSSA presents the new calculation numbers for a period of 5 years whereas in previous years we have only shown it for less than 5 years as the new metric was introduced in FY19.
- **Inspection Results:** the current compliance rate looks at the percentage of periodic inspections with no orders issued and we are introducing a new version of compliance rates where we look at the percentage of periodic inspections with no high-risk orders issued. It will align with the implementation of compliance standards which represent a risk-based approach to assess the potential harm to the public.
- The **Inspection Risk Spectrum** is no longer reported and a new risk-based compliance rate has been introduced in its place.
- The **Fuels Incident Data Map by County** has been normalized with the population of the country and the number reflects how many incidents happened per 1,000 people to give a clearer picture of the overall safety of the province.

Appendix A: Cross-Program Data

Incidents, Injuries and Risk Prediction

TSSA reports on two main measures of public safety and risk:

1. **Observed Injury Burden (OIB):** Summarizes what has happened in the past and quantifies fatalities and injuries, expressed in terms of fatality equivalents per million people per year (FE/mp).
2. **Risk of Injury or Fatality (RIF):** Uses a predictive approach¹ developed by TSSA. It is a composite score across all TSSA-regulated sectors that uses past data to predict what might happen in the future².

Table A1: Cross-Program State of Safety Measures (2014 – 2023)

Description	Fiscal Year										Total	Avg.	5-year Trend
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023			
Incidents	5,508	5,322	5,640	5,075	5,641	6,329	5,983	4,247	4,634	5,116	53,495	5,350	Increasing
Non-Permanent Injuries	1,243	1,168	1,597	1,082	1,356	1,833	1,907	423	984	1,470	13,063	1,306	Increasing
Permanent Injuries	51	56	80	69	41	59	46	20	29	26	477	48	Decreasing
Fatalities	10	5	2	4	2	2	3	5	2	1	36	4	No Trend
Observed Injury Burden (FE/mp)	0.65	0.27	0.41	0.40	0.32	0.36	0.40	0.31	0.25	0.11	N/A	0.35	N/A

Table A2: Cross-Program Risk of Injury or Fatality (2019 – 2023)

Description	Fiscal Year				
	2019	2020	2021	2022	2023
RIF	0.44	0.39	0.40	0.32	0.20

In 2023, the Observed Injury Burden (OIB) decreased to 0.11 from 0.25 in the previous year as a result of fewer permanent injuries reported as well as 1 fatality compared to 2 or more in previous years. The overall decrease in Risk of Injury or Fatality (RIF) reported in 2023 compared to previous years is attributed to the decreasing trend in the number of permanent injuries.

The TSSA RIF acceptance criterion is 1.00 FE/mpy.

¹ Veeramany A and Mangalam S. "Application of disability-adjusted life years to predict the burden of injuries and fatalities due to public exposure to engineering technologies." Population Health Metrics 12 (2014): 1-9.

² Readers are cautioned that composite Risk of Injury or Fatality has been established for reporting and benchmarking purposes only. Sections provided for the individual safety programs help gain an understanding of the significant causes, and more importantly, strategies for monitoring and managing risk to Ontarians.

Figure A1: Incidents and Observed Injury Burden for Regulated Program Areas (2014 – 2023)

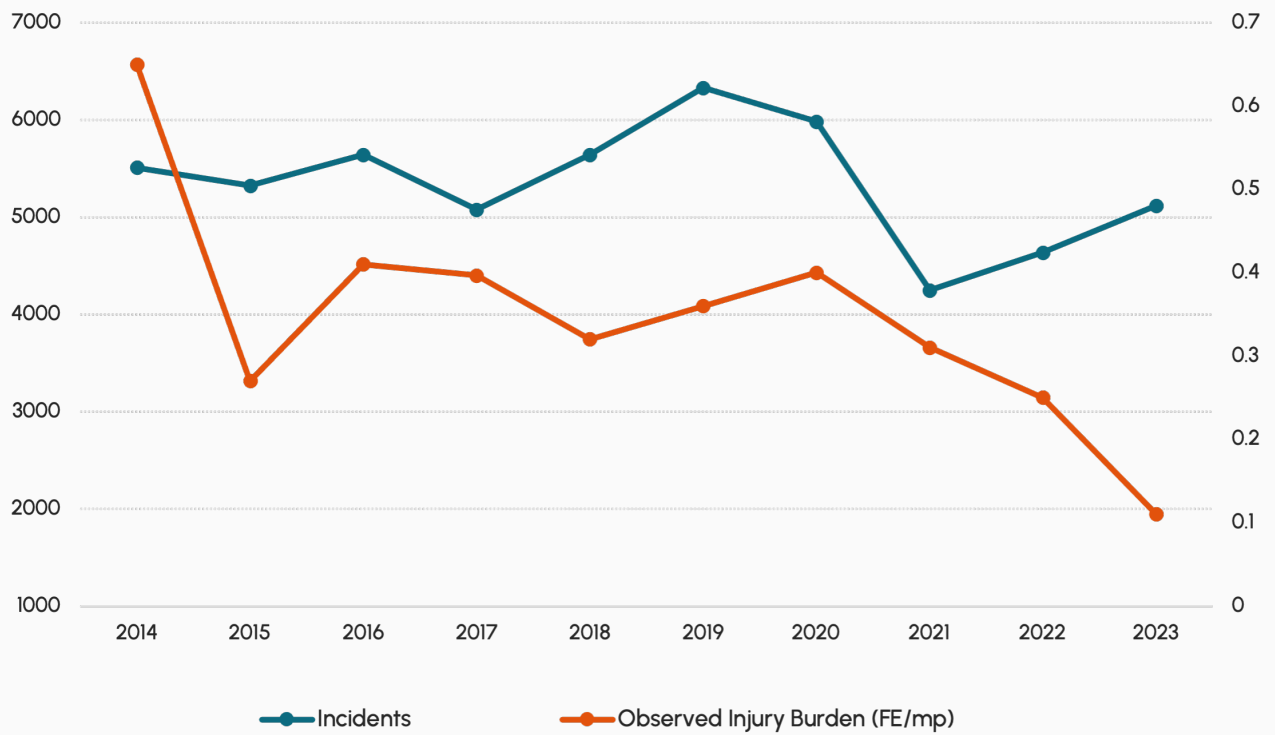
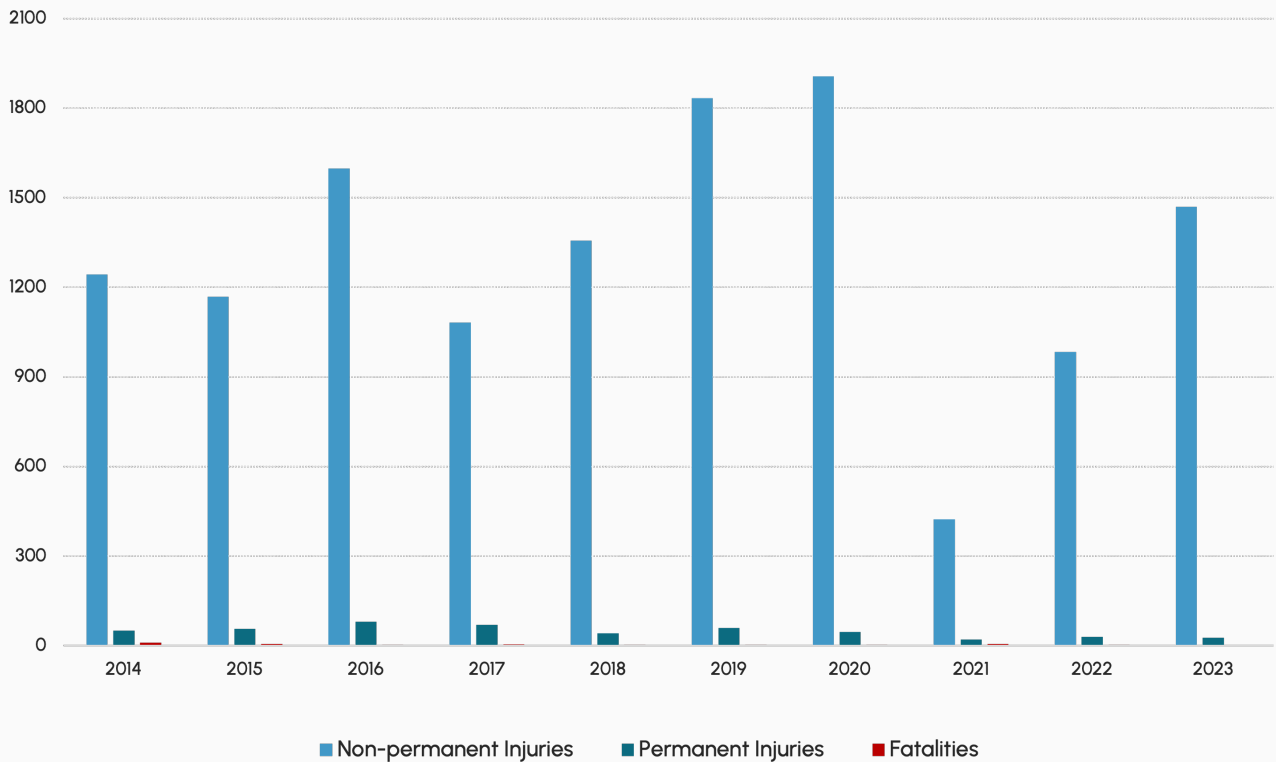


Figure A2: Injuries and Fatalities for Regulated Program Areas (2014 – 2023)



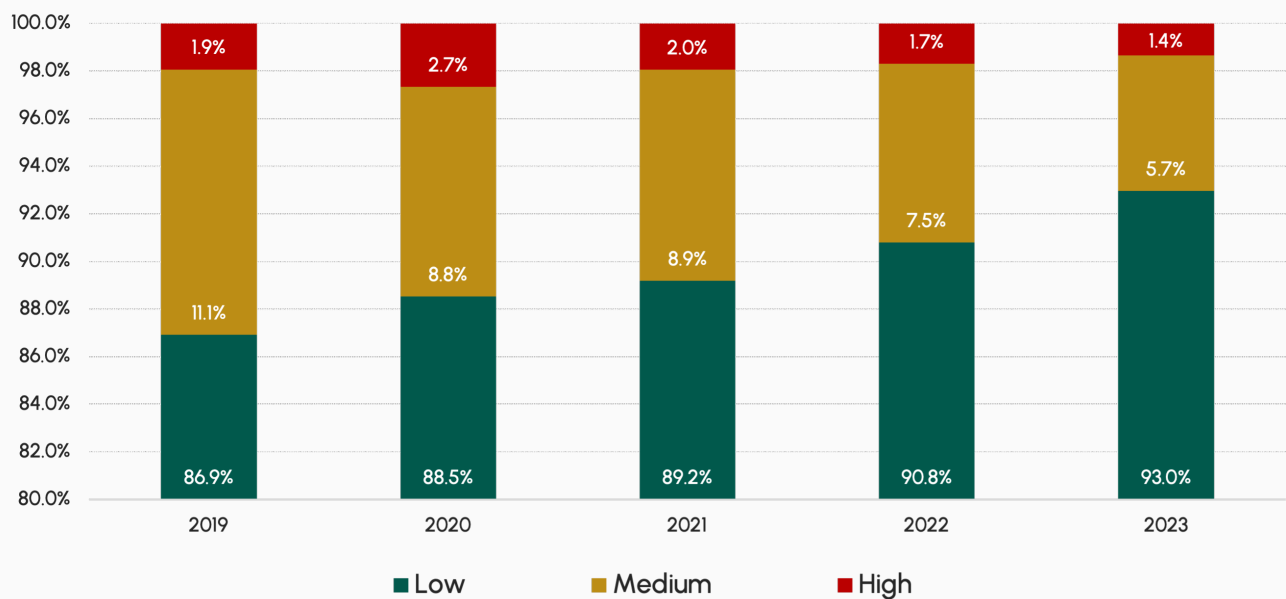
Risk of Facilities or Devices

Using a harmonized approach, an inventory risk profile has been generated to reflect the level of compliance across TSSA's entire regulated inventory. The calculation only includes devices for which there is sufficient inspection history (i.e., three or more periodic inspections) to estimate the risk. Certain sectors (i.e., Elevating Devices) have a large fraction of new devices for which an assessment cannot yet be made.

Table A3: High-Risk Inventory from Outcomes of Periodic Inspections Across All Programs (2022-2023)

Description	Fiscal Year 2022	Fiscal Year 2023
High-Risk Inventory	1.7%	1.4%

Figure A3: High-Risk Inventory based on Periodic Inspections Across All Programs (2019 – 2023)



Inspection Results – Compliance Rate

Table A4: Five-Year Mean Compliance Rate from Outcomes of Periodic Inspections Across All Programs (2019 – 2023)

Description	Fiscal Years 2019 – 2023
Compliance Rate (Mean)	27.5%

Table A5: Five-Year Mean Rate of Inspections with no High-Risk Orders from Outcomes of Periodic Inspections Across All Programs (2019 – 2023)

Description	Fiscal Years 2019 – 2023
Compliance Rate (Mean)	89.9%

Inspection and Re-Inspection Results

The table below contains numbers and types of inspections, as well as re-inspection results. "Pass" or "Fail" was based on the outcome status of an inspection. "Other" was a group of inspection outcomes that included either non-mandated outcomes that were neither 'pass' or 'fail' (such as validating installed base statuses or occurrence inspections), and various other miscellaneous statuses. "Other" outcomes were not included in the 'pass' rate. There are subtle differences between the 'pass' rate used in this table and the compliance rate used in the main body of the report, which can result in small differences between the two numbers.

Based on a recommendation from the Office of the Auditor General of Ontario's *Value for Money* report in 2019, the table below reports on the counts of inspections where no issues were found (regardless of the risk) and deemed fully compliant.

"Non-Compliance found (any risk)" refers to the outcome status of an inspection. "Other" is a group of inspection outcomes that include either non-mandated outcome, other outcomes (such as validating installed base statuses or occurrence inspections), etc. "Other" outcomes were not included in the 'pass' rate. There are subtle differences between the 'pass' rate used in this table and the compliance rate, which can result in small differences between the two numbers.

Table A6: Cross-Program Inspection and Re-Inspection Results (2023)

Inspection Type	Fully Compliant	Non-Compliance found (any risk)	Other	Grand Total	Pass Rate (%)
Ad Hoc/Unscheduled Inspections	887	594	79	1,560	60%
Alteration Inspections	546	160	3	709	77%
Complaint Inspections	277	1	0	278	100%
Initial Inspections	6,201	2,112	26	8,339	75%
Inspections for Certification	592	0	1,306	1,898	100%
Minor Alteration Inspections	666	338	0	1,004	66%
Non-Mandated/ Non-Regulated Inspections	1,220	17	84	1,321	99%
Incident Inspections	3,106	13	0	3,119	100%
Operational Inspections	2	2	0	4	50%
Other Inspections	7,417	1,712	377	9,506	81%
Periodic Inspections	6,085	2,353	146	8,584	72%
Re-Inspections	7,648	8,510	229	16,387	47%
Repair Inspections	359	1	0	360	100%
All Programs Total	35,006	15,813	2,250	53,069	69%

Appendix B: Amusement Devices



TSSA's Amusement Devices Safety Program regulates amusement rides in Ontario to ensure all devices conform to the Act and its associated regulations, codes and standards.

The various types of regulated amusement devices include roller coasters, Ferris wheels, merry-go-rounds (and other circular motion rides), water slides, flume rides, dry slides, go-karts, bumper cars, inflatables (inflatable bouncers), bungee devices, bungee-assisted bouncers, zip lines (track and cable rides), and other generic spinning and whirling rides. As part of the Amusement Devices Safety Program, TSSA: licenses operators; reviews and registers rides; conducts inspections and incident investigations; and issues permits for each ride in the current operating season.

Note that numbers may not add up fully or may exceed the 100th percentile due to rounding off.

Incidents, Injuries and Risk Prediction

Table B1: State of Safety Measures for Amusement Devices (2014 – 2023)

Description	Fiscal Year										Total	Avg.	5-year Trend
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023			
Incidents	521	647	922	439	709	1,195	1,378	97	543	995	7,446	745	Increasing
Non-Permanent Injuries	454	585	848	377	661	1,100	1,235	89	527	979	6,855	686	Increasing
Permanent Injuries	25	24	42	33	23	29	26	1	8	8	219	22	No Trend
Fatalities	0	0	0	0	0	1	0	1	0	0	2	0	No Trend
Observed Injury Burden (FE/mp)	0.02	0.08	0.11	0.08	0.11	0.15	0.15	0.12	0.01	0.03	N/A	0.09	N/A

Table B2: Risk of Injury or Fatality for Amusement Devices (2019 – 2023)

Description	Fiscal Year				
	2019	2020	2021	2022	2023
RIF	0.06	0.08	0.09	0.07	0.06

The TSSA RIF acceptance criterion is 1.00 FE/mpy.

Figure B1: Incidents and Observed Injury Burden for Amusement Devices (2014 – 2023)

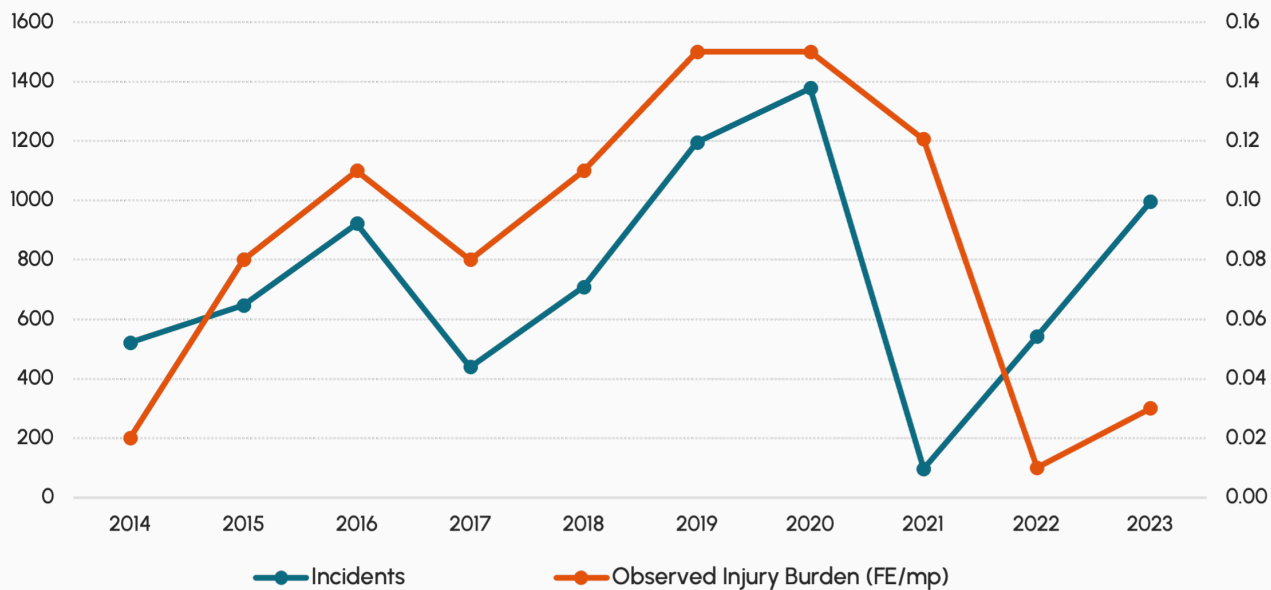


Figure B2: Injuries and Fatalities for Amusement Devices (2014 – 2023)

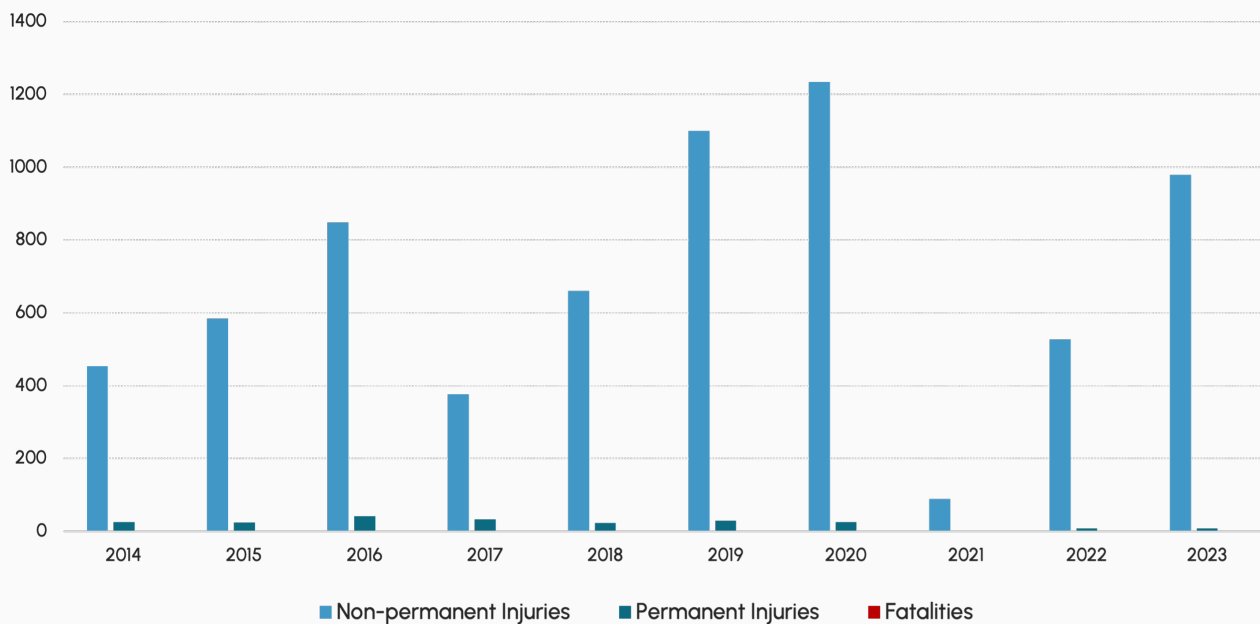


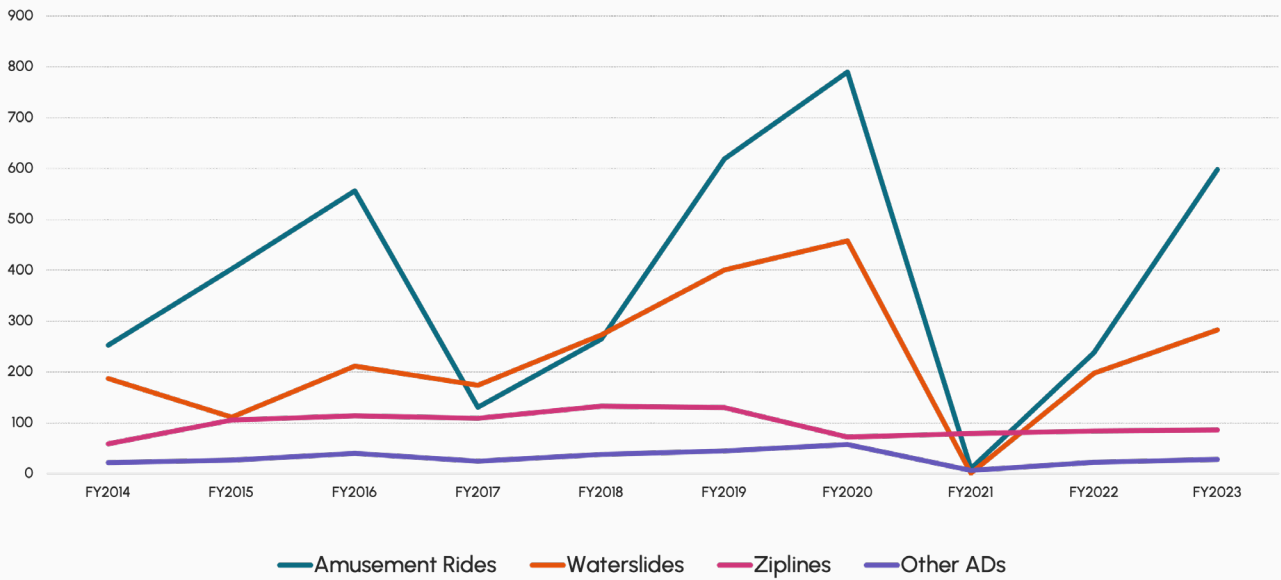
Table B3: Top Amusement Device Types by Number of Incidents (2014 – 2023)

Device Type	Percentage of Occurrences
Amusement Rides	51.88%
Water Slides	30.86%
Zip Lines	13.05%

Table B4: Top Amusement Device Types by Observed Injury Burden (2014 – 2023)

Device Type	Percentage of Observed Injury Burden
Amusement Rides	35.39%
Water Slides	26.15%
Zip Lines	21.39%

Figure B3: Number of Incidents by Amusement Device Types (2014 – 2023)



The time-series plot for amusement rides and waterslides in the Amusement Devices Program shows a clear impact of COVID-19 lockdowns on the number of incidents during FY20 and FY21. However, the incidents for amusement rides and waterslides climbed again in FY22 as operations returned to pre-COVID-19 patterns.



Risk of Devices

There are over 1,200 permitted rides in the province. However, not all become operational every year. Before an amusement device can operate for the season, an operational inspection is required to ensure it is safe for the public and that the owner/operator is in compliance with all safety requirements.

TSSA conducts periodic inspections of all amusement devices at the start of the season to oversee and manage the state of compliance across permitted amusement devices in the province of Ontario. Amusement device operations are generally seasonal in nature with a few devices operating all year round. TSSA deals with non-compliance by requiring the owner to address observed failures within an appropriate time frame through the issuance of inspection orders. This process contributes to the preventative risk management of the inventory.

Table B5: Number of Amusement Devices (2023)

Description	Number
Amusement devices inventory	4,337
Amusement devices that had sufficient inspection history to calculate a risk score	2,902

Figure B4: Inventory Risk Profiles from Outcomes of Periodic Inspections Conducted on Amusement Devices (2019 – 2023)

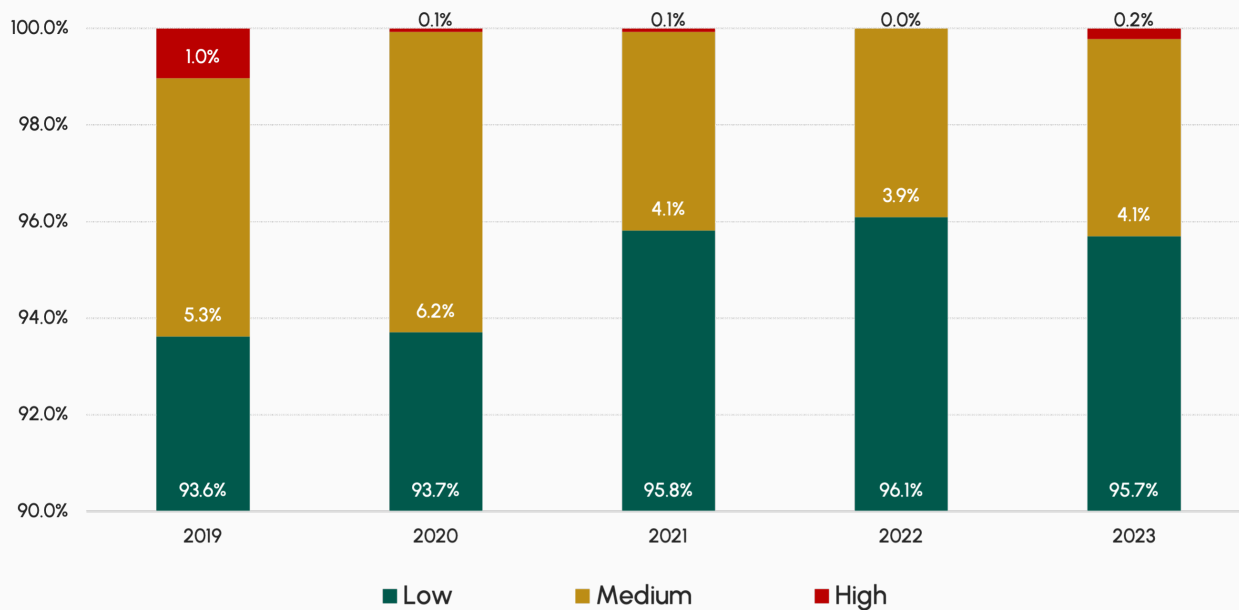


Table B7: Number of High-Risk Amusement Devices (2023)

Description	Number	Percentage of Qualified Inventory
High-Risk Devices	7	0.22%

Table B8: Top High-Risk Amusement Device Types (2023)

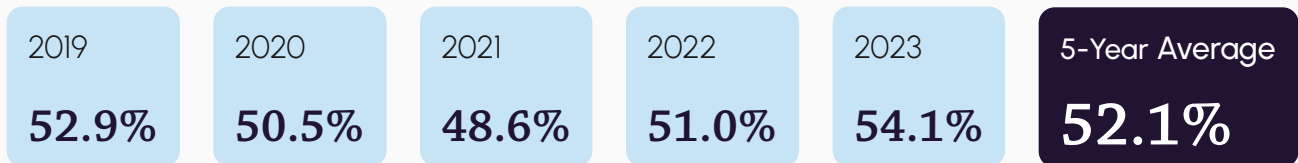
Device Type	Percentage of Total High-Risk Devices
Amusement Rides	100%

Inspection Results - Compliance Rate

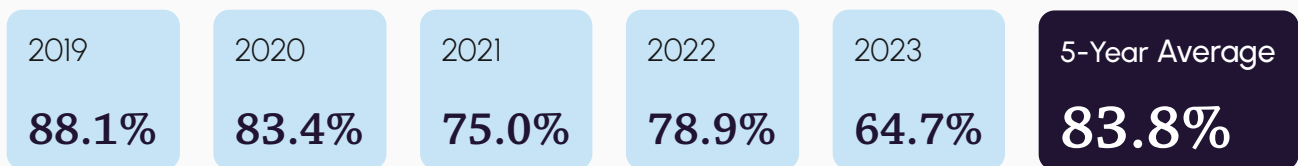
For amusement devices, the ride operators perform an important role in ensuring that the users are adhering to the rules for safe riding. Part of TSSA's inspection is to witness the operation of the ride and verify that operating procedures are being followed, thus managing the risk of non-compliance.

Some operational inspections were also performed, and their numbers are given below for comparison purposes.

**Figure B5: Rate of Periodic Inspections With No Issues
Amusement Devices (2019 – 2023)**



**Figure B6: Rate of Operational inspections with No Issues
Amusement Devices (2019 – 2023)**



**Figure B7: Rate of Periodic Inspections With No High-Risk Issues
Amusement Devices (2019 – 2023)**



**Figure B8: Rate of Operational Inspections With No High-Risk Issues
Amusement Devices (2019 – 2023)**

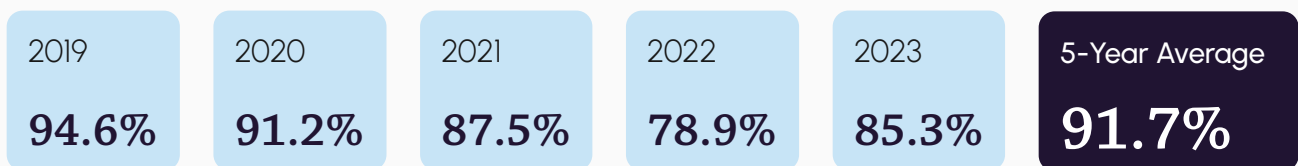


Table B6: Top Compliance Issues by Number of Orders Issued during Periodic Inspections (2019 – 2023)

Compliance Issues	Percentage Of Total Number Of Orders Issued
Hole/tear in an inflatable structure	3.63%
Secure fasteners in an approved manner	3.33%
No record of training	2.71%

Table B7: Top Compliance Issues by Number of Orders Issued during Operational Inspections (2019 – 2023)

Compliance Issue	Percentage of Total Number of Orders Issued
No record of training	8.97%
Insufficient number of ride operators	8.28%
The licenced holder must ensure they operate an amusement device as per procedures set out in the technical dossier	4.14%

Table B8: Top Compliance Issues by Risk of Orders Issued during Periodic Inspections (2019 – 2023)

Compliance Issue	Percentage of Total Risk of Orders Issued
Ensure that all aspects of the lap bar restraint are fully operational	10.35%
The device is removed from service until it is inspected by an inspector from TSSA and authorised to return to service	4.58%
Secure fasteners in an approved manner	4.04%

Table B9: Top Compliance Issues by Risk of Orders during Operational Inspections (2019 – 2023)

Compliance Issue	Percentage of Total Risk of Orders Issued
Insufficient number of ride operators	35.04%
Ensure that all aspects of the lap bar restraint are fully operational	23.97%
The attendant shall be in the designated position	2.47%

Table B10: Top Compliance Issues by Number of High-Risk Orders during Periodic Inspections (2019 – 2023)

Compliance Issue	Percentage of Total Number of Orders Issued
Secure fasteners in an approved manner	7.62%
The device is removed from service until it is inspected by an inspector from TSSA and authorised to return to service	4.76%
Ensure that all aspects of lap bar restraint are fully operational	2.46%

Table B11: Top Compliance Issues by Number of High-Risk Orders during Operational Inspections (2019 – 2023)

Compliance Issue	Percentage of Total Number of Orders Issued
Insufficient number of ride operators	18.18%
Ensure that all aspects of lap bar restraint are fully operational	7.58%
Tie downs and anchors are used in an unapproved manner	4.55%

Table B12: Top Compliance Issues by Risk of High-Risk Orders during Periodic Inspections (2019 – 2023)

Compliance Issue	Percentage of Total Risk of Orders Issued
Ensure that all aspects of lap bar restraint are fully operational	11.57%
The device is removed from service until it is inspected by an inspector from TSSA and authorised to return to service	4.93%
Secure fasteners in an approved manner	4.45%

Table B13: Top Compliance Issues by Risk of High-Risk Orders during Operational Inspections (2019 – 2023)

Compliance Issue	Percentage of Total Risk of Orders Issued
Lap bar restraint is not fully operational	36.93%
Ensure that all aspects of the lap bar restraint are fully operational	25.26%
The attendant shall be in the designated position	2.60%

Inspection and Re-Inspection Results

Table B14: Amusement Devices Inspection and Re-Inspection Results (2023)

Inspection Type	Fully Compliant	Non-Compliances Found (any risk)	Other	Grand Total	Pass Rate (%)
Ad Hoc/Unscheduled Inspection	0	4	0	4	0%
Alteration Inspection	1	0	0	1	100%
Incident Inspection	0	0	0	0	N/A
Initial Inspection	74	51	0	125	59%
Minor Alteration Inspection	1	0	0	1	100%
Operational Inspection	2	2	0	4	50%
Other Inspection	0	0	0	0	N/A
Periodic Inspection	814	37	0	851	96%
Re-Inspection	270	109	4	383	71%
Grand Total	1,162	203	4	1,369	85%

Legislation and Regulatory Information

Table B15: TSSA Amusement Devices Legislation and Regulatory Information (2023)

Legislation and Regulatory Information	Latest Revision
Ontario Regulation 221/01: Amusement Devices Regulation	2009
Ontario Regulation 187/03: Certification and Training of Amusement Device Mechanics	2013
Amusement Devices CAD Amendment 541/21	2021
Amendments to the Amusement Devices Code Adoption Document (CAD) 2021	2021
Canadian Bungee Safe Code of Practice	2000
Guideline for the Design Review of Rides manufactured prior to January 1, 2012 543/22 ^{el}	2022
Amusement Ride and Device Classifications Advisory 542/21	2021
Amusement Devices (AD)-544/22, June 10, 2022 – Alteration guideline and checklist	2023



▶ For a comprehensive listing of legislation and regulatory information, see: <https://www.tssa.org/en/amusement-devices/legislation-and-regulatory-information.aspx>

Appendix C: Boilers and Pressure Vessels



TSSA's Boilers and Pressure Vessels Safety Program ensures the safe design, construction, maintenance, use, operation, and repair of pressure-retaining components in Ontario.

This includes all pressure-retaining components that produce and distribute hot water, steam, compressed air and other compressed liquids and gases for industrial, commercial, or institutional purposes.

Note that numbers may not add up fully or may exceed the 100th percentile due to rounding off.

Incidents, Injuries and Risk Prediction

Table C1: State of Safety Measures for Boilers and Pressure Vessels (2014 – 2023)

Description	Fiscal Year										Total	Avg.	5-year Trend
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023			
Incidents	0	1	5	4	22	117	150	150	129	116	694	70	Increasing
Non-Permanent Injuries	0	0	1	0	0	2	0	0	1	0	4	0	No Trend
Permanent Injuries	0	0	1	2	1	0	0	0	0	0	4	0	No Trend
Fatalities	0	0	0	0	0	0	0	0	0	0	0	0	No Trend
Observed Injury Burden (FE/mp)	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	N/A	0.00	N/A

Table C2: Risk of Injury or Fatality for Boilers and Pressure Vessels (2019 – 2023)

Description	Fiscal Year				
	2019	2020	2021	2022	2023
RIF	0.001	0.001	0.001	0.001	0.001

The TSSA RIF acceptance criterion is 1.00 FE/mpy.

Incidents involving these types of equipment could include cracked and corroded vessels or piping, leaks or rupture resulting in poisonings, suffocations, fires and/or explosions. Failures can be catastrophic and may immediately threaten life and property. The safe design, installation, operation, and maintenance of boilers and pressure vessels, in accordance with appropriate codes and standards, are essential to public safety. TSSA's activities help ensure that safeguards are in place for the lifecycle of this type of equipment.

Figure C1: Occurrences and Observed Injury Burden For Boilers and Pressure Vessels (2014 – 2023)

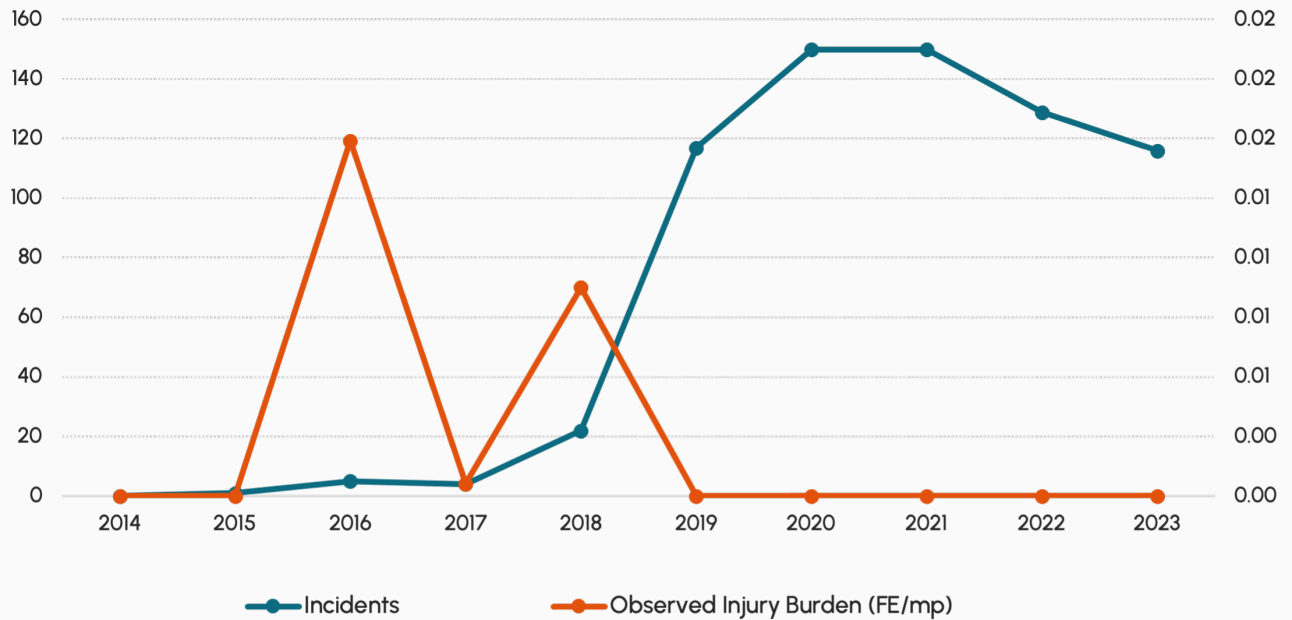
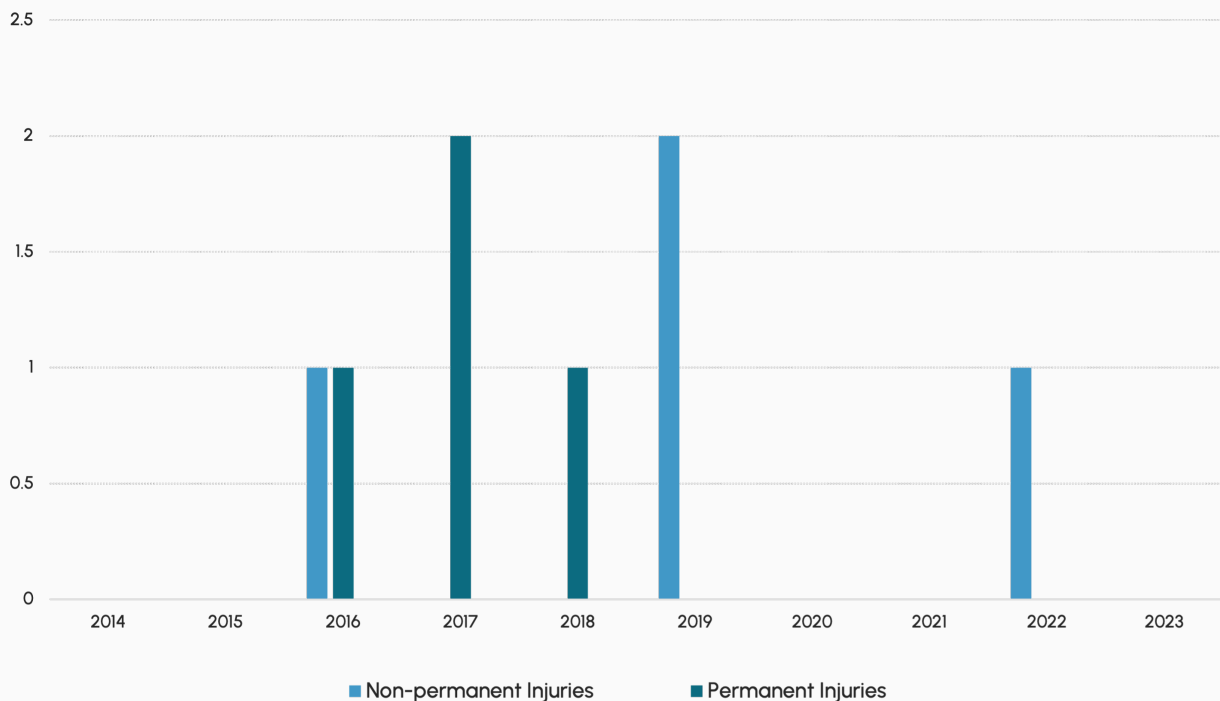


Figure C2: Injuries and Fatalities for Boilers and Pressure Vessels (2014 – 2023)



Compliance

Ontario Regulation 220/01, Boilers and Pressure Vessels assigns responsibility for periodic inspection to both TSSA and insurers who underwrite boiler and machinery insurance. Insurers conduct periodic inspections for the majority of Ontario's fleet of boilers and pressure vessels.

On July 1, 2018, TSSA began issuing Certificates of Inspection (COI) for boilers and pressure vessels which had undergone periodic inspections by insurance companies or their delegates.

The frequency of inspections is specified in the Code Adoption Document (CAD) associated with *Ontario Regulation 220/01*. Periodic inspections contribute to the preventative management of risk associated with boilers and pressure vessels. Through the inspection process, any non-conformances are directed to the owner for action within an appropriate time frame.

Table C3: Top Compliance Issues by Number of Orders Issued from Outcomes of Periodic Inspections Conducted on Boilers and Pressure Vessels (2019 – 2023)

Compliance Issue	Percentage of Total Number of Orders Issued
Proper procedures, qualified technician and report submitted for Magnetic Particle or Liquid Penetrant examination	19.72%
Equipment not prepared for TSSA inspection	12.21%
Equipment not maintained in safe working condition	5.63%

Note that the Boilers and Pressure Vessels Safety Program does not currently use a risk-based inspection system.

Inspection and Re-Inspection Results

Table C4: Uninsured Boilers and Pressure Vessels Inspection and Re-Inspection Results (2023)

Inspection Type	Fully Compliant	Non-Compliance (any risk)	Other	Grand Total	Pass Rate (%)
Alteration Inspection	84	1	0	85	99%
Incident Inspection	7	0	0	7	100%
Initial Inspection	2,827	171	14	3,012	94%
Inspection For Certification	592	0	1,306	1,898	100%
Non-Mandated/Non-regulated Inspection	1,200	0	84	1,284	100%
Other Inspection	5,665	45	326	6,036	99%
Periodic Inspection	239	7	14	260	97%
Re-inspection	139	175	0	314	44%
Repair Inspection	359	1	0	360	100%
Grand Total	11,112	400	1,744	13,256	97%

Legislation and Regulatory Information

Table C5: TSSA Boilers and Pressure Vessels Legislation and Regulatory Information (2023)

Legislation and Regulatory Information	Latest Revision
Ontario Regulation 220/01: Boilers and Pressure Vessels Regulation	2018
Summary of Key Changes for the Regulation of Pressure Equipment	2001
Minister's Exemption for Agriculture – Revocation	2021
Boilers and Pressure Vessels CAD Amendment BPV-20-01 R1	2021
BPV Incident Reporting Advisory BPV-22-01	2022

During this fiscal year, there was one Boilers and Pressure Vessels advisory issued.



▶ For a comprehensive listing of legislation and regulatory information, see: <https://www.tssa.org/en/boilers-pressure-vessels/legislation-and-regulatory-information.aspx>

Appendix D: Elevating Devices – Elevators



The Elevating Devices Safety Program regulates elevating devices in Ontario to ensure all devices conform to the Act and applicable regulations, codes and standards.

TSSA reviews and registers elevating devices, issues licenses, conducts inspections, performs incident investigations, registers contractors and certifies mechanics.

The Elevating Devices Safety Program consists of three areas: **elevators, escalators and moving walks**, and **passenger ropeways (ski lifts)**.

Regulated elevators include passenger elevators, freight elevators, observation elevators, temporary elevators, limited use/limited application elevators, dumbwaiters, freight platform lifts, material lifts, lifts for persons with disabilities (including stair chair lifts, enclosed stair platform lifts, unenclosed stair platform lifts, enclosed vertical platform lifts, and unenclosed vertical platform lifts), manlifts, construction hoists, incline lifts (including funicular railways), stage lifts, parking garage lifts, and special elevating devices.

Note that numbers may not add up fully or may exceed the 100th percentile due to rounding off.

Incidents, Injuries and Risk Prediction

Table D1: State of Safety Measures for Elevators (2014 – 2023)

Description	Fiscal Year										Total	Avg.	5-year Trend
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023			
Incidents	501	464	570	543	701	738	677	579	640	656	6,069	607	No Trend
Non-Permanent Injuries	186	119	169	146	132	122	131	88	76	85	1,254	125	Decreasing
Permanent Injuries	7	7	11	11	4	5	8	6	7	5	71	7	No Trend
Fatalities	0	2	0	2	1	0	1	0	0	0	6	1	No Trend
Observed Injury Burden (FE/mp)	0.03	0.03	0.02	0.18	0.03	0.02	0.16	0.004	0.02	0.001	N/A	0.05	N/A

Table D2: Risk of Injury or Fatality for Elevators (2019 – 2023)

Description	Fiscal Year				
	2019	2020	2021	2022	2023
RIF	0.06	0.08	0.07	0.04	0.01

The TSSA RIF acceptance criterion is 1.00 FE/mpy.

Figure D1: Occurrences and Observed Injury Burden for Elevators (2014 – 2023)

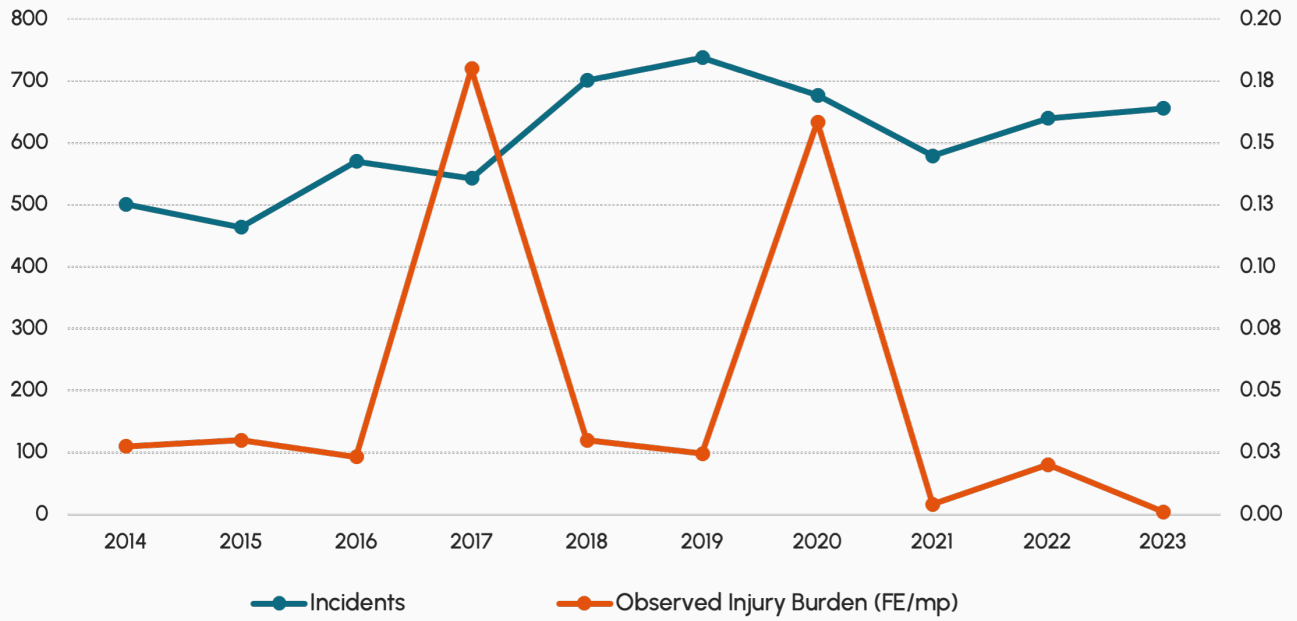


Figure D2: Injuries and Fatalities for Elevators (2014 – 2023)

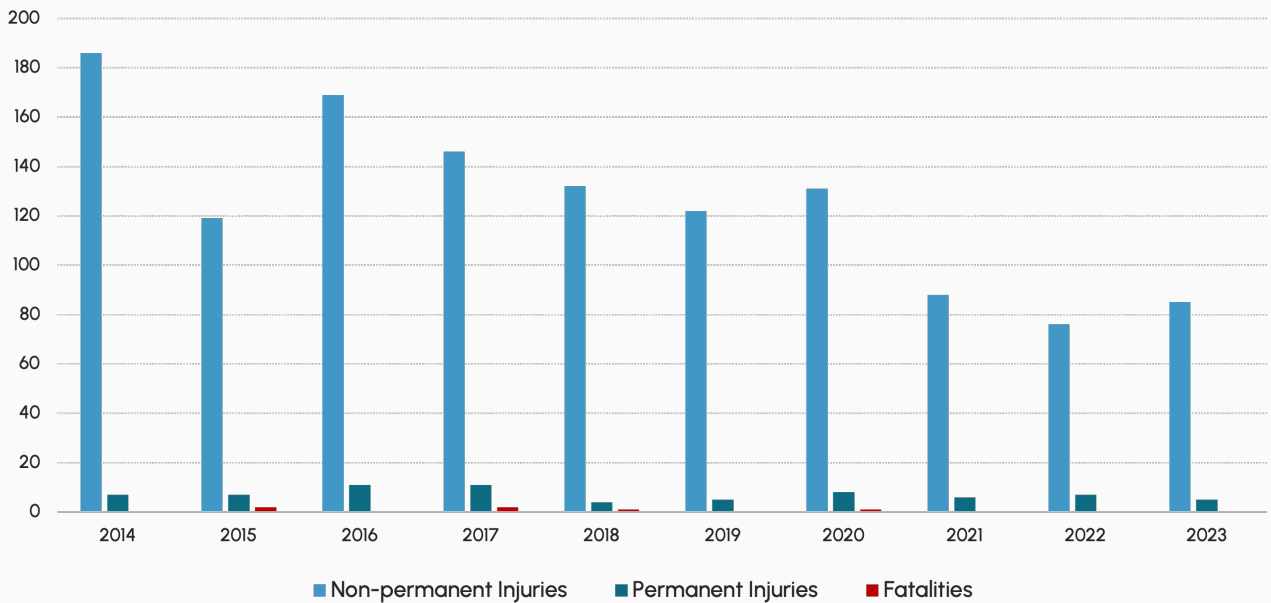


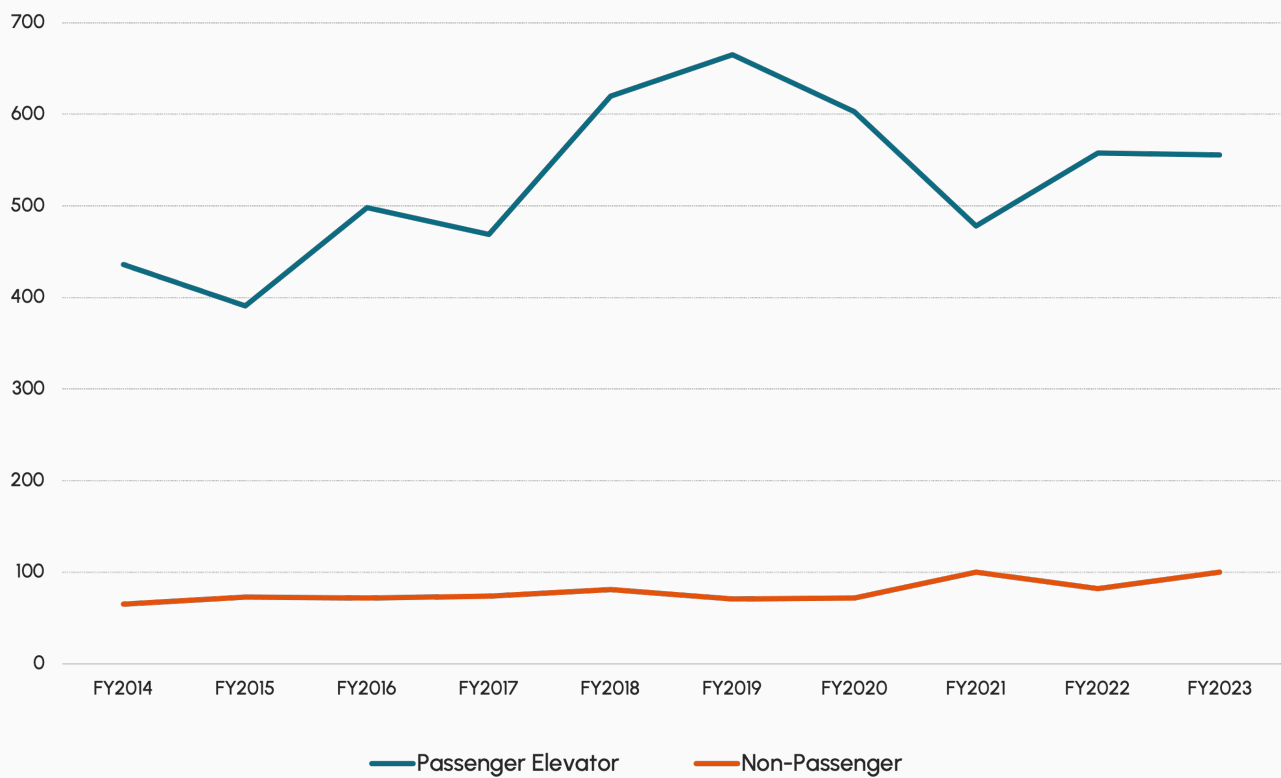
Table D3: Top Elevator Building Types by Number of Incidents (2014 – 2023)

Building Type	Percentage of Occurrences
Rental	22.49%
Condominium	20.17%
Office	18.83%

Table D4: Top Elevator Building Types by Observed Injury Burden (2014 – 2023)

Building Type	Percentage of Observed Injury Burden
Condominium	33.41%
Office	25.92%
Rental	16.35%

Figure D4: Number of Incidents by Device Types (2014 – 2023)



Passenger elevators have seen a slight upward trend on a year-on-year basis over the past 10 years. However, the last two years (FY22 and FY23) have seen a slight decrease in incidents overall.

Risk of Devices

TSSA conducts periodic inspections of all elevators using a risk-based approach to oversee and manage the state of compliance across all elevators in the province of Ontario. TSSA deals with non-compliance by requiring the owner to address observed failures within an appropriate time frame through the issuance of inspection orders. This process contributes to the preventative risk management of the inventory.

Table D5: Number of Elevators (2023)

Description	Number
Elevator inventory	61,592
Elevators that had sufficient inspection history to calculate a risk score	47,015

Figure D5: Inventory Risk Profiles from Outcomes of Periodic Inspections Conducted on Elevators (2019 – 2023)

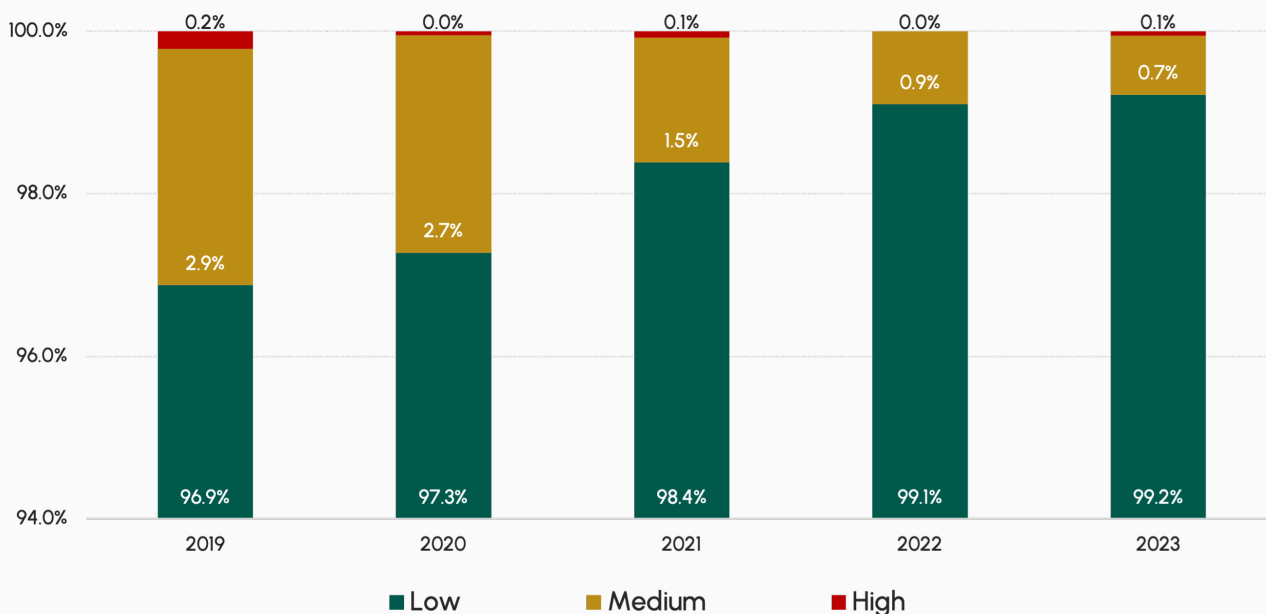


Table D6: Number of High-Risk Elevators (2023)

Description	Number	Percentage of Qualified Provincial Inventory
High-Risk Devices	25	0.05%

Table D7: Top High-Risk Elevator Building Types (2023)

Building Type	Percentage of Total High-Risk Elevators
Assemblies	28.00%
Rental	24.00%
Offices	16.00%

Inspection Results – Compliance Rate

Figure D6: Rate of Periodic Inspections with no Issues Found Elevators (2019 – 2023)



Figure D7: Rate of Periodic Inspections with no High-Risk Issues Elevators (2019 – 2023)



Table D8: Top Compliance Issues by Number of Orders Issued during Periodic Inspections (2019 – 2023)

Compliance Issue	Percentage of Total Number of Orders Issued
Late annual periodic task for emergency power and lowering operation	3.13%
Firefighter emergency annual periodic task not complete	2.30%
Post license in conspicuous location	1.91%

Table D10: Top Compliance Issues by Risk of Orders Issued during Periodic Inspections (2019 – 2023)

Compliance Issue	Percentage of Total Risk of Orders Issued
The restrictor is not consistently locking the car door when the elevator is out of the unlocking zone	53.27%
Machine brake requiring repair or replacement	6.84%
No record of maintenance in the logbook	4.82%

Table D11: Top Compliance Issues by Number of High-Risk Orders Issued during Periodic Inspections (2019 – 2023)

Compliance Issue	Percentage of Total Number of Orders Issued
Top guard rails do not meet code requirements	7.23%
No reference point for oil level	5.44%
Unlicensed elevating device	3.42%

Table D12: Top Compliance Issues by Risk of Orders Issued during Periodic Inspections (2019 – 2023)

Compliance Issue	Percentage of Total Risk of Orders Issued
Restrictor is not consistently locking the car door when the elevator is out of the unlocking zone	23.36%
Faulty hoistway door interlock	11.87%
No record of monthly maintenance	11.53%

Inspection and Re-Inspection Results

Table D13: Elevators Inspection and Re-Inspection Results (2023)

Inspection Type	Full Compliance	Non-Compliances (any risk)	Other	Grand Total	Pass Rate (%)
Ad Hoc/Unscheduled Inspection	604	416	71	1,091	59%
Alteration Inspection	367	139	3	509	73%
Incident Inspection	4	8	0	12	33%
Initial Inspection	1,468	1,589	10	3,067	48%
Minor Alteration Inspection	646	338	0	984	66%
Non-Mandated/Non-regulated Inspection	18	17	0	35	51%
Other Inspection	0	16	10	26	0%
Periodic Inspection	1,398	1,214	65	2,677	54%
Re-inspection	5,948	7,525	209	13,682	44%
Grand Total	10,453	11,262	368	22,083	48%

Legislation and Regulatory Information

Table D14: TSSA Elevators Legislation and Regulatory Information (2023)

Legislation and Regulatory Information	Latest Revision
Ontario Regulation 209/01: Elevating Devices	2021
Ontario Regulation 222/01: Certification and Training of Elevating Devices Mechanics	2009
Elevating Devices CAD Amendment 277-19	2019
Referenced Standards and Cross Reference Guideline for Parking Garage Lifts (PGL's) as adopted in ED CAD 295 / 22 Part 9	2022
The Director for the purposes of Ontario Regulation 209/01 (Elevating Devices), pursuant to section 4 of Ontario Regulation 223/01 CAD	2022
Binder of active code adoption documents, guidelines, advisories, Director's Orders & Director's Safety Orders as of August 1, 2022	2023
Elevating devices (ED 301-23), April 30, 2023 – Director's Safety Order: dover counterweight frame cracks and repair	2023
Elevating devices (ED 303-23), April 30, 2023 – Advisory: Bearings on all 2 to 1 roped counterweights	2023

The advisories issued in 2021:

- 287 / 20 – Foot Operated Elevator Operating Buttons;
- 288 / 20 – Anniversary Dates for Category Tests;
- 289 / 20 – Monitoring of Cylinder Corrosion Protection;
- 290 / 20 – Elevator Phones – Acceptability of Communication Technologies (POTS, VoIP, Cellular / Wireless, other);
- 291 / 20 – Elevator Car Lighting Branch Circuit;
- 292 / 20 – Construction Hoist and Transport Platform Hoistway Wiring;
- 293 / 21 – Grounding of Transformers;
- 294 / 21 – TSSA regulatory jurisdiction as related to elevating devices when associated with federal or other non-regulatory activities or functions; and
- 299 / 21 – Temporary Special Provisions for EDM-T Construction Hoist Industry.

The advisory issued in 2022:

- 300 / 21- Escalator Step/Skirt Performance Index and Step to Skirt Clearance Requirements

▶ For a comprehensive listing of legislation and regulatory information, see: <https://www.tssa.org/en/elevating-devices/legislation-and-regulatory-information.aspx>



Appendix E: Elevating Devices – Escalators and Moving Walks



The Elevating Devices Safety Program regulates elevating devices in Ontario to ensure all devices conform to the Act and applicable regulations, codes and standards.

TSSA reviews and registers elevating devices, issues licenses, conducts inspections, performs incident investigations, registers contractors and certifies mechanics.

The Elevating Devices Safety Program consists of three areas: **elevators**, **escalators and moving walks**, and **passenger ropeways (ski lifts)**. The various types of regulated devices include escalators and moving walks (including shopping cart conveyors).

Note that numbers may not add up fully or may exceed the 100th percentile due to rounding off.

Incidents, Injuries and Risk Prediction

Table E1: State of Safety Measures for Escalators and Moving Walks (2014 – 2023)

Description	Fiscal Year										Total	Avg.	5-year Trend
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023			
Incidents	642	592	742	701	726	786	679	389	508	668	6,433	643	Increasing
Non-Permanent Injuries	438	383	470	441	459	521	459	205	301	375	4,052	405	Increasing
Permanent Injuries	3	7	5	4	0	4	1	3	1	2	30	3	No Trend
Fatalities	0	0	0	0	0	0	0	1	0	1	2	0	No Trend
Observed Injury Burden (FE/mp)	0.002	0.01	0.02	0.002	0.003	0.004	0.003	0.02	0.03	0.01	N/A	0.01	N/A

Table E2: Risk of Injury or Fatality for Escalators and Moving Walks (2019 – 2023)

Description	Fiscal Year				
	2019	2020	2021	2022	2023
RIF	0.01	0.01	0.01	0.02	0.00

The TSSA RIF acceptance criterion is 1.00 FE/mpy.

Figure E1: Occurrences and Observed Injury Burden for Escalators and Moving Walks (2014 – 2023)

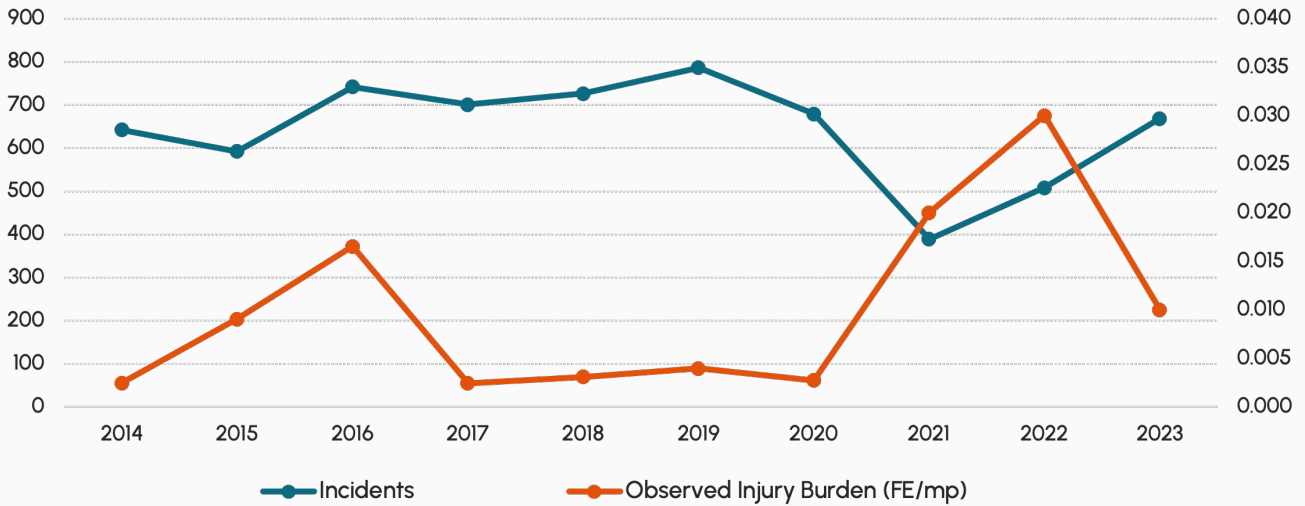


Figure E2: Injuries and Fatalities for Escalators and Moving Walks (2014 – 2023)

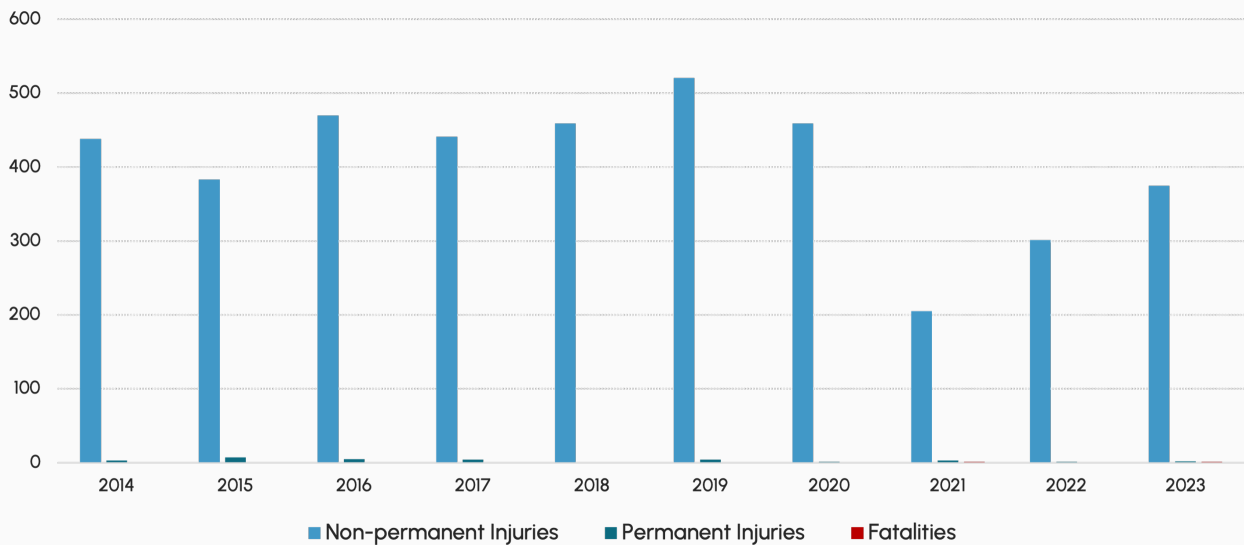


Table E3: Top Escalator and Moving Walk Building Types by Number of Incidents (2014 – 2023)

Building Type	Percentage of Occurrences
Mass Transportation	65.04%
Mercantile	27.23%
Office	4.07%

Table E4: Top Escalator and Moving Walk Building Types by Observed Injury Burden (2014 – 2023)

Building Type	Percentage of Observed Injury Burden
Mass Transportation	51.24%
Mercantile	46.12%
Assemblies	1.36%

Risk of Devices

TSSA conducts periodic inspections of all escalators and moving walks to oversee and manage the state of compliance in the province of Ontario. TSSA deals with non-compliance by requiring the owner to address observed failures within an appropriate time frame through the issuance of inspection orders. This process contributes to the preventative risk management of the inventory.

Table E5: Number of Escalators and Moving Walks (2023)

Description	Number
Escalators and moving walks inventory	2,371
Escalators and moving walks that had sufficient inspection history to calculate a risk score	1,588

Figure E4: Inventory Risk Profiles from Outcomes of Periodic Inspections Conducted on Escalators and Moving Walks (2019 – 2023)

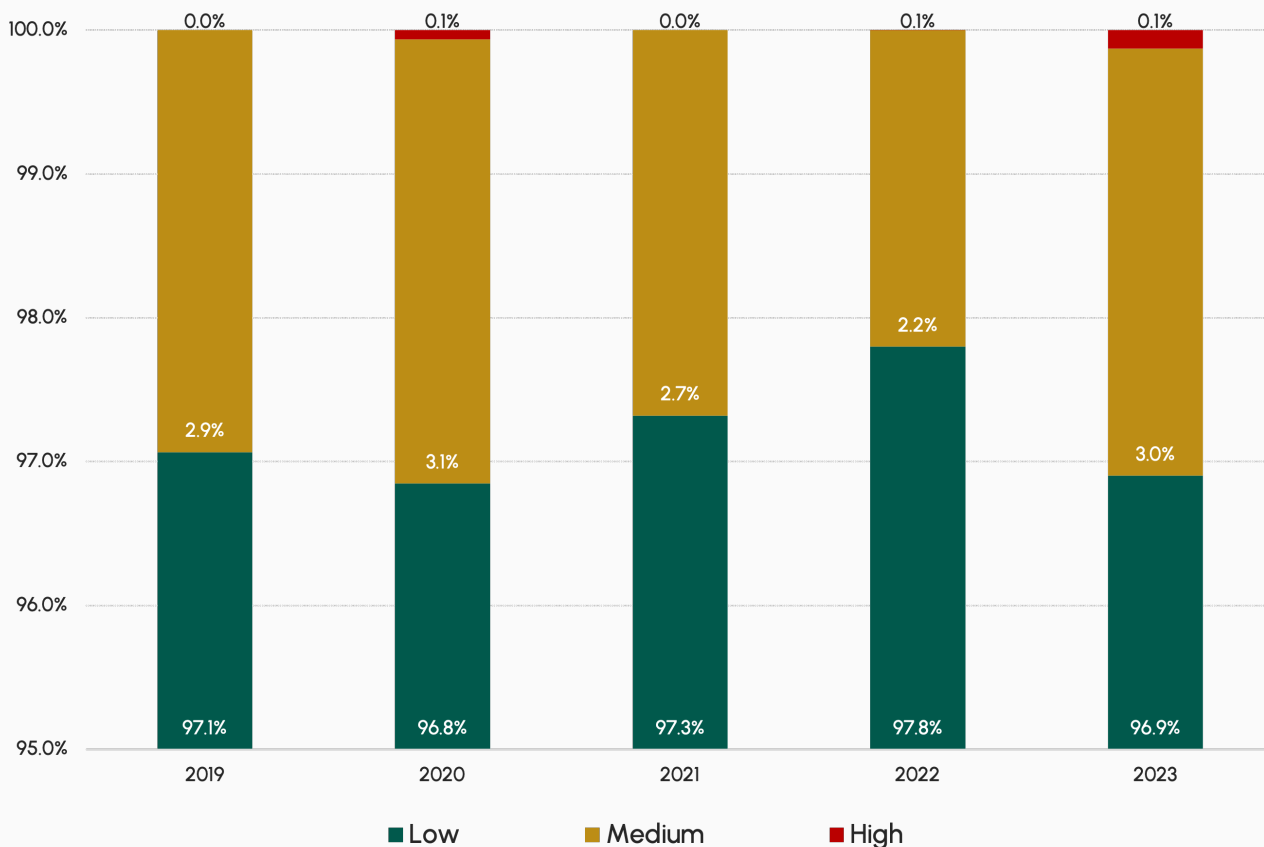


Table E6: Number of High-Risk Escalators and Moving Walks (2023)

Description	Number	Percentage of Qualified Provincial Inventory
High-Risk Devices	2	0.13%

Inspection Results – Compliance Rate

**Figure E5: Rate of Periodic Inspections with no Issues Found
Escalators and Moving Walks (2019 – 2023)**



**Figure E6: Rates of Periodic Inspections with no High-Risk Issues
Escalators and Moving Walks (2019 – 2023)**



Table E7: Top Compliance Issues by Number of Orders Issued during Periodic Inspections (2019 – 2023)

Compliance Issue	Percentage of Total Number of Orders Issued
Late annual periodic test for escalator clearance between step and skirt-loaded gap	6.78%
Late annual periodic task for skirt/step performance index	4.81%
Late maintenance for escalator cleaning	2.26%

Table E8: Top Compliance Issues by Risk of Orders Issued during Periodic Inspections (2014 – 2023)

Compliance Issue	Percentage of Total Risk of Orders Issued
Handrail speed should be synchronized with that of steps	9.51%
Handrail entry device not operative	9.20%
Brake torque not as per data tag information	1.82%

Table E9: Top Compliance Issues by Number of High-Risk Orders Issued during Periodic Inspections (2019 – 2023)

Compliance Issue	Percentage of Total Number of Orders Issued
Inadequate brake torque	11.72%
Incorrect no-loading stopping distance	8.01%
Make skirt obstruction device operative	6.25%

Table E10: Top Compliance Issues by Risk of High-Risk Orders Issued during Periodic Inspections (2014 – 2023)

Compliance Issue	Percentage of Total Risk of Orders Issued
Inadequate brake torque	5.50%
Missing guard where handrail and ceiling meet	4.11%
Handrail speed should be synchronized with that of steps	3.84%

Inspection and Re-Inspection Results

Table E11: Escalators and Moving Walks Inspection and Re-Inspection Results (2023)

Inspection Type	Full Compliance	Non-Compliance (any risk)	Other	Grand Total	Pass Rate (%)
Ad Hoc/Unscheduled Inspection	0	14	8	22	0%
Incident Inspection	0	1	0	1	0%
Initial Inspection	43	93	1	137	32%
Minor Alteration Inspection	19	0	0	19	100%
Other Inspection	0	2	0	2	0%
Periodic Inspection	27	18	24	69	60%
Re-inspection	224	296	12	532	43%
Grand Total	313	424	45	782	42%

Legislation and Regulatory Information

Table E12: TSSA Escalators and Moving Walks Legislation and Regulatory Information (2023)

Legislation and Regulatory Information	Latest Revision
Ontario Regulation 209/01: Elevating Devices	2021
Ontario Regulation 222/01: Certification and Training of Elevating Devices Mechanics	2009
Elevating Devices CAD Amendment 277-19	2019

During this fiscal year, there were no Escalators and Moving Walks Director's Orders, bulletins or guidelines issued. The following advisories were issued:

- 286-20 – Simplified Revision Form to Correct / Revise a Registered Design Submission
- 288-20 – Anniversary Dates for Category Tests; and
- 294-21 – TSSA regulatory jurisdiction as related to elevating devices when associated with federal or other non-regulatory activities or functions

▶ For a comprehensive listing of legislation and regulatory information, see: <https://www.tssa.org/en/elevating-devices/legislation-and-regulatory-information.aspx>

Appendix F: Elevating Devices – Passenger Ropeways and Ski Lifts



The Elevating Devices Safety Program regulates elevating devices in Ontario to ensure all devices conform to the Act and applicable regulations, codes and standards.

TSSA reviews and registers elevating devices, issues licenses, conducts inspections, performs incident investigations, registers contractors and certifies mechanics.

The Elevating Devices Safety Program consists of three areas: **elevators**, **escalators and moving walks**, and **passenger ropeways (ski lifts)**. The various types of regulated ski lifts include chair lifts, bar lifts, recreational conveyors, gondola lifts, reversible ropeways, passenger ropeways, rope tows, tube tows, belt tows and aerial tramways.

Note that numbers may not add up fully or may exceed the 100th percentile due to rounding off.

Incidents, Injuries and Risk Prediction

Table F1: State of Safety Measures for Ski Lifts (2014 – 2023)

Description	Fiscal Year										Total	Avg.	5-year Trend
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023			
Incidents	88	66	72	71	87	83	91	33	73	27	691	69	No Trend
Non-Permanent Injuries	66	52	54	60	64	66	62	25	59	20	528	53	No Trend
Permanent Injuries	3	2	2	3	2	1	2	2	3	1	21	2	No Trend
Fatalities	0	0	0	0	0	0	0	0	0	0	0	0	No Trend
Observed Injury Burden (FE/mp)	0.03	0.02	0.03	0.01	0.01	0.005	0.001	0.01	0.02	0.01	N/A	0.01	N/A

Table F2: Risk of Injury or Fatality for Ski Lifts (2019 – 2023)

Description	Fiscal Year				
	2019	2020	2021	2022	2023
RIF	0.01	0.01	0.01	0.01	0.01

The TSSA RIF acceptance criterion is 1.00 FE/mpy

Figure F1: Occurrences and Observed Injury Burden for Ski Lifts (2014 – 2023)

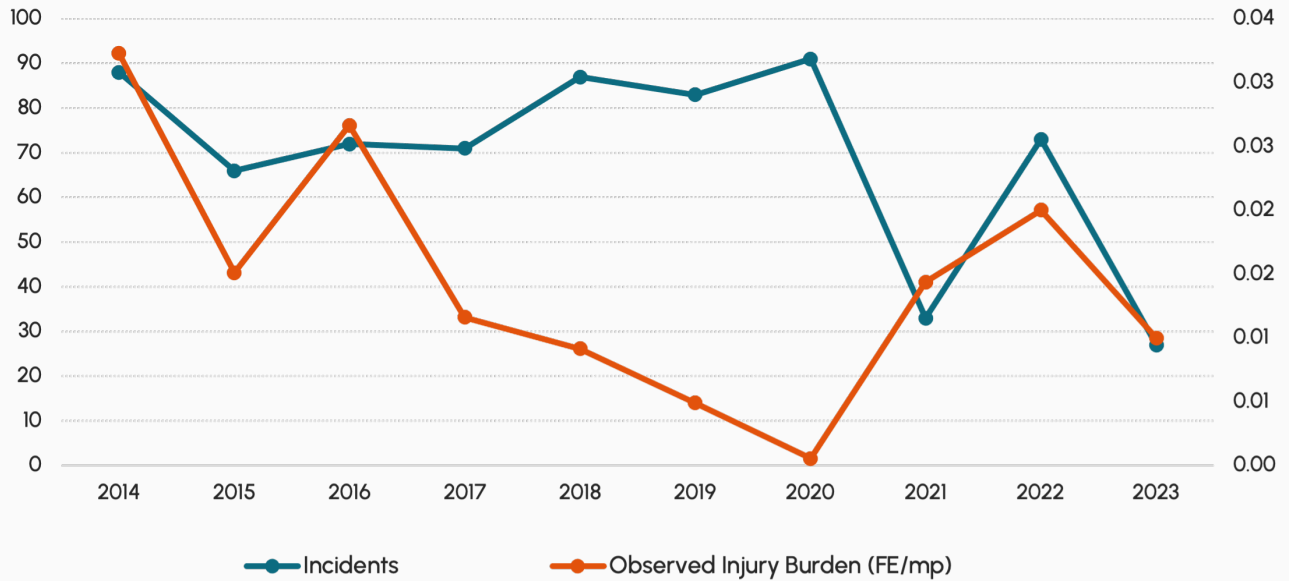
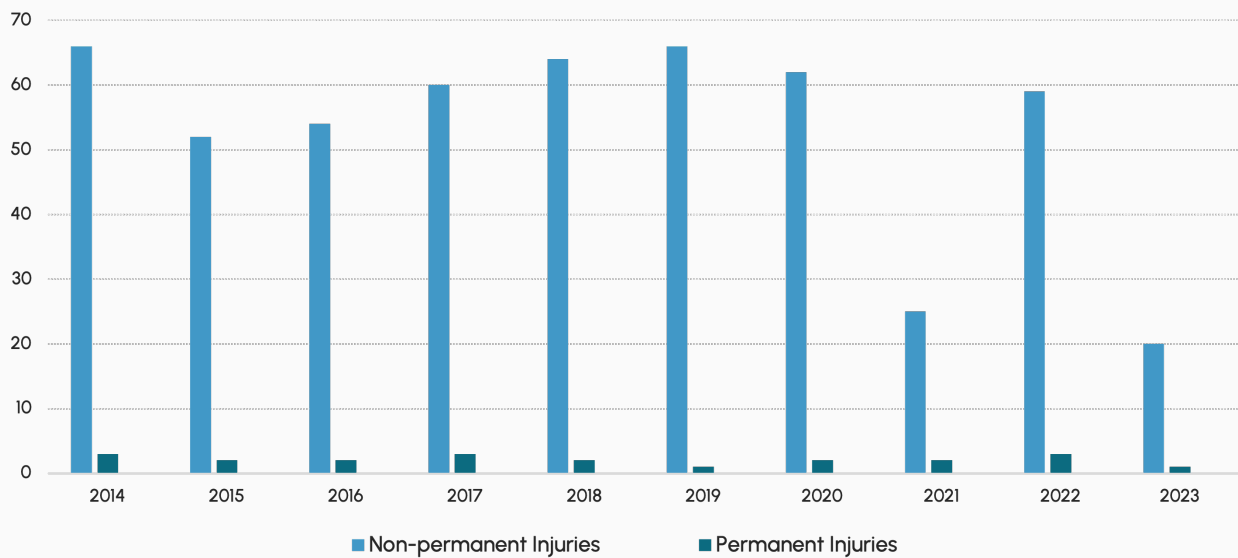


Figure F2: Injuries and Fatalities for Ski Lifts (2014 – 2023)



Risks Due to All Causes

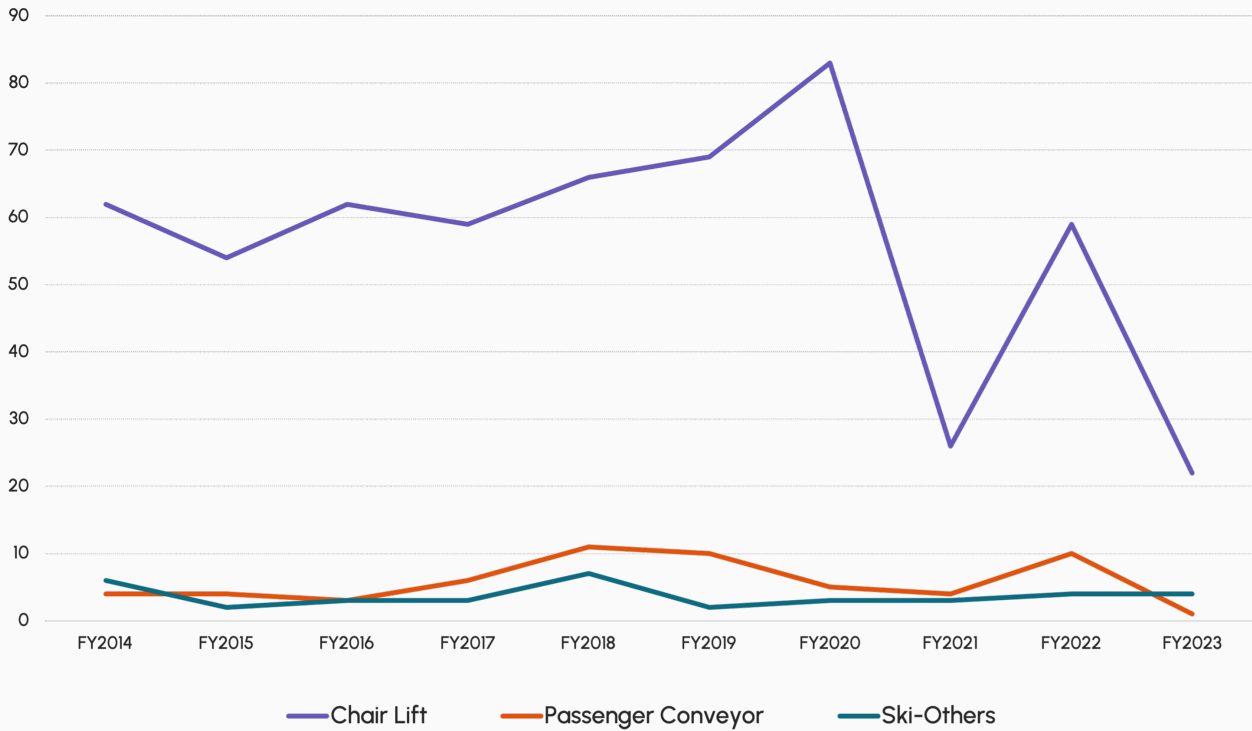
Table F3: Top Ski Lift Types by Number of Incidents (2014 – 2023)

Device Type	Percentage of Occurrences
Chair Lift	85.53%
Passenger Conveyor	8.68%
Bar Lift	3.33%

Table F4: Top Ski Lift Types by Observed Injury Burden (2014 – 2023)

Device Type	Percentage of Observed Injury Burden
Chair Lift	86.22%
Rope Tow	9.41%
Passenger Conveyor	3.31%

Figure F3: Number of Incidents by Ski Device Types (2014 – 2023)



FY23 stands out as an outlier year due to low number of ski incidents compared to the previous nine years. However, FY21 was an exception due to COVID-19 lockdowns. The industry has made some improvements that have resulted in fewer incidents. Additionally, the weather has had an impact.



Risk of Devices

TSSA conducts periodic inspections of all ski lifts using a risk-based approach to oversee and manage the state of compliance across all regulated ski lifts in the province of Ontario with the inspection frequency ranging from as often as twice a season to once every two years. TSSA deals with non-compliance by requiring the owner to address observed failures within an appropriate time frame through the issuance of inspection orders. This process contributes to the preventative management of risk associated with ski lifts.

Table F5: Number of Ski Lifts (2023)

Description	Number
Ski lifts inventory	222
Ski lifts that had sufficient inspection history to calculate a risk score	211

Figure F4: Inventory Risk Profiles from Outcomes of Periodic Inspections Conducted on Ski Lifts (2014 – 2023)

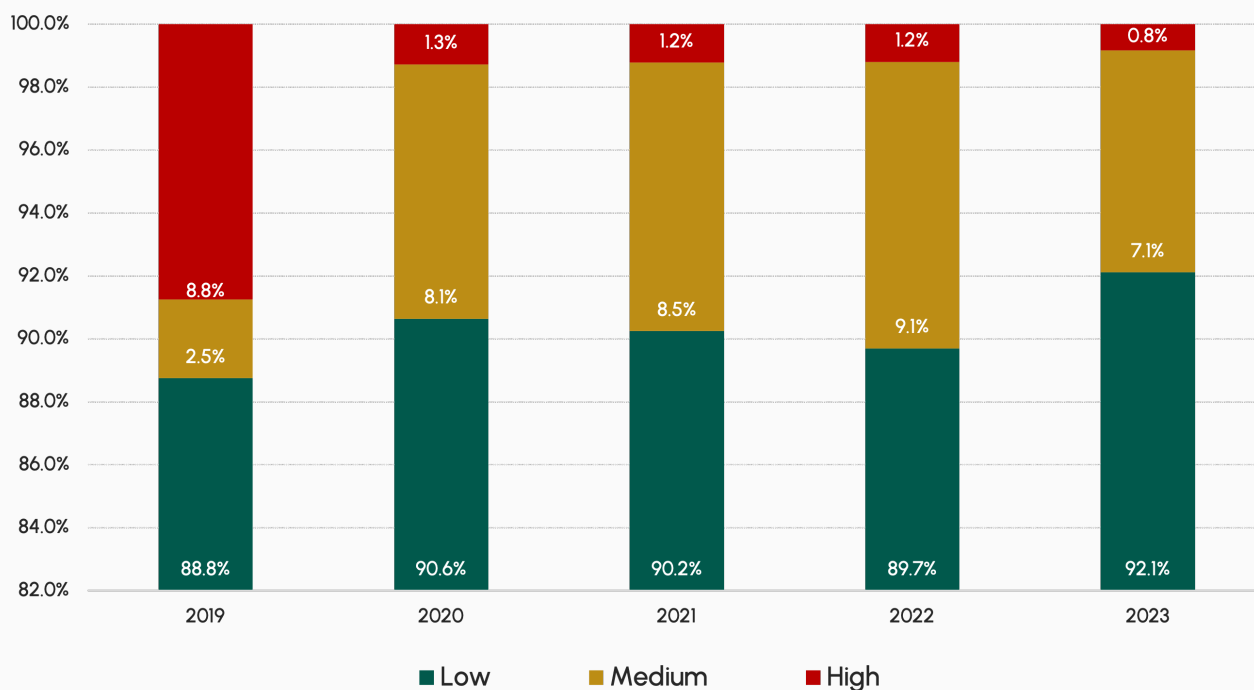


Table F6: Number of High-Risk Ski Lifts (2023)

Description	Number	Percentage of Qualified Provincial Inventory
High-Risk Devices	2	0.83%

Table F7: Top High-Risk Ski Lift Types (2023)

Device Type	Percentage of Total High-Risk Ski Lifts
Chair Lifts	100%

Inspection Results – Compliance Rate

Figure F5: Rate of Periodic Inspections With No Issues
Ski Lifts (2019 – 2023)

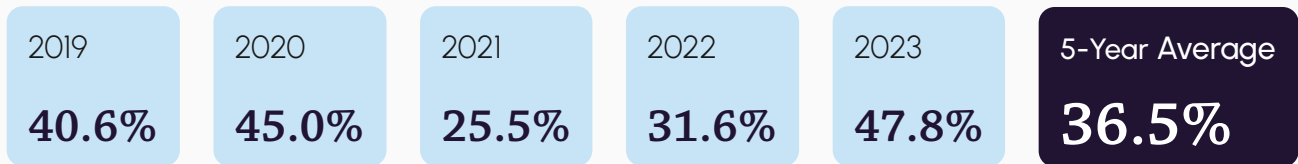


Figure F6: Rates of Operational Inspections With No Issues
Ski Lifts (2019 – 2023)

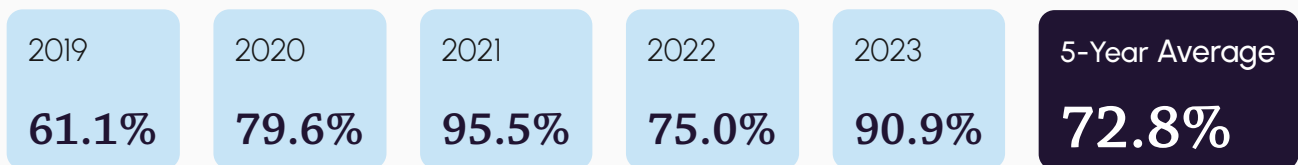


Figure F7: Rate of Periodic Inspections With No High-Risk Issues
Ski Lifts (2019 – 2023)

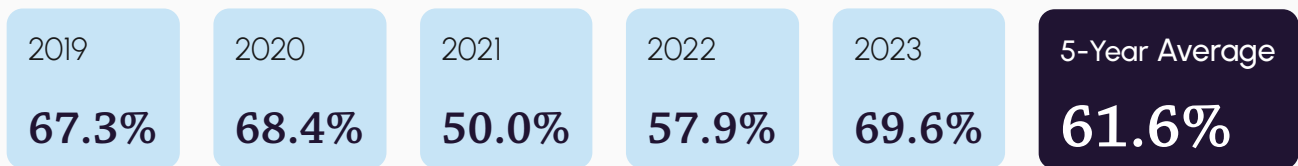


Figure F8: Rate of Operational Inspections With No High-Risk Issues
Ski Lifts (2019 – 2023)

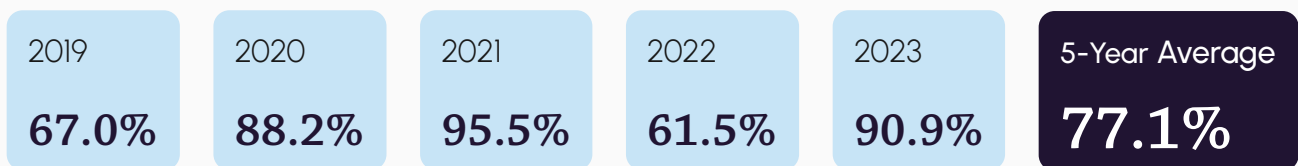


Table F8: Top Compliance Issues by Number of Orders Issued from Outcomes of Periodic Inspections (2019 – 2023)

Compliance Issue	Percentage of Total Number of Orders Issued
Evacuation training has not been conducted	5.04%
Lack of supervising and training all personnel	2.86%
Overhanging tree limbs not removed	2.52%

Table F9: Top Compliance Issues by Number of Orders Issued from Outcomes of Operational Inspections (2019 – 2023)

Compliance Issue	Percentage of Total Number of Orders Issued
Operator not trained for a specific device	20.43%
Personnel not adequately trained	17.20%
Device operated by untrained personnel	13.98%

Table F10: Top Compliance Issues by Risk of Orders Issued from Outcomes of Periodic Inspections (2019 – 2023)

Compliance Issue	Percentage of Total Risk of Orders Issued
Overhanging tree limbs not removed	8.84%
Damaged safety bar hinges	5.87%
High pressure hydraulic tensioning unit failed	4.35%

Table F11: Top Compliance Issues by Risk of Orders Issued from Outcomes of Operational Inspections (2019 – 2023)

Compliance Issue	Percentage of Total Risk of Orders Issued
Operator not trained for specific device	21.46%
Device operated by untrained personnel	14.68%
Safety gate too far from unloading point	9.21%

Table F12: Top Compliance Issues by Number of High-Risk Orders Issued from Outcomes of Periodic Inspections (2019 – 2023)

Compliance Issue	Percentage of Total Number of Orders Issued
Overhanging tree limbs not removed	6.43%
Operation of unlicensed devices	3.80%
Alignment issues with the hauling rope	3.22%

Table F13: Top Compliance Issues by Number of High-Risk Orders Issued from Outcomes of Operational Inspections (2019 – 2023)

Compliance Issue	Percentage of Total Number of Orders Issued
Operator not trained for a specific device	33.93%
Device operated by untrained personnel	23.21%
Lack of attention by the operator at loading area	3.57%

Table F14: Top Compliance Issues by Risk of High-Risk Orders Issued from Outcomes of Periodic Inspections (2019 – 2023)

Compliance Issue	Percentage of Total Risk of Orders Issued
Overhanging tree limbs not removed	10.72%
Damaged safety bar hinges	7.12%
Operation of unlicensed devices	4.84%

Table F15: Top Compliance Issues by Risk of High-Risk Orders Issued from Outcomes of Operational Inspections (2019 – 2023)

Compliance Issue	Percentage of Total Risk of Orders Issued
Operator not trained for a specific device	23.80%
Device operated by untrained personnel	16.28%
Safety gate is too far from the unloading point	10.22%

Inspection and Re-Inspection Results

Table F16: Passenger Ropeways (Ski Lifts) Inspection and Re-Inspection Results (2023)

Inspection Type	Full Compliance	Non-Compliances (any risk)	Other	Grand Total	Pass Rate (%)
Ad Hoc/Unscheduled Inspection	2	0	0	2	100%
Alteration Inspection	0	3	0	3	0%
Initial Inspection	1	2	0	3	33%
Periodic Inspection	1	7	0	8	13%
Re-inspection	19	8	0	27	70%
Grand Total	23	20	0	43	53%

Legislation and Regulatory Information

Table F17: TSSA Passenger Ropeways (Ski Lifts) Legislation and Regulatory Information (2023)

Legislation and Regulatory Information	Latest Revision
Ontario Regulation 209/01: Elevating Devices	2021
Ontario Regulation 222/01: Certification and Training of Elevating Devices Mechanics	2009
Elevating Devices CAD Amendment 277-19	2019

Advisory issued last year:

- 214-09 R2 – Incident Reporting Guideline as Applicable to Passenger Ropeways & Passenger Conveyors.

During this fiscal year, there were no Ski Lifts Director's Orders, advisories, bulletins or guidelines issued. The following guideline was issued:

- 224-07 R2 – Aging Ski lift – Subsequent engineering assessments.



▶ For a comprehensive listing of legislation and regulatory information, see: <https://www.tssa.org/en/ski-lifts/legislation-and-regulatory-information.aspx>

Appendix G: Fuels



TSSA's Fuels Safety Program regulates the transportation, storage, handling and use of fuels in Ontario.

Fuels under this program include: natural gas; propane; butane; hydrogen; digester gas; landfill gas; fuel oil; gasoline; and, diesel. TSSA licenses fuel facilities, registers contractors and certifies tradespeople who install and service equipment. TSSA also reviews and approves facility plans for sites licensed by TSSA and performs custom equipment approvals and inspection services to ensure safe handling and usage of fuel.

Note that numbers may not add up fully or may exceed the 100th percentile due to rounding off.

Incidents, Injuries and Risk Prediction

Table G1: State of Safety Measures for Fuels (2014 – 2023)

Description	Fiscal Year										Total	10-year Avg.	5-year Trend
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023			
Incidents	3,754	3,550	3,327	3,312	3,391	3,388	2,998	2,997	2,726	2,653	32,096	3,210	Decreasing
Non-Permanent Injuries	99	28	55	58	40	22	20	16	20	11	369	37	Decreasing
Permanent Injuries	12	15	18	16	11	20	9	8	10	9	128	13	No Trend
Fatalities	10	3	2	2	1	1	2	3	2	0	26	3	No Trend
Number of Pipeline Strike Occurrences	2,423	2,451	2,404	2,315	2,374	2,317	2,145	2,256	2,015	2,066	22,766	2,277	Decreasing
Number of Non-Pipeline Strike Occurrences	1,331	1,099	923	997	1,017	1,071	853	741	711	587	9,330	933	Decreasing
Observed Injury Burden (FE/mp)	0.57	0.11	0.21	0.12	0.16	0.17	0.08	0.15	0.17	0.05	N/A	0.18	N/A

Table G2: Number of Incidents by Fuel Type (2014 – 2023)

Description	Fiscal Year										Total	10-year Avg.
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023		
Natural Gas	2,467	2,606	2,792	2,879	2,938	3,049	2,798	2,823	2,436	1,529	26,317	2632
Liquid Fuel - Fuel Oil	188	167	175	165	143	134	80	68	52	28	1,200	120
Propane	72	77	55	58	48	56	47	47	19	27	506	51
Liquid Fuel - Diesel	52	27	47	36	54	53	30	18	19	27	363	36
Liquid Fuel - Gasoline	58	41	49	41	37	40	29	17	17	18	347	35
Liquid Fuel - Used / Waste / Lube Oil	3	0	1	1	2	1	0	1	4	4	17	2
Butane	0	1	1	1	2	0	0	0	0	0	5	1
Hydrogen	0	0	2	0	0	0	0	0	0	2	4	0
Liquid Fuel - Aviation Fuel	0	1	0	0	0	2	0	0	0	0	3	0
Compressed Natural Gas	1	0	0	0	0	0	0	0	0	0	1	0
Other	913	630	205	131	167	53	14	23	179	1,018	3,333	333

Table G3: Risk of Injury or Fatality for Fuels (2019 – 2023)

Description	Fiscal Year				
	2019	2020	2021	2022	2023
RIF	0.29	0.22	0.22	0.19	0.12

The TSSA RIF acceptance criterion is 1.00 FE/mpy.



Figure G1: Occurrences and Observed Injury Burden for Fuels (2014 – 2023)

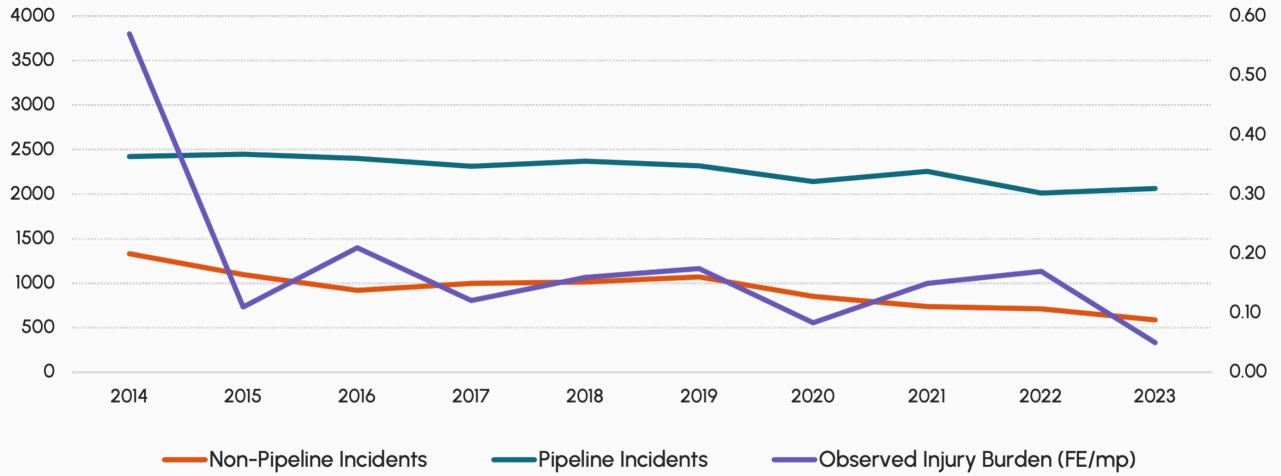


Figure G2: Injuries and Fatalities for Fuels (2014 – 2023)

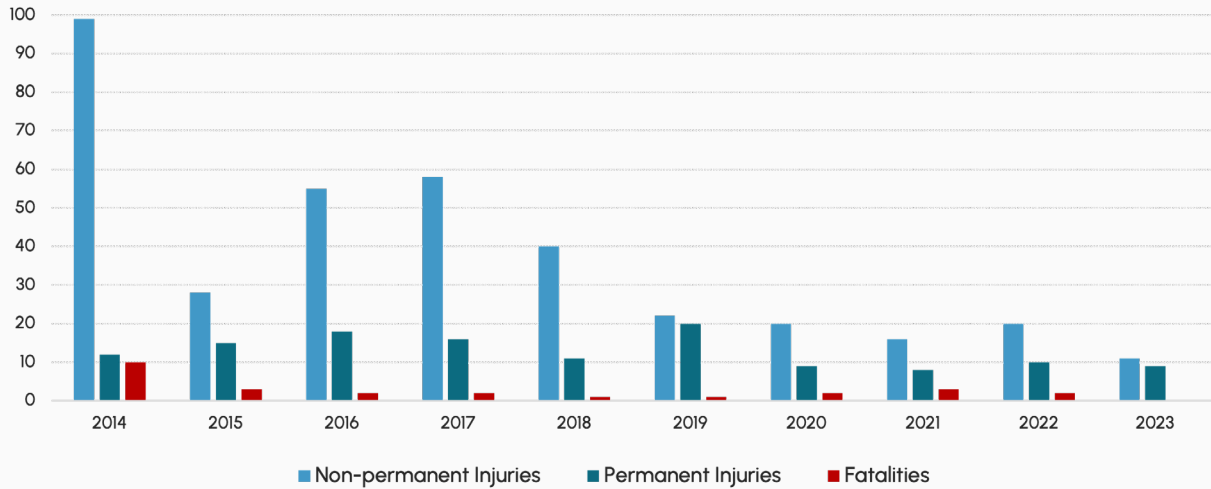


Figure G3: Incidents by Occurrence Type – (2014 – 2023)

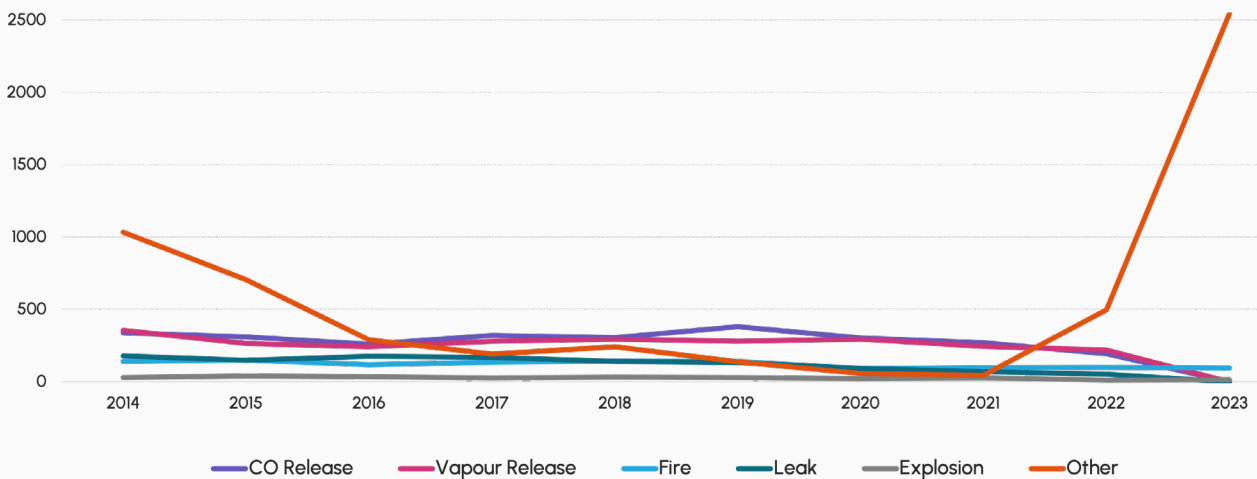
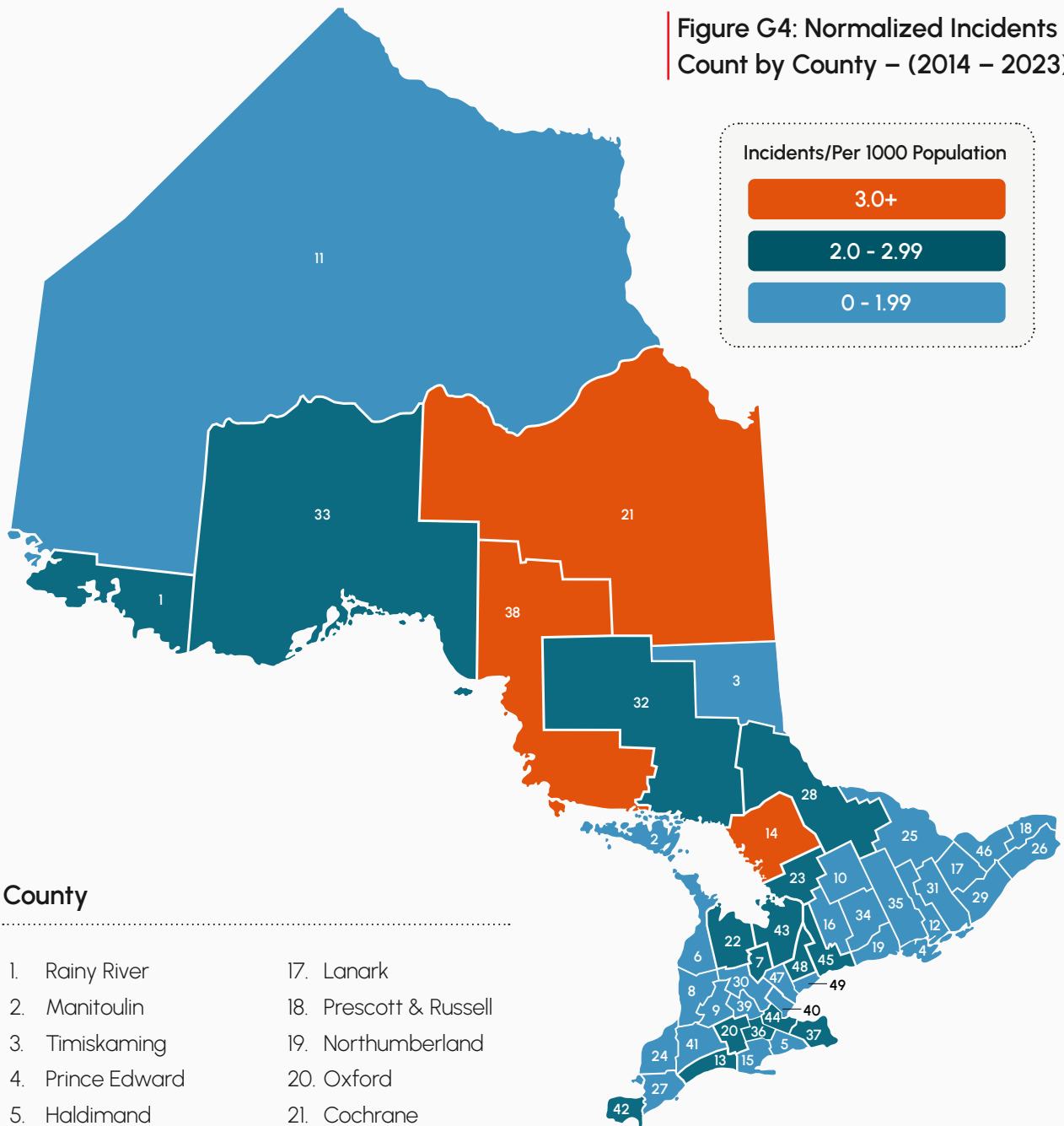


Figure G4: Normalized Incidents Count by County – (2014 – 2023)



County

- | | | | |
|------------------------|----------------------------------|------------------|---------------|
| 1. Rainy River | 17. Lanark | | |
| 2. Manitoulin | 18. Prescott & Russell | | |
| 3. Timiskaming | 19. Northumberland | | |
| 4. Prince Edward | 20. Oxford | | |
| 5. Haldimand | 21. Cochrane | | |
| 6. Bruce | 22. Grey | | |
| 7. Dufferin | 23. Muskoka | | |
| 8. Huron | 24. Lambton | 32. Sudbury | 41. Middlesex |
| 9. Perth | 25. Renfrew | 33. Thunder Bay | 42. Essex |
| 10. Haliburton | 26. Stormont, Dundas & Glengarry | 34. Peterborough | 43. Simcoe |
| 11. Kenora | 27. Chatham-Kent | 35. Hastings | 44. Hamilton |
| 12. Lennox & Addington | 28. Nipissing | 36. Brant | 45. Durham |
| 13. Elgin | 29. Leeds & Grenville | 37. Niagara | 46. Ottawa |
| 14. Parry Sound | 30. Wellington | 38. Algoma | 47. Peel |
| 15. Norfolk | 31. Frontenac | 39. Waterloo | 48. York |
| 16. Kawartha Lakes | | 40. Halton | 49. Toronto |

Pipeline Strikes

A pipeline strike is a reportable pipeline incident (or near-miss) involving damage to a pipeline, or its protective coating, including gouges, scrapes, dents or creases, resulting in, or having the potential to, damage a pipeline, even if there is no release/spillage of products or substances from the pipeline. Even small disturbances to a pipeline's integrity may cause a future leak due to subsequent corrosion. A pipeline strike can also involve the rupture of an underground natural gas pipeline during an excavation that results in the release of natural gas.

Licensed Liquid Fuels Sites

Risk of Sites

TSSA conducts periodic inspections of liquid fuels storage and dispensing facilities at least once every three years to oversee and manage the state of compliance across all licensed sites in Ontario.

Table G4: Number of Licensed Liquid Fuels Sites (2023)

Description	Number
Licensed liquid fuels sites inventory	4,087
Licensed liquid fuels sites that had sufficient inspection history to calculate a risk score	3,289

Figure G5: Inventory Risk Profiles from Outcomes of Periodic Inspections Conducted on Licensed Liquid Fuels Sites (2019 – 2023)

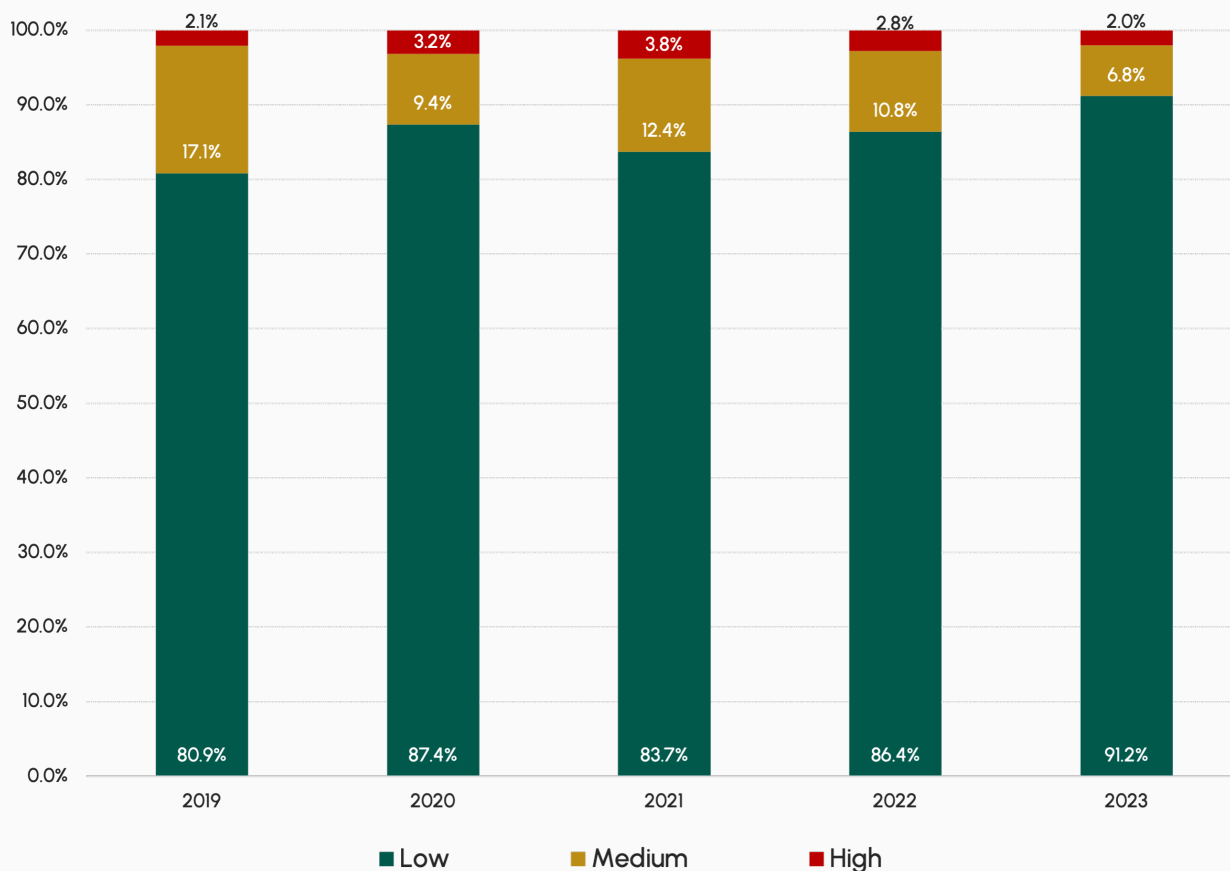


Table G5: Number of High-Risk Licensed Liquid Fuels Sites (2023)

Description	Number	Percentage of Qualified Provincial Inventory
High-Risk Sites	66	2.01%

Table G6: Top High-Risk Licensed Liquid Fuels Site Types (2023)

Site Type	Percentage of Total High-Risk Sites
Gas Stations	87.9%
Marinas	9.1%
Bulk Plants	3.0%

Inspection Results – Compliance Rate

Figure G6: Rates of Periodic Inspections with No Issues Licensed Liquid Fuels Sites (2019 – 2023)

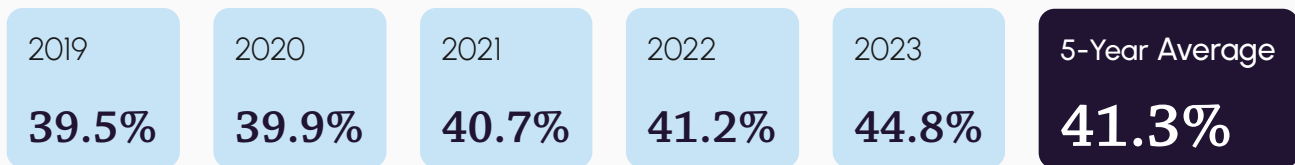
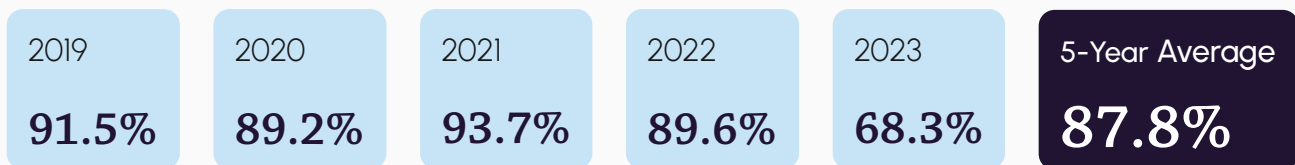


Figure G7: Rates of Periodic Inspections with No High-risk Issues Licensed Liquid Fuels Sites (2019 – 2023)

**Table G7: Top Compliance Issues by Number of Orders Issued during Periodic Inspections on Liquid Fuels Licensed Sites (2019 – 2023)**

Compliance Issue	Percentage of Total Number of Orders Issued
Every retail outlet, marina, private outlet, bulk plant, and highway tank shall be maintained in a safe operating condition by the authorization holder and shall be operated safely	10.23%
Shear valves and leak detection systems shall be maintained and tested at least once per year	9.06%
Provide a written record of the maintenance and testing of the shear valves and leak detection system	3.63%

Table G8: Top Compliance Issues by Risk of Orders issued during Periodic Inspections on Liquid Fuels Licensed Sites (2019 – 2023)

Compliance Issue	Percentage of Total Risk of Orders Issued
Training records of employees with equipment use spill response and emergency response are not kept for the duration of their employment period	18.58%
Leak testing not being performed	5.78%
Every retail outlet, marina, private outlet, bulk plant, and highway tank must be maintained in a safe operating condition by the authorization holder and operated safely	4.58%

Table G9: Top Compliance Issues by Number of High-Risk Orders Issued during Periodic Inspections on Liquid Fuels Licensed Sites (2019 – 2023)

Compliance Issue	Percentage of Total Number of Orders Issued
Training records of employees are not kept for the duration of their employment period.	12.54%
Fire extinguishers not maintained in accordance with the Ontario Fire Code	8.84%
"No smoking" and "Turn ignition off" signage missing	5.08%

Table G10: Top Compliance Issues by Risk of High-Risk Orders during Periodic Inspections on Liquid Fuels Licensed Sites (2019 – 2023)

Compliance Issue	Percentage of Total Risk of Orders Issued
Training records of employees are not kept for the duration of their employment period	25.08%
Leak testing not being performed	7.80%
Not following proper outdoor handling procedures	4.31%

Licensed Propane Sites

Risk of Sites

TSSA conducts periodic inspections of propane facilities to oversee and manage the state of compliance across all licensed sites in the province of Ontario.

Table G11: Number of Licensed Propane Sites (2023)

Description	Number
Licensed propane sites inventory	1,201
Licensed propane sites that had sufficient inspection history to calculate a risk score	966

Figure G8: Inventory risk profiles from outcomes of periodic inspections conducted on licensed propane sites (2019 – 2023)

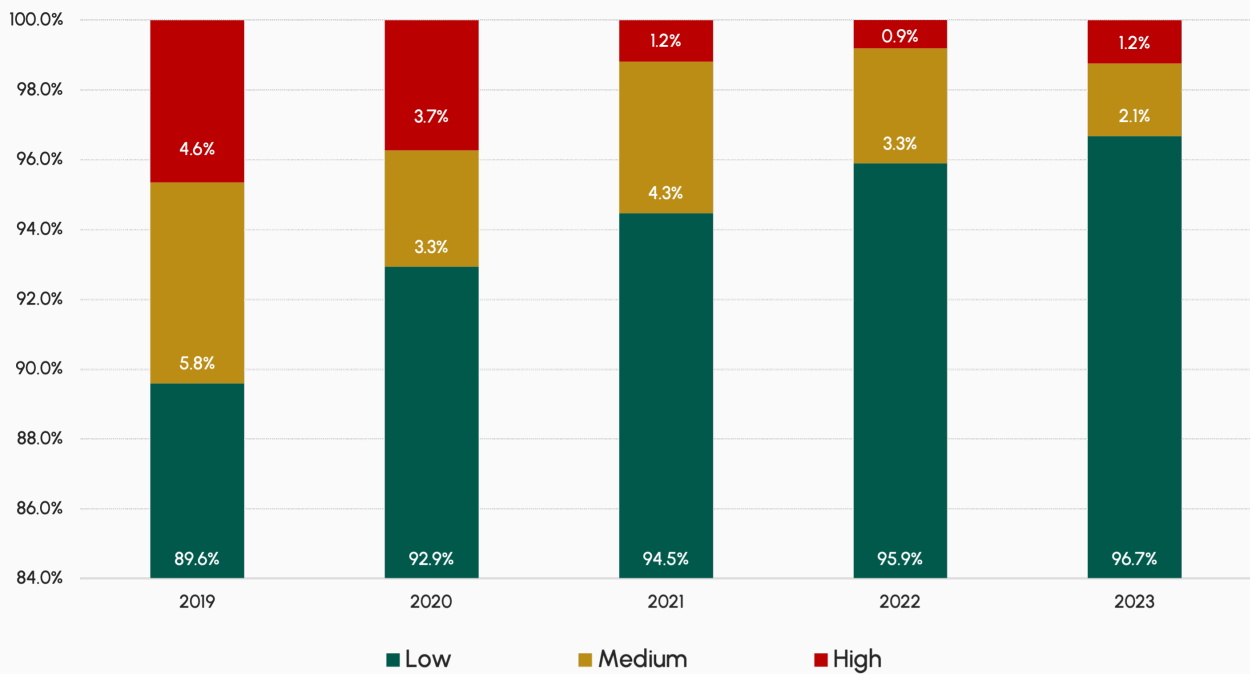


Table G12: Number of High-Risk Licensed Propane Sites (2023)

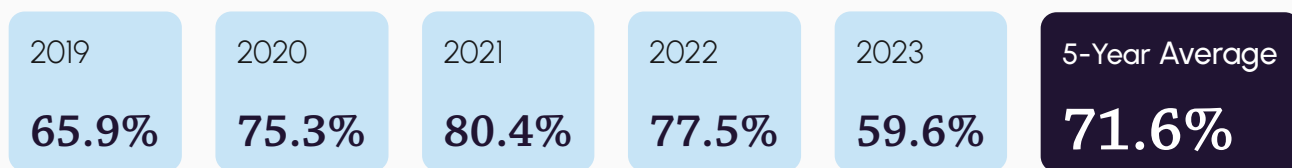
Description	Number	Percentage of Qualified Provincial Inventory
High-Risk Sites	12	1.24%

Table G13: Top High-Risk Licensed Propane Site Types (2023)

Site Type	Percentage of Total High-Risk Sites
Cylinder Refill Centres	58.3%
Unknown	41.7%

Inspection Results – Compliance Rate

**Figure G9: Rate of Periodic Inspections with No Issues
Licensed Propane Sites (2019 – 2023)**



**Figure G10: Rate of Periodic Inspections with No High-risk Issues
Licensed Propane Sites (2019 – 2023)**



Table G14: Top Compliance Issues by Number of Orders Issued during Periodic Inspections on Licensed Propane Sites (2019 – 2023)

Compliance Issue	Percentage of Total Number of Orders Issued
Annual inspections must be conducted by authorized personnel	4.85%
Ensure that the propane tank inspection is conducted by an authorized person and that the inspection record is retained for 10 years	3.52%
Develop and/or maintain operating procedures that are appropriate to the facility	3.23%

Table G15: Top Compliance Issues by Risk of Orders Issued during Periodic Inspections on Licensed Propane Sites (2019 – 2023)

Compliance Issue	Percentage of Total Risk of Orders Issued
Handling propane without a certificate	70.73%
Make sure to install a spring-loaded relief valve that is the right size for your tank	4.37%
Propane cylinders not properly stored	3.23%

Table G16: Top Compliance Issues by Number of High-Risk Orders Issued during Periodic Inspections on Licensed Propane Sites (2019 – 2023)

Compliance Issue	Percentage of Total Number of Orders Issued
Annual inspections must be conducted by authorized personnel	12.17%
No fire extinguisher (portable) is installed/available	6.93%
No proof of training records on employees who are handling propane	4.68%

Table G17: Top Compliance Issues by Risk of High-Risk Orders Issued during Periodic Inspections on Licensed Propane Sites (2019 – 2023)

Compliance Issue	Percentage of Total Risk of Orders Issued
Handling propane without a certificate	71.47%
Make sure to install a spring-loaded relief valve that is the right size for your tank	4.41%
Propane cylinders in storage are not affixed with plugs or caps	3.02%

Heating Contractors

Audit Results

TSSA conducts periodic audits on heating contractors to monitor their safety and risk management practices.

Figure G11: Rate of Periodic Audits with Issues Found Heating Contractors (2019 – 2023)



Table G18: Top Compliance Issues by Number of Orders Issued from Outcomes of Periodic Audits Conducted on Heating contractors (2019 – 2023)

Compliance Issue	Percentage of Total Number of Orders Issued
Develop a program to ensure your employees comply with Ontario regulations	30.12%
Ensure that any appliance you install in a premise where gas will be supplied for the first time is not used until the distributor has examined the installation and confirmed compliance with Ontario Regulations	9.78%
Report any incidents described in Ontario regulations to TSSA and do not interfere with the scene unless an inspector gives permission as required	9.25%

Table G19: Top Compliance Issues by Risk of Orders Issued during Periodic Audits on Heating Contractors (2019 – 2023)

Compliance Issue	Percentage of Total Risk of Orders Issued
Ensure all field vehicles are clearly marked with your business name and registration number	38.28%
Develop a program to ensure your employees comply with Ontario regulations	7.80%
Ensure that any appliance you install in a premise where gas will be supplied for the first time is not used until the distributor has examined the installation and confirmed compliance with Ontario regulations	7.70%

Petroleum Contractors

Audit Results

TSSA conducts periodic audits on petroleum contractors to monitor their safety and risk management practices.

**Figure G13: Rate of Periodic Audits with No Issues
Petroleum Contractors (2019 – 2023)**



Table G20: Top Compliance Issues by Number of Orders Issued from Outcomes of Periodic Audits Conducted on Petroleum Contractors (2019 – 2023)

Compliance Issue	Percentage of Total Number of Orders Issued
Above ground storage tank is not protected from vehicular impact	9.76%
Operators' vehicle should display the certification number and name	7.32%
No notification of unacceptable conditions	7.32%

Table G21: Top Compliance Issues by Risk of Orders Issued from Outcomes of Periodic Audits Conducted on Petroleum Contractors (2019 – 2023)

Compliance Issue	Percentage of Total Risk of Orders Issued
Above ground equipment shall be safeguarded from vehicular impact	13.32%
Ensure personnel comply with the TSS Act	9.99%
Dangerous conditions shall be notified to the equipment owner	9.99%

Table G22: Top Compliance Issues by Number of High-Risk Orders Issued from Outcomes of Periodic Audits Conducted on Petroleum Contractors (2019 – 2023)

Compliance Issue	Percentage of Total Number of Orders Issued
Above ground storage tank is not protected from vehicular impact	12.90%
No notification of unacceptable conditions	9.68%
Ensure personnel comply with the TSS Act	9.68%

Table G23: Top Compliance Issues by Risk of High-Risk Orders Issued from Outcomes of Periodic Audits Conducted on Petroleum Contractors (2019 – 2023)

Compliance Issue	Percentage of Total Risk of Orders Issued
Above ground equipment shall be safeguarded from vehicular impact	14.28%
No notification of unacceptable conditions	10.71%
Ensure personnel comply with the TSS Act	10.71%

Inspection and Re-Inspection Results

Table G24: Fuels Inspection and Re-Inspection Results (2023)

Inspection Type	Pass	Fail	Other	Grand Total	Pass Rate (%)
Ad Hoc/Unscheduled Inspection	281	160	0	441	64%
Alteration Inspection	94	17	0	111	85%
Complaint Inspection	277	1	0	278	100%
Incident Inspection	3,085	0	0	3,085	100%
Initial Inspection	1,632	171	1	1,804	91%
Other Inspection	1,749	1,645	41	3,435	52%
Periodic Inspection	3,023	490	26	3,539	86%
Re-inspection	731	346	4	1,081	68%
Grand Total	10,872	2,830	72	13,774	79%

Legislation and Regulatory Information

Table G25: TSSA Fuels Legislation and Regulatory Information (2023)

Legislation and Regulatory Information	Latest Revision
Oil and Gas Pipeline Systems	
Ontario Regulation 210/01: Oil and Gas Pipeline Systems	2001
Ontario Regulation 210/01: Director's Order	2001
Oil and Gas Pipeline Systems CAD Amendment FS-253-20	2020
Propane Storage and Handling	
Ontario Regulation 211/01: Propane Storage and Handling	2015
Ontario Regulation 197/14: Liability Insurance Requirements for Propane Operators	2016
Propane CAD Amendment FS-254-20	2020
Mobile Food Service Equipment Code TSSA-MFSE-2020	2020
Gaseous Fuels	
Ontario Regulation 212/01: Gaseous Fuels	2015
Ontario Regulation 212/01: Director's Order	2001
Gaseous Fuels CAD Amendment FS-255-21	2021
Mobile Food Service Equipment Code TSSA-MFSE-2020	2020
Field Approval Code TSSA-FA-2020	2020
Digester, Landfill and Bio-Gas Code TSSA-DLB-2020	2020
High-Pressure Piping Code TSSA-HPP-2020	2020
Fuel Oil	
Ontario Regulation 213/01: Fuel Oil	2001
Ontario Regulation 213/01: Director's Order	2001
Fuel Oil CAD Amendment FS-219-16	2016
Fuel Oil CAD Amendment FS-259-21 (this replaces the above FS-219-16)	2021
Compressed Gas	
Ontario Regulation 214/01: Compressed Gas	2007
Compressed Gas CAD Amendment FS-143-09	2009
Liquid Fuels	
Ontario Regulation 217/01: Liquid Fuels	2001
Liquid Fuels CAD Amendment FS-235-18	2019
Minister's Exemption Liquid Fuels Regulation 217/01	2020
Requirements for Contractors	
Ontario Regulation 216/01: Certification of Petroleum Equipment Mechanics	2008
Ontario Regulation 215/01: Fuel Industry Certificates	2019
Amendment to Ontario Regulation 215/01 - CDT Activation (Ontario Regulation 184/03)	2003

The following advisories were issued:

- **2021: Fuel Oil:** FS-247-19 R1: Introduction of TSSA's Fuel Oil Distributor Audit Program; and
- **2023: Fuel Oil:** FS-268-23: Electrical Approval Requirements for Equipment and Installations subject to TSSA Approval
- **2021: Propane:** FS-188-11 R4: Propane Facility Licence Process.
- **2023: Propane:** FS-268-23: Electrical Approval Requirements for Equipment and Installations subject to TSSA Approval.
- **2023: Propane:** FS- 265-23: Renewal; of Level 2 Propane Licenses.
- **2023: Compress Gas:** FS-268-23: Electrical Approval Requirements for Equipment and Installations subject to TSSA Approval
- **2023: Gaseous Fuel:** FS-268-23: Electrical Approval Requirements for Equipment and Installations subject to TSSA Approval
- **2023: Liquid Fuels:** FS-268-23: Electrical Approval Requirements for Equipment and Installations subject to TSSA Approval
- **2023: Oil and Gas Pipeline Systems:** FS-268-23: Electrical Approval Requirements for Equipment and Installations subject to TSSA Approval

During this fiscal year, there were no Fuels Director's Orders, bulletins or guidelines issued. The following advisories were issued:

- FS-256-21: Registration of High-Pressure Piping
- FS-260-22: Illegal Refilling of One-Pound Propane Cylinders Using Adaptor Kits.
- FS-258-21: Approval of Underground Propane Tank Installations

▶ For a comprehensive listing of legislation and regulatory information, see: <https://www.tssa.org/en/fuels/legislation-and-regulatory-information.aspx>



Appendix H: Operating Engineers



TSSA's Operating Engineers Safety Program registers, inspects and regulates plants that power Ontario with electricity, refrigeration, heating and cooling and is also responsible for the examination and certification of operating engineers (also known as power engineers).

In addition, TSSA provides oversight of the management, operation, and maintenance of plants to ensure compliance with the regulation and established safety standards.

Note that numbers may not add up fully or may exceed the 100th percentile due to rounding off.

Incidents, Injuries and Risk Prediction

Table H1: State of Safety Measures for Operating Plants (2014 – 2023)

Description	Fiscal Year										Total	Avg.	5-year Trend
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023			
Incidents	2	2	2	5	5	22	10	2	15	1	66	7	No Trend
Non-Permanent Injuries	0	1	0	0	0	0	0	0	0	0	1	0	No Trend
Permanent Injuries	1	1	1	0	0	0	0	0	0	1	4	0	No Trend
Fatalities	0	0	0	0	0	0	0	0	0	0	0	0	No Trend
Observed Injury Burden (FE/mp)	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N/A	0.002	N/A

Table H2: Risk of Injury or Fatality for Operating Plants (2019 – 2023)

Description	Fiscal Year				
	2019	2020	2021	2022	2023
RIF	0.001	0.001	0.002	0.001	0.001

The TSSA RIF acceptance criterion is 1.00 FE/mpy.

Figure H1: Occurrences and Observed Injury Burden for Operating Plants (2014 – 2023)

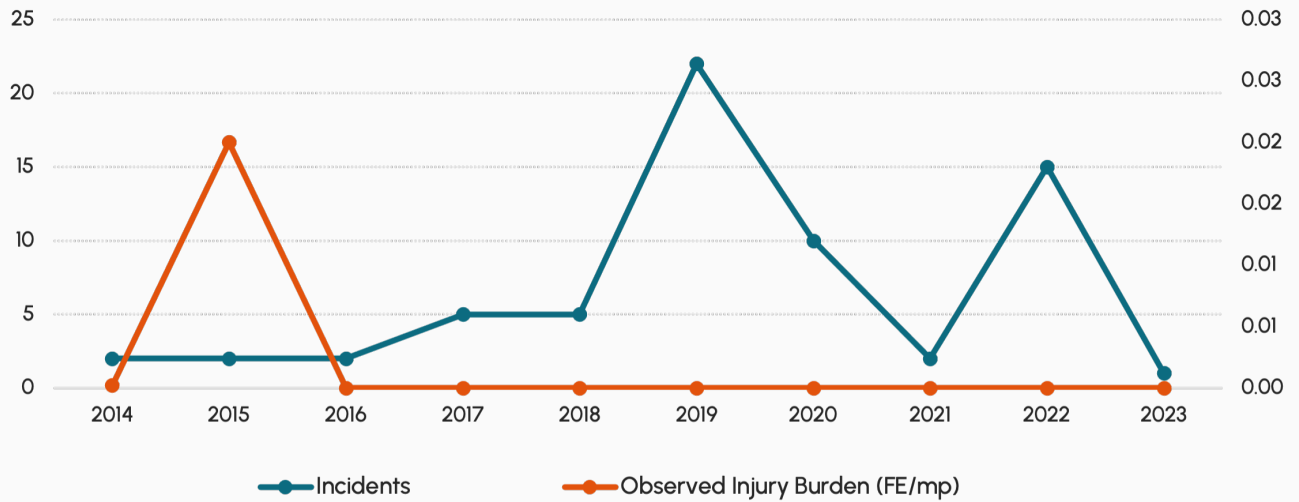


Figure H2: Injuries and Fatalities for Operating Plants (2014 – 2023)

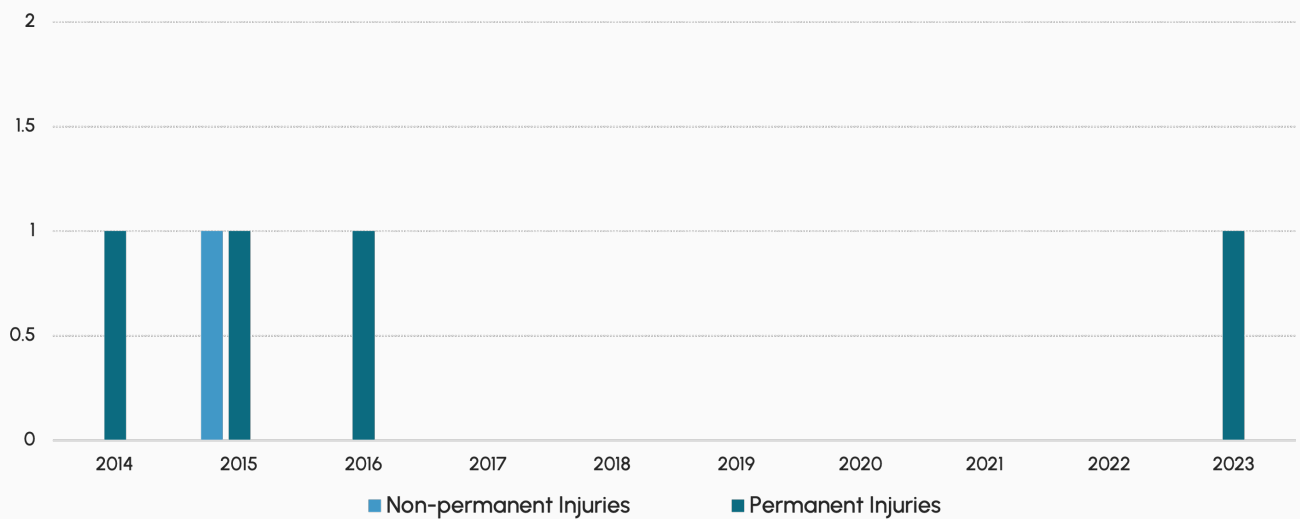


Table H3: Number of Operating Engineers (2023)

Description	Number
Operating engineers	11,409

Table H4: Number of Operating Plants (2023)

Description	Number
Operating plants inventory	2,720
Operating plants that had sufficient inspection history to calculate a risk score	2,676

Figure H4: Inventory Risk Profiles from Outcomes of Periodic Inspections Conducted on Operating Plants (2019 – 2023)

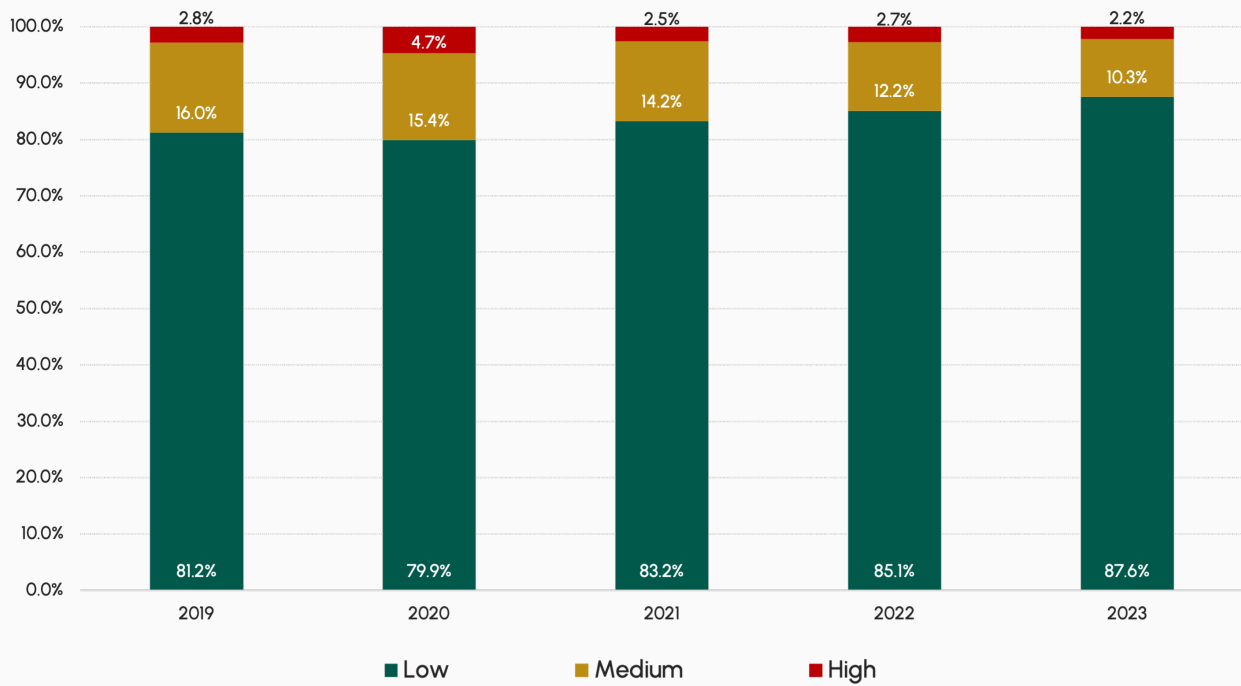


Table H5: Number of High-Risk Operating Plants (2023)

Description	Number	Percentage of Qualified Provincial Inventory
High-Risk Operating Plants	58	2.17%

Table H6: Top High-Risk Plant Types (2023)

Plant Type	Percentage of Total High-Risk Plants
Refrigeration Plant	20.69%
High-Pressure Water tube Low-Water-Volume Power Plant	17.24%
Low Pressure Steam Plant	13.79%

Table H7: Top High-Risk Plant Function Types (2023)

Plant Function Type	Percentage of Total High-Risk Plants
Manufacturing Industries	22.41%
Academic	10.34%
Medical	10.34%

Inspection Results – Compliance Rate

Figure H5: Rate of Periodic Inspections with no Issues
Operating Plants (2019 – 2023)

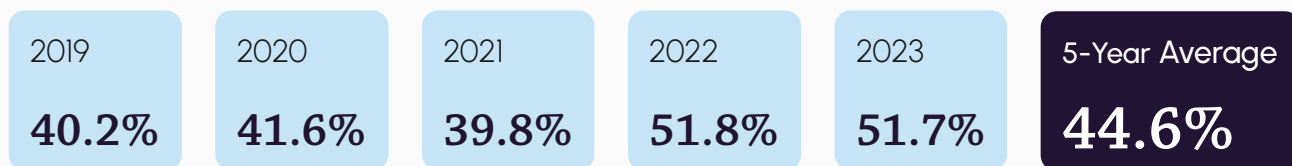


Figure H6: Rates of Periodic Inspections with no High-Risk Issues
Operating Plants (2019 – 2023)

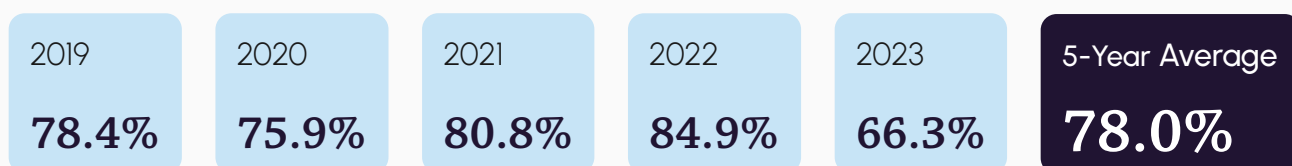


Table H8: Top Compliance Issues by Number of Orders Issued from Outcomes of Periodic Inspections
Conducted on Operating Plants (2019 – 2023)

Compliance Issue	Percentage of Total Number of Orders Issued
Equipment not inspected and posted by an Insurance Company or TSSA	11.65%
Safety concerns not rectified	3.88%
Refrigeration safety limiting devices are not tested, logged and tagged at least once a year	3.82%

Table H9: Top Compliance Issues by Risk of Orders Issued from Outcomes of Periodic Inspections
Conducted on Operating Plants (2019 – 2023)

Compliance Issue	Percentage of Total Risk of Orders Issued
TSSA-registered seals missing	87.05%
Boiler safety valves over 5 years old have not been recertified or replaced	3.43%
Refrigeration plant safety valves over 5 years old have not been maintained or replaced	1.69%

Table H10: Top Compliance Issues by Number of High-Risk Orders Issued from Outcomes of Periodic Inspections Conducted on Operating Plants (2019 – 2023)

Compliance Issue	Percentage of Total Number of Orders Issued
Boiler safety valves over 5yrs old not recertified or replaced	12.06%
Refrigeration plant safety valves over 5 years old not maintained or replaced	11.91%
Safety concerns not rectified	6.90%

Table H11: Top Compliance Issues by Risk of High-Risk Orders Issued from Outcomes of Periodic Inspections Conducted on Operating Plants (2019 – 2023)

Compliance Issue	Percentage of Total Risk of Orders Issued
TSSA-registered seals missing	89.93%
Boiler safety valves over 5yrs old not recertified or replaced	3.54%
Refrigeration plant safety valves over 5 years old not maintained or replaced	1.75%

Inspection and Re-Inspection Results

Table H12: Operating Plants Inspection and Re-Inspection Results (2023)

Inspection Type	Full Compliance	Non-Compliances (any risk)	Other	Grand Total	Pass Rate (%)
Incident Inspection	10	4	0	14	71%
Initial Inspection	156	35	0	191	82%
Non-Mandated/Non-regulated Inspection	2	0	0	2	100%
Other Inspection	3	4	0	7	43%
Periodic Inspection	583	580	17	1,180	50%
Re-inspection	317	51	0	368	86%
Grand Total	1,071	674	17	1,762	61%

Legislation and Regulatory Information

Table H13: TSSA Operating Engineers Legislation and Regulatory Information (2023)

Legislation and Regulatory Information	Latest Revision
Ontario Regulation 219/01: Operating Engineers Regulation	2001
Ontario Regulation 219/01: Director's Order	2003
Minister's Order for Operating Engineers Alternate Rules	2020
Operating Engineers (OE-001-23) registered; unattended ice surfaced plant advisory	2023

During this fiscal year, there were no Operating Engineers Director's Orders, advisories bulletins or guidelines issued.



▶ For a comprehensive listing of legislation and regulatory information, see: <https://www.tssa.org/en/operating-engineers/legislation-and-regulatory-information.aspx>

Appendix I: List of Acronyms

CAD	Code Adoption Document
CO	Carbon Monoxide
DALY	Disability-Adjusted Life Year
FE/mpy	Fatality Equivalent(s)/million people/year (with RIF)
FE/mp	Fatality Equivalent(s)/million people (with OIB)
OIB	Observed Injury Burden
RIF	Risk of Injury or Fatality
TTC	Time to Compliance



Appendix J: Glossary of Terms

<p>Code Adoption Document (CAD)</p>	<p>The default regulatory instrument for mandatory requirements of general application, such as the adoption of codes and standards. This instrument is used to identify and communicate changes to TSSA-specific requirements.</p>
<p>Director's Order</p>	<p>A regulatory decision made by a Statutory Director under the powers given to him/her as per the Act.</p> <p>Director's Order, Limited Use (s. 27)</p> <p>Places limits on the operation of a thing that is found to be defective or to not comply with the conditions of its authorization after the thing is fabricated or installed.</p> <p><i>27. A director may,</i></p> <p><i>(a) establish the limits of operation and use of things that are found to be defective or do not conform with its authorization after fabrication or installation;</i></p> <p><i>(b) permit the operation and use of such thing within such limits as are prescribed, or if there are no such limits, as the director considers safe.</i></p> <p>Director's Order, Public Safety (s. 31)</p> <p>Used only where there is or may be a demonstrable threat to public safety and the subject matter has not otherwise been provided for in the Act or its associated regulations. It can require regulation, use or disuse of specified things.</p> <p><i>31. In cases where there is or may be a demonstrable threat to public safety, a director may make an order with respect to the following matters if they have not otherwise been provided for in this Act, the regulations or a Minister's order:</i></p> <ol style="list-style-type: none"> <i>1. Requiring and establishing the form and location of notices, markings or other forms of identification to be used in conjunction with equipment or other things that are prescribed.</i> <i>2. Regulating, governing and providing for the authorization of the design, fabrication, processing, handling, installation, operation, access, use, repair, maintenance, inspection, location, construction, removing, alteration, service, testing, filling, replacement, blocking, dismantling, destruction, removal from service and transportation of any thing, whether new or used, or a part of a thing and any equipment or attachment used in connection with it.</i>
<p>Disability-Adjusted Life Year (DALY)</p>	<p>A DALY of 1.0 is the loss of one year of healthy life of a single person due to an injury. Please see Appendix L for a full description.</p> <p>Injury Burden</p> <p>Quantified health impact determined by integrating injuries and fatalities observed across the population exposed to TSSA-regulated devices/technologies over a period of time. The DALY metric is used to combine injuries and fatalities into a single metric. The injury burden is expressed in the units of fatality-equivalents per exposed population (in millions) per year. Refer to Appendix L for additional details.</p>

Fatality-Equivalent (FE)	<p>A unit of measure obtained by integrating quantified health impacts into a single count of equivalent fatalities for benchmarking and decision-making purposes. Injury burden and Risk of Injury or Fatality are expressed in terms of Fatality-Equivalents (FEs).</p> <p>Fatality-equivalent/million people/year (FE/mpy) is a unit of measure obtained by integrating quantified health impacts into a single count of equivalent fatalities for benchmarking and decision-making purposes. Refer to Appendix L for additional details.</p>
Fiscal Year	<p>Represents TSSA's fiscal year (May 1 – April 30), e.g., 2023 represents fiscal year 2023 (May 1, 2022 – April 30, 2023)</p>
Health Impact	<p>Refers qualitatively to injuries or fatalities sustained by the public exposed to TSSA-regulated devices/technologies. A health impact could be one of fatal, permanent or non-permanent injuries.</p> <p>Permanent Injury</p> <p>An injury sustained by an individual that partially or totally impairs the normal abilities of that individual for the rest of his/her expected remaining life.</p> <p>Non-Permanent Injury</p> <p>The consequence of an incident occurrence wherein there was an observed health impact that was estimated to be non-permanent based on the nature of the injury and its associated severity using a methodology developed by the World Health Organization (WHO). A non-permanent injury has no significant impact on the individual's life expectancy at the time of injury.</p>
Inspection	<p>An official examination of a device, system or procedure conducted by an inspector under the Act in accordance with Section 17 of the Act.</p>
Inspection Order	<p>The authority to issue an order comes from Section 21 of the Act and is served by an inspector to one who contravenes and/or who corrects a contravention to the Act or its associated regulations. Under this section, an inspector may also seal anything with respect to amusement devices, boilers and pressure vessels, elevating devices, fuels, and operating engineers, as referred to in the regulations. Where there is or may be a demonstrable threat to public safety, whether or not the thing is subject to an authorization, an inspection order includes the specific nature of identified contravention, the conditions and actions to be taken to correct the contravention and the allowable time to comply for each identified contravention.</p> <p>Orders can be classified into high-, medium-, and low-risk categories, which statutory directors can define to suit the needs of their program area. With the exception of Operating Engineers, the classifications are defined below.</p> <p>High-Risk Inspection Order</p> <p>Issued where non-compliance is identified and warrants an inspection order for immediate action within 0 to 14 days, for time to compliance to regulatory requirements.</p> <p>Medium- and Low- Risk Issues – Safety Tasks</p> <p>Issued where noncompliance is identified and warrants an inspection order for action within 90 days, for time to compliance to regulatory requirements.</p>

<p>Occurrence</p>	<p>The realization of a hazard which results in, or has the potential to result in, a consequence to people or property.</p> <p>Incident</p> <p>An occurrence involving a system/device/component/tradesperson under TSSA's jurisdiction, whereby a hazard is exposed resulting in a consequence to people or property.</p> <p>Near-Miss</p> <p>An occurrence involving a system/device/component/tradesperson under TSSA's jurisdiction, whereby a hazard is exposed demonstrating an instance of elevated exposure to risk, while in this particular instance resulting in no consequence to people or property.</p>
<p>Periodic Inspection</p>	<p>An inspection conducted at such intervals as may be determined by the statutory director, risk-based scheduling (where applicable), or required by code or regulation for the purpose of ensuring the safe operation of the device/facility.</p>
<p>Risk</p>	<p>The combination of the probability of occurrence of harm from a thing or a class of things under Section 2 of the Act and the severity of that harm.</p>
<p>Risk of Injury or Fatality (RIF)</p>	<p>The injury burden predicted using a simulation model to combine the probability of occurrence of harm (estimated as occurrence rates) to someone interacting or exposed to TSSA-regulated devices/equipment/technologies and severity of that harm. The Risk of Injury or Fatality (RIF) metric is expressed in fatality-equivalents per exposed population (expressed in millions) per year (FE/mpy).</p> <p>This measure of risk accounts for historical occurrences while taking into consideration the uncertainties and variability inherent in the involved parameters such as the occurrence rate, number of victims, age of each victim and types of injuries sustained. Refer to Appendix L for additional details.</p>
<p>Time to Compliance (TTC)</p>	<p>The time required for a client to have the work completed as specified in a TSSA inspector's order due to a deficiency found during an inspection. Also known as time to comply.</p>
<p>Trend</p>	<p>A statistically representative measure for the noticeable tendency or movement toward, or in, a particular direction over a measured period of time (e.g. positive trend, negative trend and no significant quarterly trend).</p>

Appendix K: Outcome-Based Regulator

Introduction

TSSA statutory directors have general supervisory and administrative responsibility of the Act and its associated regulations to ensure the safety of Ontarians.

Outcome-Based Regulator

TSSA takes a risk-informed approach to safety oversight. The organization's focus is on safety outcomes – and its goal is to use its expertise and strong partnerships to achieve positive safety outcomes for the people of Ontario. TSSA uses data to understand risk, shape the safety oversight framework and develop programs to better target risk and harm reduction and enable compliance. This is what TSSA means by being a modern, Outcome-Based Regulator.



Appendix L: Metrics

Disability-Adjusted Life Year (DALY)

The Risk of Injury or Fatality (RIF) metric is determined using the Disability-Adjusted Life Year (DALY) metric. The DALY is a universal health impact metric, introduced by the World Health Organization as a single measure to quantify the burden of diseases and injuries. The DALY can be thought of as equivalent years of "healthy" life lost by virtue of being in states of poor health or disability and/or due to premature fatality.

A DALY of 1.0 is the loss of one year of healthy life of a single person due to an injury. For example, a DALY of 28.1 means that 28.1 years of "healthy" life were lost due to injuries arising from all the sectors that TSSA regulates.

The expected health impact for a fatality is calculated based on the standard life expectancy at age of death in years and is based on age and sex (e.g., fatality of a male child aged 5 would translate to 70 DALY assuming an average life expectancy of 75 years). The expected health impact for an injury is calculated by multiplying the average duration of the injury by a weight factor that reflects the severity of the injury on a scale from 0 (being in perfect health) to 1 (being fatal).

Health loss is characterized by three dominant aspects of public health:

- Quality of life;
- Quantity of life; and
- Social magnitude.

The quality of life is measured by duration of injury and life expectancy of a victim. The quantity of life lost is expressed through disability weights, and the social magnitude is characterized by the number of people affected.

The expected health impact in units of DALY can be calculated by the following equation:

$$(\text{Short-term Weight} * \text{Short-term Duration}) + (\text{Fraction Long-term}) * (\text{Long-term Weight} * \text{Long-term Duration})$$

There are four injury types categorized in the TSSA database:

- i. Fatality;
- ii. Permanent injury;
- iii. Non-permanent injury; and
- iv. No injury.

The permanent and non-permanent injuries are further characterized by 28 specific types of injury descriptions. In the above equation, disability weights, fraction long-term and short-term durations, associated with the various injury descriptions, have been adopted and/or modified from the Australian Burden of Disease and Injury Study³. The long-term duration is the expected life expectancy at the time of injury and is applicable in the case of a permanent injury.

Consider the following hypothetical example to better understand the evaluation of expected health impact. Assume a male victim sustains a spinal injury at the age of 30 years due to the malfunctioning of a regulated technology. Using the cohort life expectancy of 48.1 years for males aged 25 to 34, the equivalent healthy years lost due to the spinal injury can be calculated as 21.31 DALYs by using the above equation. In this calculation, the short-term weight of 0 and duration of 0 years were used respectively, and the fraction long-term and long-term duration parameters were taken to be 1 and 0.443 respectively.

³Begg S, Vos T, Barker B, Stevenson C, Stanley L and Lopez A. "The burden of disease and injury in Australia." (2003). Cat. No. PHE 82. Canberra: AIHW 2007.

Injury Burden

The observed health impact is quantified based on each victim's age and injury type in denominations of DALY and is then scaled by the time period under study, the median life expectancy and the exposed population to determine the injury burden in units of fatality-equivalents per exposed population per year. Note that the scaling factors are dynamic and subject to change year-over-year or once every five years during a nation-wide census update.

This edition of the **Public Safety Report** includes the observed injury burden expressed using actual DALYs, as well as the risk of injury or fatality. The former reflects the health impact experienced in a given year, while the latter is a prediction of the injury burden expected in the future based on historical data.

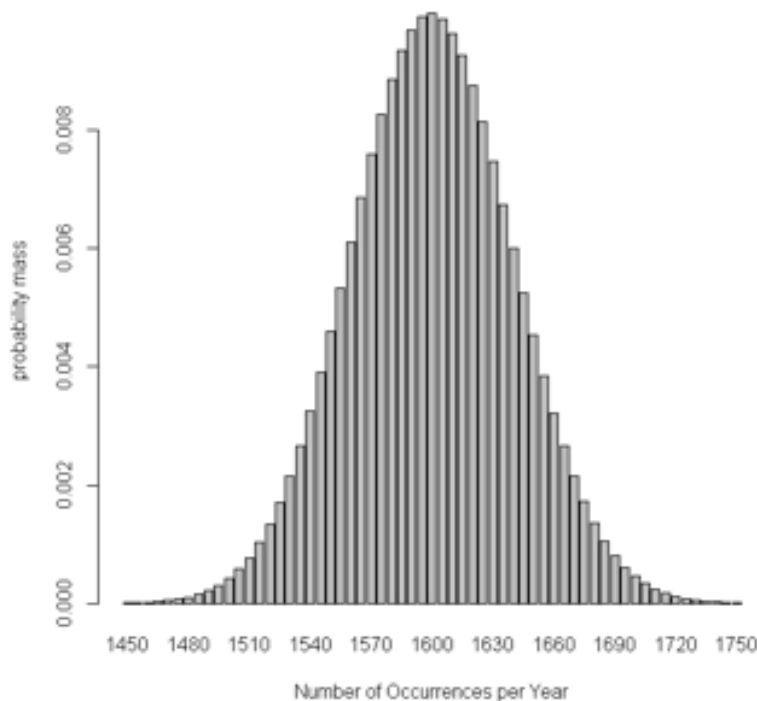
Risk of Injury or Fatality

The Risk of Injury or Fatality (RIF) approach determines predicted injury burden by accounting for historical occurrences while taking into consideration the uncertainties and variability inherent in the involved parameters and predicts the future state of safety in terms of fatality-equivalents per exposed population per year. The rationale behind this approach is that there is a potential for some of the occurrences without health impacts to manifest themselves as incidents with injuries and fatalities in the future. A simulation approach is used to conduct the predictions based on actual observations. Parametric uncertainties are taken as probability distributions which are then input into the prediction model:

- a. One major uncertainty is in the actual number of occurrences. This attribute is subject to reporting bias which means that an unknown fraction of incidents goes unreported to TSSA. The randomness is assumed to follow a Poisson distribution⁴ with the observed occurrence rate as the input parameter.

Figure M1 illustrates the breadth of uncertainty in the occurrence rate when, for example, 1,600 occurrences a year are observed on average.

Figure M1: Probability Mass Distribution of the Occurrence Rate (Example)

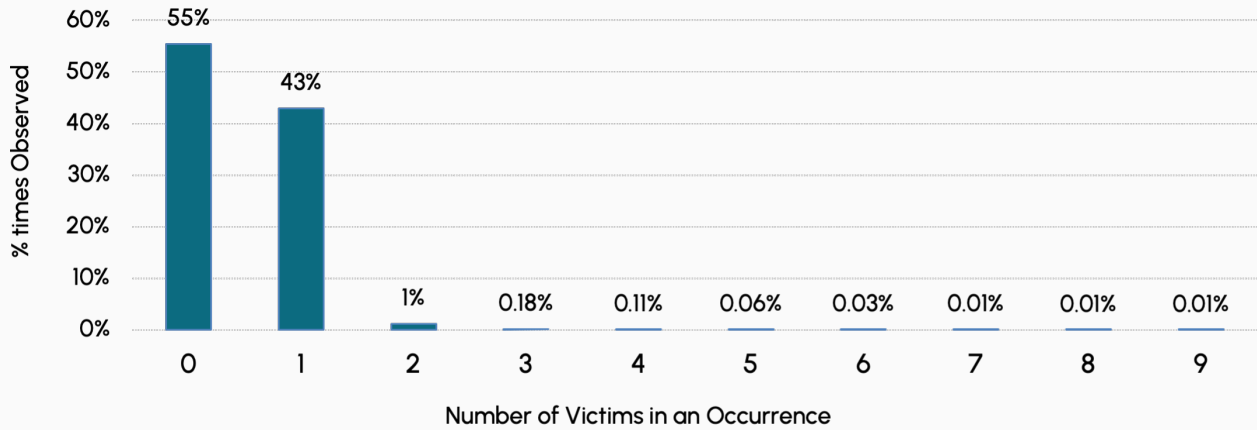


⁴ https://en.wikipedia.org/wiki/Poisson_distribution

b. The number of victims involved in an occurrence is assumed to be a discrete empirical probability distribution constructed from historical observations. This scheme ensures that extreme tail events are assigned a minimal probability, instead of assuming that they are equally likely compared to the most representative estimate.

Figure M2 illustrates the victim count distribution for a typical composite TSSA State of Safety prediction. The example shows that there are no victims involved in 55% of the cases, one victim involved in 43% of the occurrences and as high as nine victims in less than 0.01% of the occurrences.

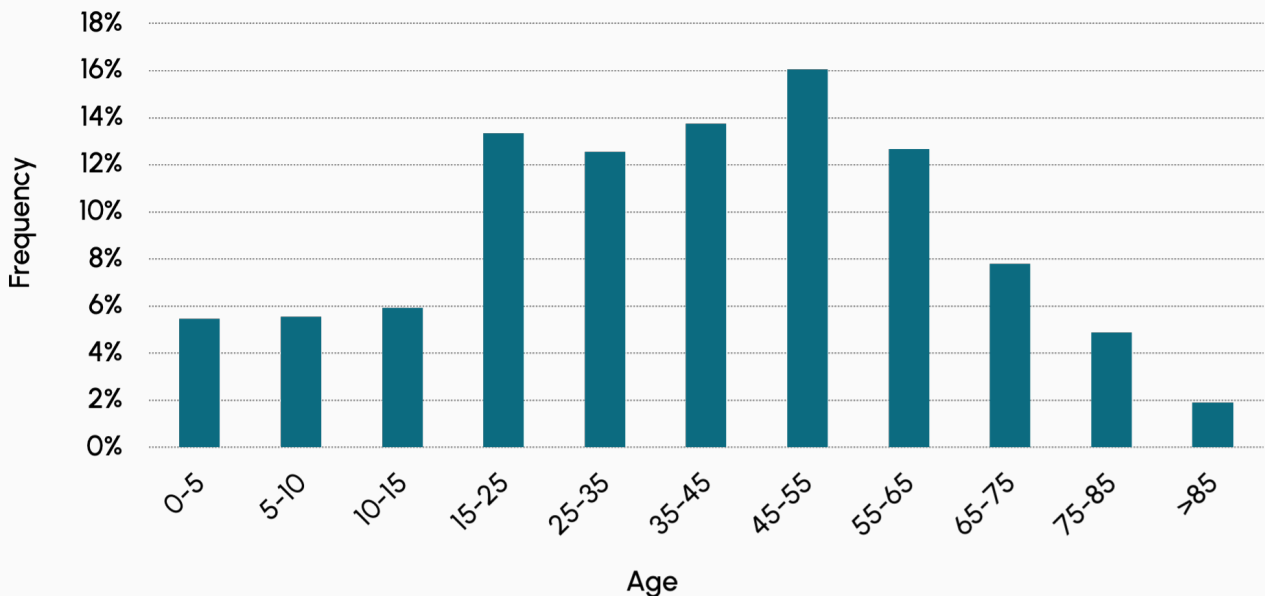
Figure M2: Frequency of the Number of Victims in an Occurrence (Example)



c. The age of a victim is also uncertain, and the range is between that of being an infant and an elderly person. It is sampled from an age-based population census estimate from Statistics Canada.

Ontarians aged 15 – 65 constitute about 70% of the population as seen in Figure M3 and are more likely to be victims of an occurrence than otherwise.

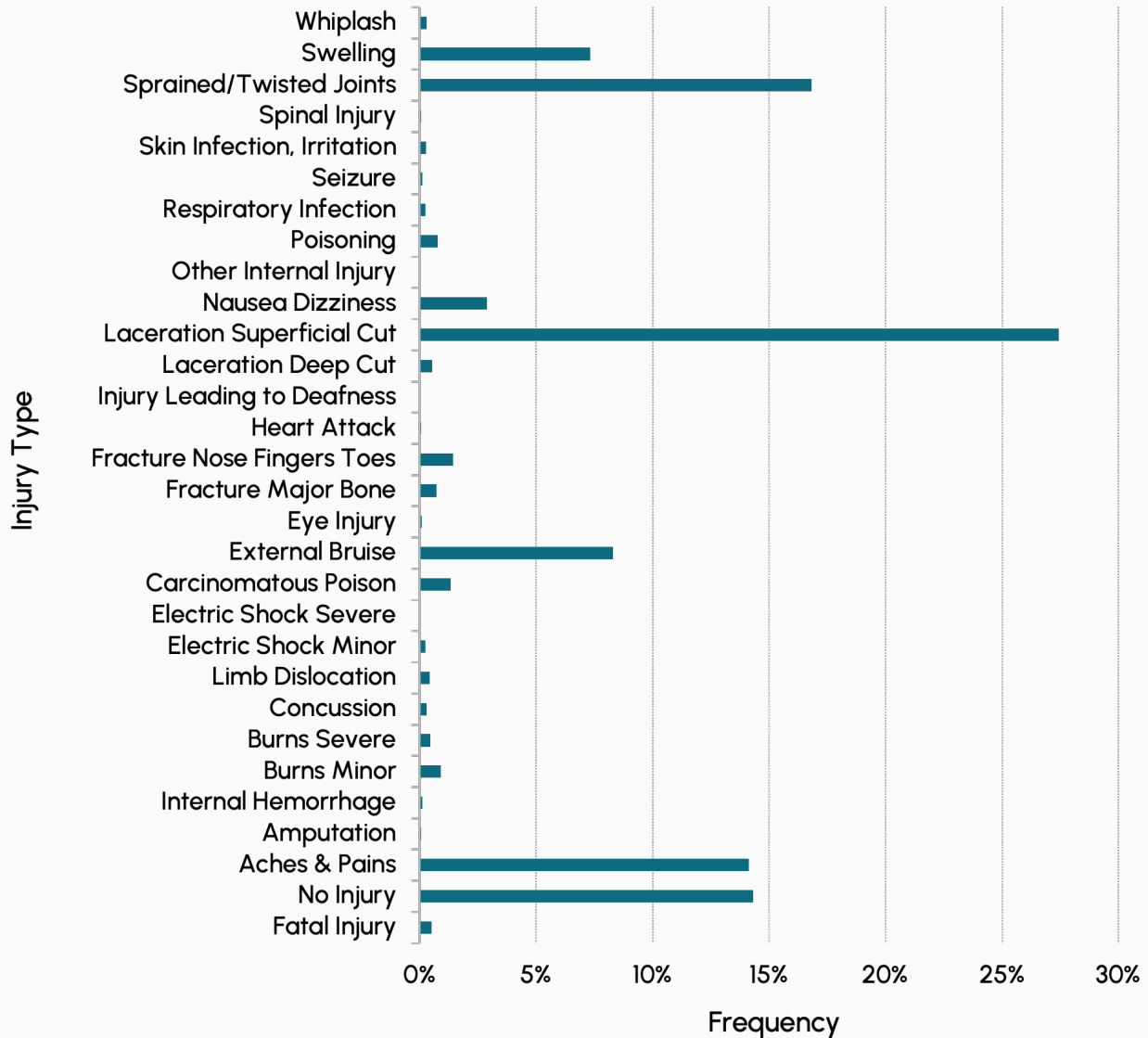
Figure M3: Age Distribution for Predicted Risk Simulation (Example)



d. The number and type of injuries is sampled from a distribution constructed out of observations. This distribution is dependent on the program and the specific occurrence type under consideration.

An injured victim is likely to sustain superficial cuts, sprains, aches and pains or no injury at all more often than a fatal injury as seen in Figure M4. The distribution is for illustrative purposes only and varies depending on the regulated sector under study.

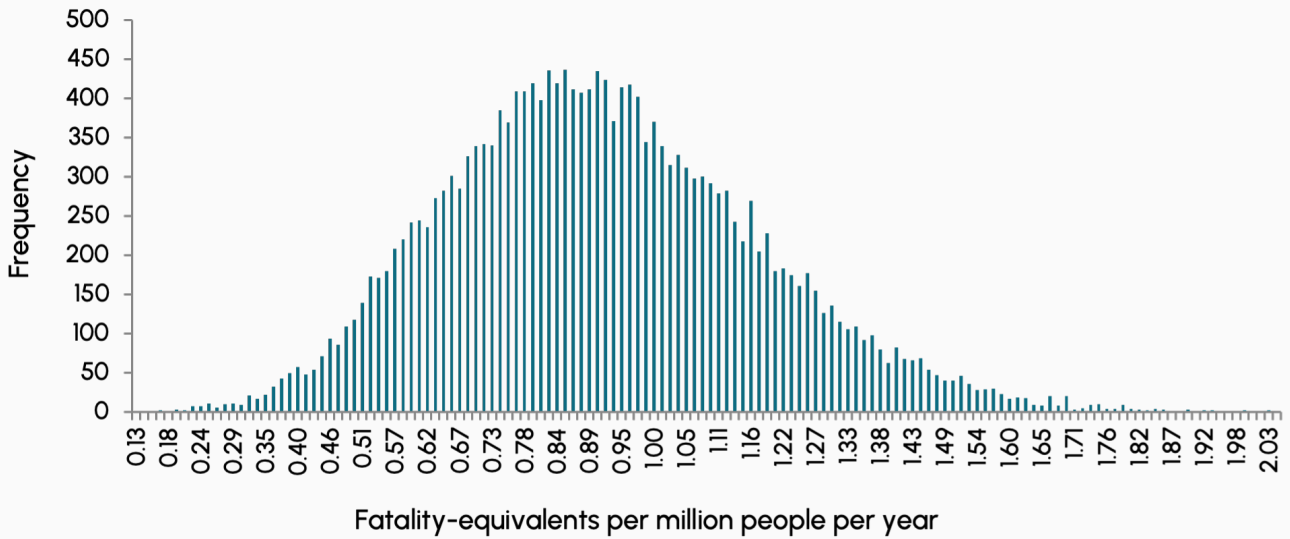
Figure M4: Injury Distribution for the Composite Risk of Injury or Fatality (Example)



In fiscal year 2019, the calculation was updated to improve accuracy and reduce numerical instabilities. In particular, the victim and number of injury distributions now rely on empirical distributions rather than uniform distributions.

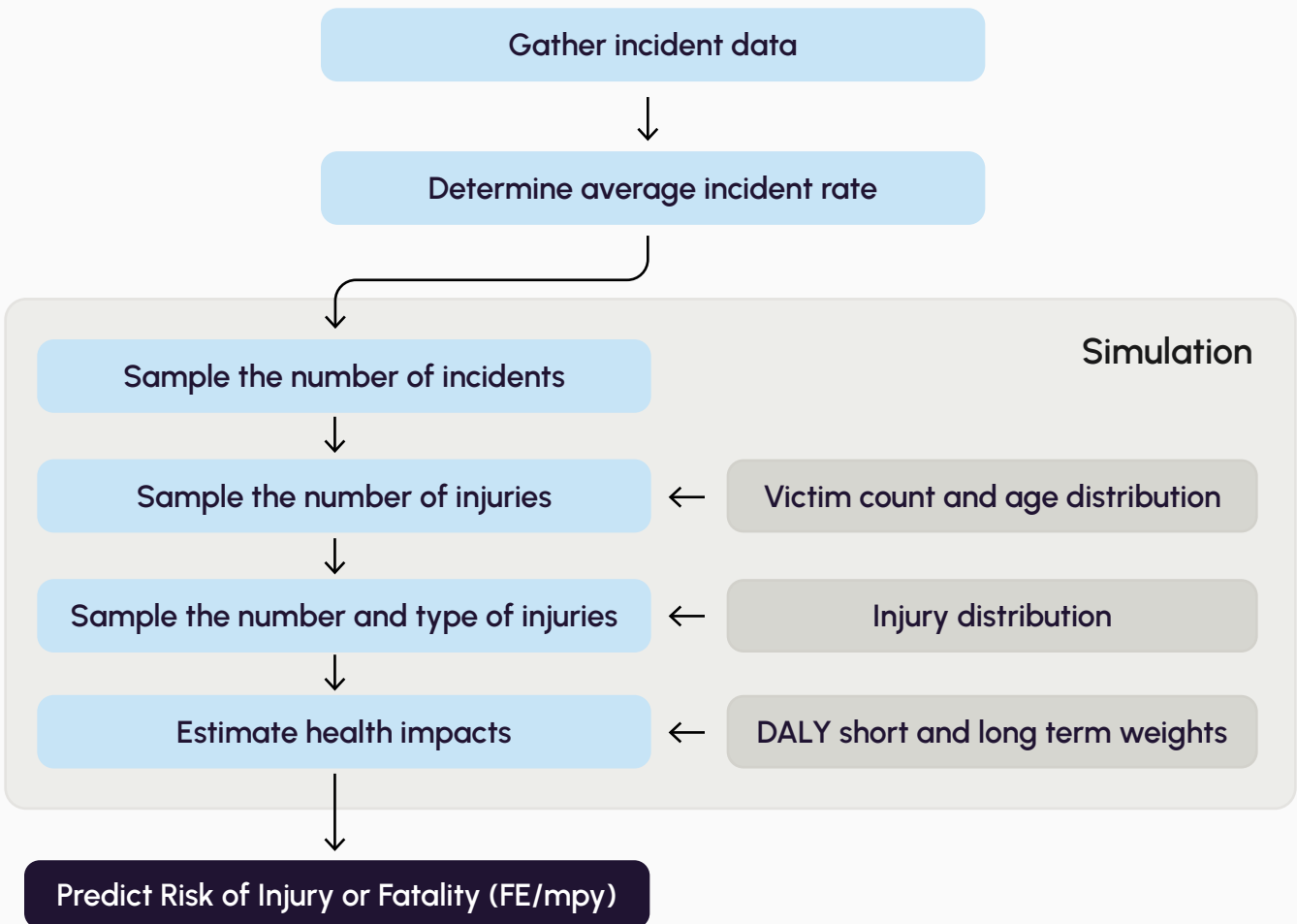
The end result of a risk simulation is a frequency distribution of predicted health impacts as exemplified in Figure M5. The mean value is used for reporting purposes in the report. In Figure M5, the respective estimate is 0.91 fatality-equivalents/million/year. Note that the risk of injury or fatality is expected to be somewhat larger than the corresponding observed risk. This is a result of the model design to consider near-misses as potential incidents and to ensure that a larger set of uncertainties are incorporated into the model that are not exhaustively captured in the actual observations.

Figure M5: Risk of Injury or Fatality Distribution (Example)



The procedure followed to determine the anticipated health impacts is shown in Figure M6.

Figure M6: Flowchart to Predict Future Health Impacts



Statistical Methods

The statistical analysis of the time-series data in this report includes data analysis and trend tests.

When presenting data, it is often desirable to know whether the measured indicator is increasing or decreasing over time. While time-series plots tempt the reader to make visual assumptions on the behaviour of variables over time, trend tests allow for rigorous statistical hypotheses testing. This has three additional advantages over graphical data analysis:

- It ensures a systematic, consistent method of data analysis;
- It yields a measure of the increase or decrease over time; and
- It presents a measure of the strength of the evidence (the p-value).

The current format of the **Public Safety Report** does not include the p-value explicitly, but it is used as a step in the trend analysis.

The Mann-Kendall test⁵ is a non-parametric trend test and does not require any assumption of normality or canonical distributions in the data. This test is robust and allows missing data to be present in the analysis.

The trend analysis presented in this report considers the predominantly seasonal nature of the operation of devices (i.e., amusement devices and ski lifts). The trend analysis confirms and takes into account seasonality while establishing historical patterns of safety and compliance performance.

There are many instances where seasonality is the source of variation in the response variable. As such, this report uses Kruskal-Wallis⁶ statistics for testing seasonality in the time series, which was done using Python's `pymannkendall` 1.4.2 package⁷. The assertions of any of these tests are made with 95% confidence and if evidence is found for seasonality, then the Seasonal Mann-Kendall trend test is used instead of the Mann-Kendall test.

Assumptions and Sources of Uncertainty

The analysis of compliance trends is provided over a rolling five-year period, which aligns with TSSA's Strategic Planning process. This approach allows for appropriate measurement and reporting on the effectiveness of these strategies. Trend analysis on incidents and near-miss occurrences is based on an indefinite period, limited by the nature and quality of information available in TSSA's database. This will help in better understanding the changing risk profile over extended periods of time.

In producing this report, TSSA's Public Safety Risk Management (PSRM) team of the Strategic Analytics department has made every effort to ensure a high level of quality control over its calculations and methodologies. To this effect, TSSA takes every precaution to ensure the accuracy and quality of data presented in the **Public Safety Report**. Intrinsically, PSRM developed a Quality Management System in 2012 to ensure accurate presentation of public safety information. Occasionally, it is necessary to make restatements to results reported in previous years, typically a result of timeframe factors, such as information received subsequently to the issuance of the report, localized reporting lags for periodic data, investigations completed, and other issues.

Analysis involving reported and inspected incidents and near-miss occurrences may be impacted by reporting biases. Due to the varied nature of reporting across the different regulated sectors, TSSA is currently unable to quantify the level of reporting bias and is therefore not currently in a position to account for this uncertainty.

Some figures were created using numbers that have been rounded off for ease of display and as such some totals may not add up fully or may exceed the 100th percentile.

⁵ https://en.wikipedia.org/wiki/Trend_analysis

⁶ https://en.wikipedia.org/wiki/Kruskal%E2%80%93Wallis_one-way_analysis_of_variance

⁷ `pyMannKendall`: a python package for non parametric Mann Kendall family of trend tests. <https://pypi.org/project/pymannkendall/>

The average rate of injury and the observed injury burden figures are assumed on a fixed Ontario population size of 15,500,632⁸ in the calculation, resulting in some degree of uncertainty. However, it is not considered to be significant.

Occasionally, data records can be misclassified. For example, an amusement device occurrence might be mistakenly entered into the database as an elevating device occurrence. This would not affect the overall RIF calculation, but would be filtered out for the program RIF calculation. Misclassified data such as this would be followed up with the relevant program so the data can be corrected for future editions of the **Public Safety Report**. In addition, data records may have missing or inaccurate information, such as a victim's age being unknown in an occurrence report. When a victim's age is unknown, the risk software assumes an average age. If age information is later found to be inaccurate, then this would again be followed up with the relevant program to modify the database, so it could be corrected for future editions of the **Public Safety Report**. Assumptions can also be made while entering data. For example, a decision will need to be made on whether an injury should be described as a "minor" or a "severe" burn, which requires some degree of interpretation. TSSA makes every effort to minimize these sources of uncertainty and makes corrections, if applicable, when they are discovered.

This report contains occurrences that were reported and had their investigations completed, and had their data entered into TSSA's information system. It does not include ongoing inspections or investigations. Accordingly, this may result in a slight underreporting in some numbers.

⁸ The population of Ontario in Q1 2021 was 15,500,632 per Statistics Canada (ref: <https://www150.statcan.gc.ca/t1/tbl/en/tv.action?pid=1710000901>).



www.tssa.org