

# DATA TABLES

TSSA PUBLIC SAFETY REPORT 2021



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

Table A1: Cross-Program State of Safety Measures (2012 – 2021)

DESCRIPTION	FISCAL YEAR										TOTAL	AVERAGE	TREND (ANNUAL)
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021			
Incidents and Near Miss Occurrences	4,592	4,922	5,459	5,332	5,577	5,042	5,607	6,266	6,006	4,052	52,855	5,286	No Trend
Non-Permanent Injuries	913	950	1,246	1,167	1,595	1,079	1,354	1,819	1,899	415	12,437	1,244	No Trend
Permanent Injuries	32	35	51	56	80	68	41	59	46	13	481	48	No Trend
Fatalities	4	5	10	5	1	4	2	2	3	4	40	4	No Trend
Observed Injury Burden (FE/mpy)	0.32	0.59	0.65	0.39	0.28	0.40	0.32	0.36	0.40	0.26	N/A	0.40	N/A

Data presented here and throughout represents an extract from TSSA records as of May 1, 2021. In some cases, older records have been updated via data cleansing or new information and thus historical records may not match previous editions of the report.

Table A2: Cross-Program Risk of Injury or Fatality (2017 – 2021)

DESCRIPTION	FISCAL YEAR				
	2017	2018	2019	2020	2021
RIF, Old Calculation (FE/mpy)	0.83	0.99	0.94	0.93	0.95
RIF, New Calculation (FE/mpy)	N/A	N/A	0.44	0.39	0.40

The TSSA high-risk threshold is 1.00 FE/mpy.



Figure A1: Occurrences and Observed Injury Burden for Regulated Program Areas (2012 – 2021)

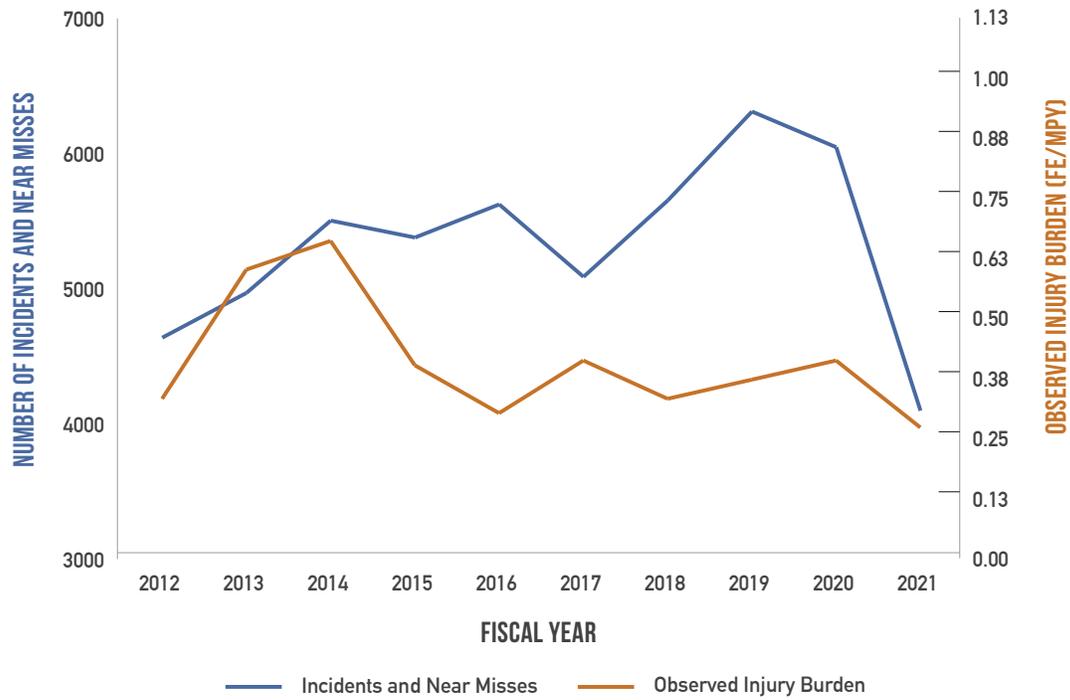


Figure A2: Injuries and Fatalities for Regulated Program Areas (2012 – 2021)



## Identifying Risks – Risk of Injury or Fatality (RIF) Approach

TSSA uses a risk-informed approach to identify the top areas of risk in each of its regulated program areas. The state of safety is described using a risk metric, known as the risk of injury or fatality (RIF). The RIF is measured in terms of fatality equivalents per million people per year (FE/mpy). This measure helps compare against international<sup>1</sup> risk acceptability criteria benchmarks and set internal thresholds for decision-making.

Introduced in 2012, the RIF calculation has provided TSSA a way of measuring risk (probability x impact), particularly where injuries may not have fully manifested themselves (e.g., near misses, “luck” and other random characteristics). As detailed in [Appendix M<sup>2</sup>](#), the RIF relies on historical data (i.e., reported occurrences and injuries over the last 10 fiscal years) to determine the potential risks that could be observed by certain populations of interest (typically the Ontario population as a whole) when exposed to TSSA-regulated technologies and devices. The approach relies on the use of predictive analytics and multiple simulations. For reporting and decision-making purposes, the 50<sup>th</sup> percentile value of the simulations is used to avoid overestimating or underestimating risks.

Specifically, TSSA uses a criterion of 1.00 FE/mpy for evaluating risk to the general population of Ontario and a criterion of 0.30 FE/mpy for evaluating risks to sensitive sub-populations<sup>3</sup>.

## Changes to the RIF Calculation

In 2019, TSSA changed the method of calculating the RIF after noticing the following weaknesses in the calculation:

1. It overestimated the risk significantly when compared to the observed injury burden (the actual number of injuries and fatalities that have occurred in the past).
2. Within some defined parameters, it was numerically unstable and sometimes saw big swings.
3. It didn't fully account for the nature of the incidents (e.g., some occurrence types have a high injury burden while others do not).

TSSA's new RIF calculation employs the same logic as the previous calculation, but with certain adjustments to the formula. While the result is a more stable and reliable metric, it also significantly lowers the estimated risk.

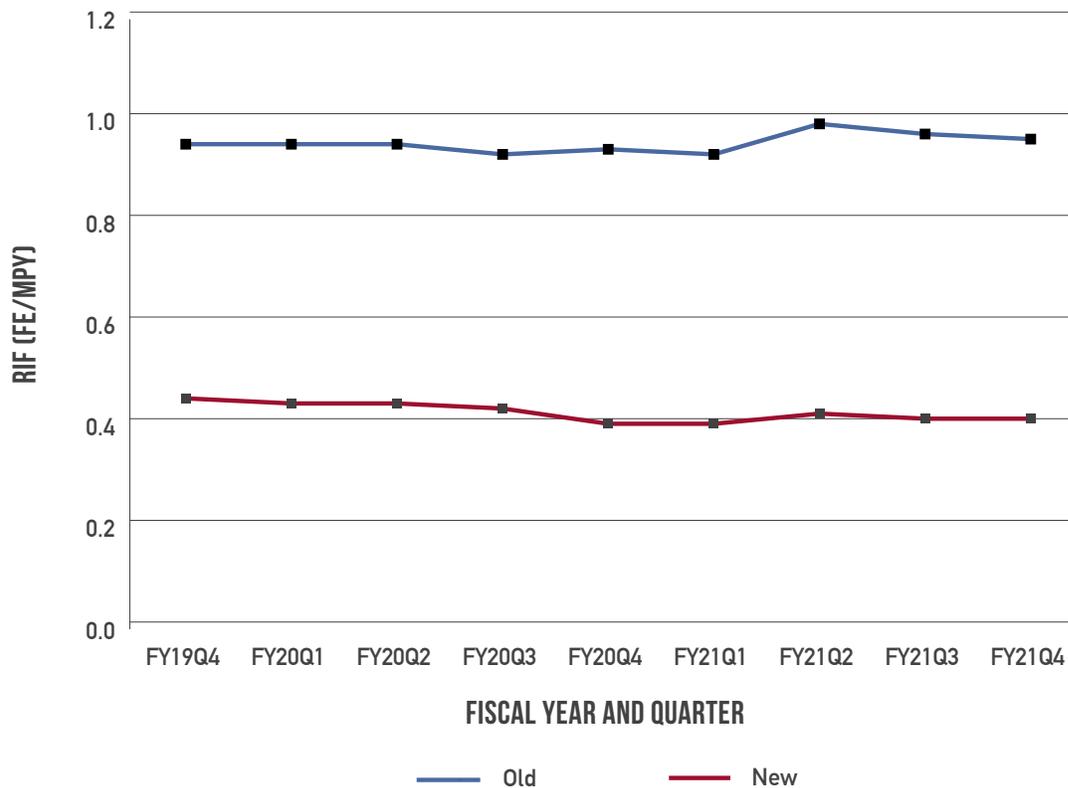
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<sup>1</sup> Health and Safety Executive. “ALARP ‘at a glance’.” Retrieved May 1, 2015 from <http://www.hse.gov.uk/risk/theory/alarpglance.htm>.  
US Centers for Disease Control (CDC), The National Institute for Occupational Safety and Health (NIOSH), Hierarchy of Controls. Retrieved on April 12, 2017 from <https://www.cdc.gov/niosh/topics/hierarchy/default.html>.  
PSM Division, CSChE. Major Industrial Accidents Council of Canada (MIACC) Criteria for land-use planning (2008).

<sup>2</sup> [Appendix M](#) is found in Technical Appendices report.

<sup>3</sup> PPSM Division, CSChE. Major Industrial Accidents Council of Canada (MIACC) Criteria for land-use planning (2008).  
Vatn J. “A discussion of the acceptable risk problem.” Reliability Engineering & System Safety 61 (1998): 11-19.  
Aven T. “Reliability & Risk Analysis.” North Holland, 1992.  
Health and Safety Executive. “ALARP ‘at a glance’.” Retrieved May 1, 2015 from <http://www.hse.gov.uk/risk/theory/alarpglance.htm>.

Figure A3: Trend of RIF Values for All Programs Combined for Fiscal Years 2019 – 2021



### Further Examination of RIF Calculation Accuracy

Furthermore, it is important to note that the results of the new RIF calculation have changed the picture on the areas of concern. While the new RIF calculation moves some former areas of concern under the critical risk threshold, the public safety concerns that rank highest in the sectors TSSA regulates remain legitimate safety concerns. Across all TSSA sectors, the organization is looking to identify and target anything that represents a high risk, even if the total number of high-risk devices and facilities are low.

In addition to TSSA’s risk model and the safety data the organization has, TSSA is equally interested in the information and data the organization doesn’t have. This lack of data can result from a number of factors including poor incident reporting to illegal activity. Continuing to improve TSSA’s data collection methods and risk scores presents an opportunity to more fully reflect the safety risks in Ontario.

TSSA will continue on its journey of continuous improvement in the months ahead – leveraging the insights provided by the technical and regulatory experts involved in TSSA’s FY20 peer engagement group – to review and enhance the organization’s risk model and assess whether additional modifications would improve the clarity and quality of TSSA’s report on the state of public safety in Ontario.

## Comparison of RIFs for 2020 Areas of Concern

In fiscal year 2019, TSSA began using the new risk calculation. However, since the new risk values were much lower than those determined using the old calculation, TSSA blended the old and new RIF values into a composite risk score.

When determining composite blended risk scores for fiscal year 2020, TSSA increased the percentage of the new RIF and decreased the percentage of the old RIF (this gradual change in values is known as a 'forgetting function').

For fiscal year 2021, TSSA completely eliminated the use of old the RIF calculation and fully transitioned to reporting on the new RIF values. Below is a comparison of the 2020 Areas of Concern showing the old RIF calculation, the new RIF calculation and the composite blended value.



Table A3: Comparison of RIFs for 2020 Areas of Concern (2019 – 2021)

DESCRIPTION	FISCAL YEAR		
	2019	2020	2021
<b>ELEVATOR RISKS IN RETIREMENT AND LONG-TERM CARE HOMES</b>			
RIF, Old Calculation (FE/mpy)	0.72	2.11	2.07
RIF, New Calculation (FE/mpy)	0.06	0.14	0.14
RIF, Composite (FE/mpy)	0.59	1.32	1.32
<b>CARBON MONOXIDE (CO) RISKS IN APARTMENTS AND CONDOMINIUMS</b>			
RIF, Old Calculation (FE/mpy)	4.82	5.89	6.43
RIF, New Calculation (FE/mpy)	0.02	0.03	0.02
RIF, Composite (FE/mpy)	3.86	3.54	3.87
<b>ELEVATOR RISKS IN HOSPITALS</b>			
RIF, Old Calculation (FE/mpy)	4.10	5.64	5.99
RIF, New Calculation (FE/mpy)	0.27	0.37	0.29
RIF, Composite (FE/mpy)	3.33	3.53	3.50
<b>FUEL RISKS IN PRIVATE DWELLINGS</b>			
RIF, Old Calculation (FE/mpy)	3.42	4.32	4.34
RIF, New Calculation (FE/mpy)	0.24	0.16	0.16
RIF, Composite (FE/mpy)	2.78	2.65	2.67
<b>FUEL RISKS IN SCHOOLS</b>			
RIF, Old Calculation (FE/mpy)	0.52	0.64	0.63
RIF, New Calculation (FE/mpy)	0.01	0.01	0.01
RIF, Composite (FE/mpy)	0.42	0.38	0.38
<b>FUEL RISKS IN BUSINESS UNITS</b>			
RIF, Old Calculation (FE/mpy)	0.70	0.99	0.92
RIF, New Calculation (FE/mpy)	0.04	0.03	0.03
RIF, Composite (FE/mpy)	0.57	0.61	0.57

## Top Areas of Risk

Due to the new RIF calculation determining values much lower than those of the previous calculation, this fiscal year none of TSSA's safety areas were above the high-risk thresholds of 1.00 fatality equivalents per million people per year (FE/mpy) for the general population and 0.30 FE/mpy for sensitive sub-populations. Therefore, there were no areas of concern this year. As such, TSSA developed risk profiles to demonstrate the top areas of risk. These risk profiles have been categorized into the elevators and fuels safety areas and by general population and sensitive sub-populations, as shown below.

Based on the updated RIF calculation, there were no areas of concern in the elevators sector for 2021. Elevator risks in hospitals remained the area where TSSA saw the highest risk per exposed population. Note that the exposed population for hospitals is based on the number of hospital workers and hospital capacity and not on the entire Ontario population. Since most incidents involved workers, a high-risk threshold of 1.00 FE/mpy was used. Elevator risks in retirement and long-term care homes carried a higher risk compared to other areas with a RIF of 0.14 FE/mpy because retirement and long-term care homes have sensitive sub-populations (note the risk threshold is 0.30 FE/mpy for sensitive sub-populations).

Sensitive sub-populations are populations with persons more at risk than the general population because they are less able to respond to an occurrence (e.g., in schools, retirement and long-term care homes, etc.).

Figure A4: TSSA's Risk Profile for Elevators<sup>4</sup> (General Population) (2021)

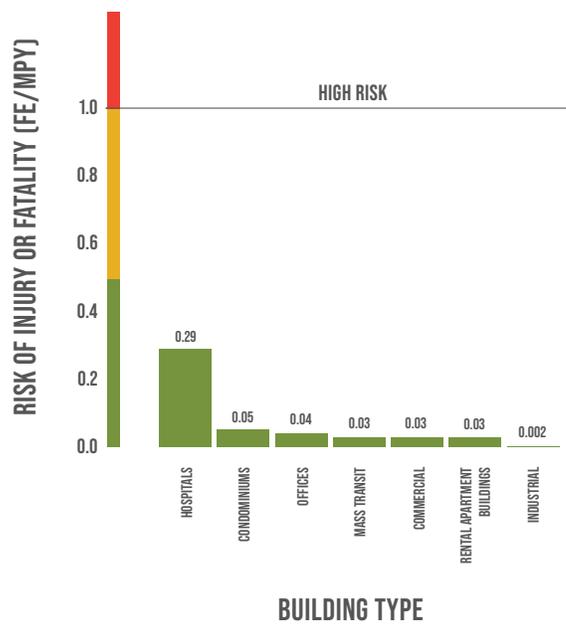
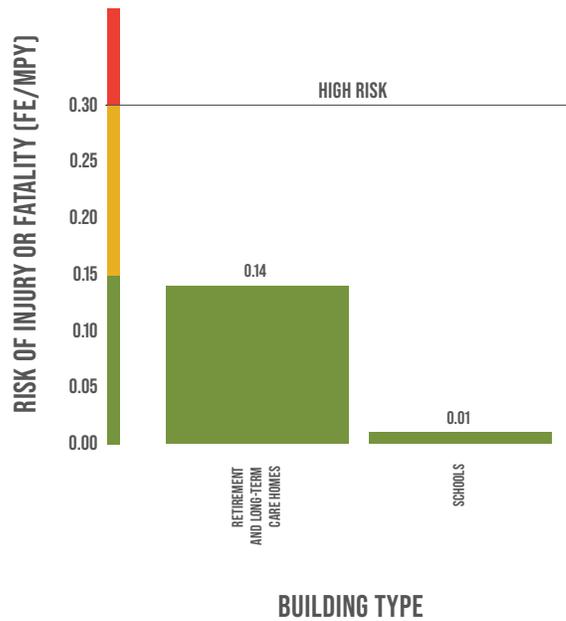


Figure A5: TSSA's Risk Profile for Elevators (Sensitive Sub-Populations) (2021)

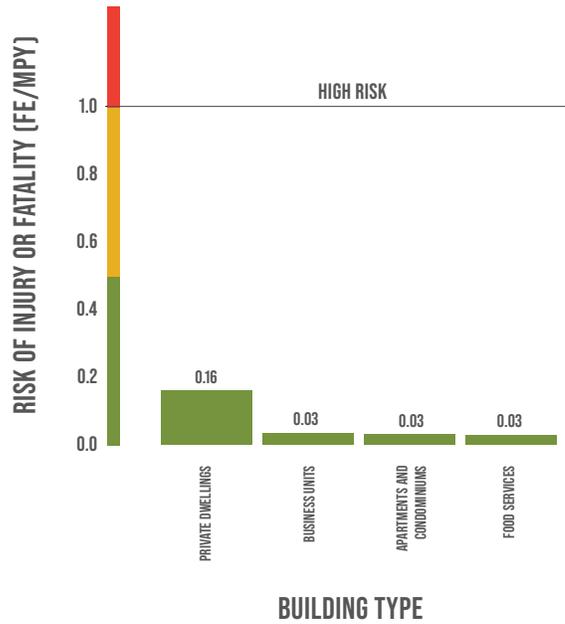


<sup>4</sup> The calculated RIFs for Hotels and Assemblies was 1.14 and 0.29 FE/MPY, respectively. However, these building types have been omitted from the figure since there are uncertainties in their exposed population estimates. TSSA will continue to refine the population estimates for next year's report.

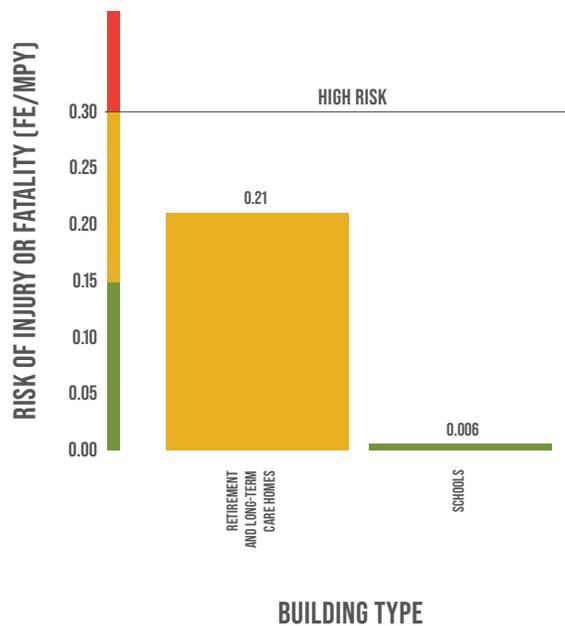
Based on the new RIF calculation, there were no areas of concern in the fuels sector for 2021. Fuels risks in private dwellings was the area where TSSA saw the highest risk per exposed population. Fuels risks in retirement and long-term care homes carried a higher risk compared to other areas with a RIF of 0.21 FE/MPY because retirement and long-term care homes have sensitive sub-populations (note: the high-risk threshold is 0.3 FE/MPY for sensitive sub-populations).

TSSA remains committed to reducing the risk of injury and fatality in the top areas of risk identified here.

**Figure A6: TSSA's Risk Profile for Fuels (General Population) (2021)**



**Figure A7: TSSA's Risk Profile for Fuels (Sensitive Sub-Populations) (2021)**



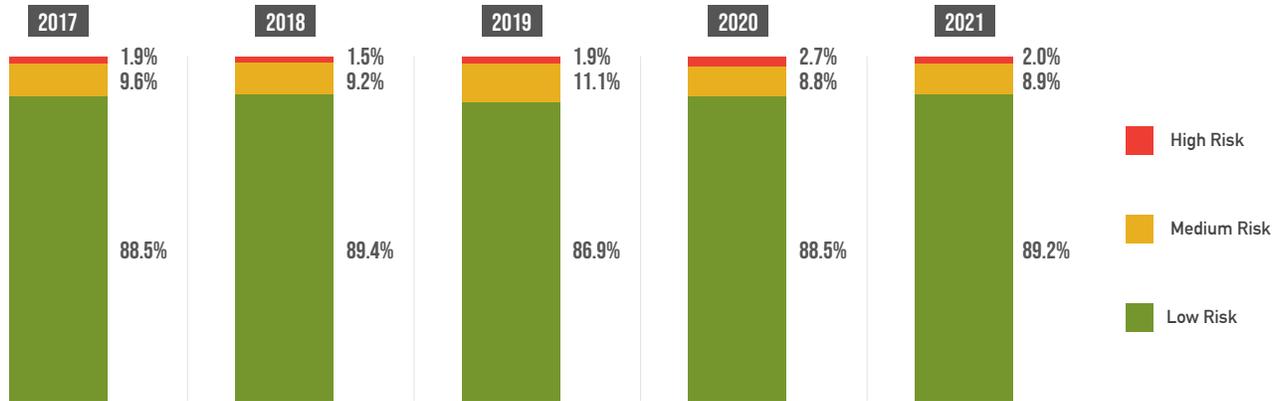
## Risk of Facilities or Devices

Using a harmonized approach described in [Appendix N<sup>5</sup>](#), 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 A4: High Risk Inventory from Outcomes of Periodic Inspections Across All Programs (2020 – 2021)**

DESCRIPTION	FISCAL YEAR 2020	FISCAL YEAR 2021	COMMENTS
High-Risk Inventory	2.7%	2.0%	Most of the change was seen in Fuels and Operating Engineers

**Figure A8: Inventory Risk Profiles from Outcomes of Periodic Inspections Across All Programs (2017 – 2021)**



## Compliance

TSSA uses a rolling five-year period for measurement and reporting of compliance information for this report. For more details on statistical methods, please refer to [Appendix M<sup>6</sup>](#).

**Table A5: Five-Year Mean Compliance Rate from Outcomes of Periodic Inspections Across All Programs (2017 – 2021)**

DESCRIPTION	FISCAL YEARS 2017 – 2021	TREND (ANNUAL)	COMMENTS
Compliance Rate (Mean)	28.2%	Decreasing	Worsening

<sup>5</sup> [Appendix N](#) is found in Technical Appendices report.

<sup>6</sup> [Appendix M](#) is found in Technical Appendices report.

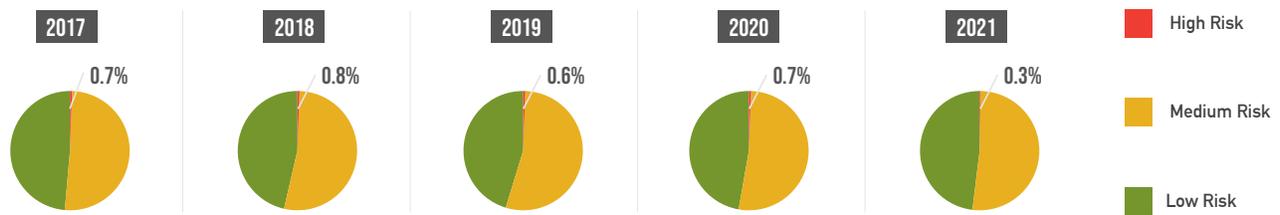
## Risk of Orders

While the compliance rate provides an outcome of the periodic inspections (e.g., pass or fail), the inspection risk spectrum (shown as a pie chart) portrays the potential safety risks associated with non-compliance found during the inspections. The red segments of the spectrums show high levels of risk.

**Table A6: Inspection Risk Spectrum from Outcomes of Periodic Inspections Conducted in All Regulated Sectors (2021)**

INSPECTION RISK SPECTRUM	FISCAL YEAR 2021
High-Risk Issues	0.3%
Low-Risk Issues	47.9%

**Figure A9: Inspection Risk Spectrums from Outcomes of Periodic Inspections Conducted in All Regulated Sectors (2017 – 2021)**



## 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, 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, which can result in small differences between the two numbers.

**Table A7: Cross-Program Inspection and Re-Inspection Results (2021)**

DESCRIPTION	PASS	FAIL	OTHER	GRAND TOTAL	PASS RATE (%)
Ad Hoc/Unscheduled Inspections	1,334	1,379	128	2,841	49.2%
Alteration Inspections	185	2	0	187	98.9%
Complaint Inspections	394	40	0	434	90.8%
Initial Inspections	6,787	2,683	14	9,484	71.7%
Inspections for Certification	2,126	3	157	2,286	99.9%
Minor Alteration Inspections	1,824	1,355	0	3,179	57.4%
Non-Mandated/Non-Regulated Inspections	1,775	432	510	2,717	80.4%
Occurrence Inspections	39	136	3,143	3,318	22.3%
Operational Inspections	29	2	0	31	93.5%
Other Inspections	10,053	3,675	223	13,951	73.2%
Periodic Inspections	6,981	14,620	299	21,900	32.3%
Re-Inspections	11,307	20,501	377	32,185	35.5%
Repair Inspections	586	10	0	596	98.3%
All Programs Total	43,420	44,838	4,851	93,109	49.2%



# Appendix B – 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 100<sup>th</sup> percentile due to rounding off.

## Incidents, Injuries and Risk Prediction

**Table B1: State of Safety Measures for Uninsured Boilers and Pressure Vessels (2012 – 2021)**

DESCRIPTION	FISCAL YEAR										TOTAL	AVERAGE	TREND (ANNUAL)
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021			
Incidents and Near Miss Occurrences	2	2	0	1	5	4	22	118	156	139	449	45	Increasing
Non-Permanent Injuries	0	0	0	0	1	0	0	2	0	0	3	0	No Trend
Permanent Injuries	2	0	0	0	1	2	1	0	0	0	6	1	No Trend
Fatalities	0	0	0	0	0	0	0	0	0	0	0	0	No Trend
Observed Injury Burden (FE/mpy)	0.001	0.00	0.00	0.00	0.01	0.001	0.01	0.00	0.00	0.00	N/A	0.003	N/A

Note that the large increase in incidents in the past few years was due to an increase in reporting, not to an increase in the actual number of incidents. The increased reporting was due to better coordination with the Spills Action Centre in the reporting of incidents.

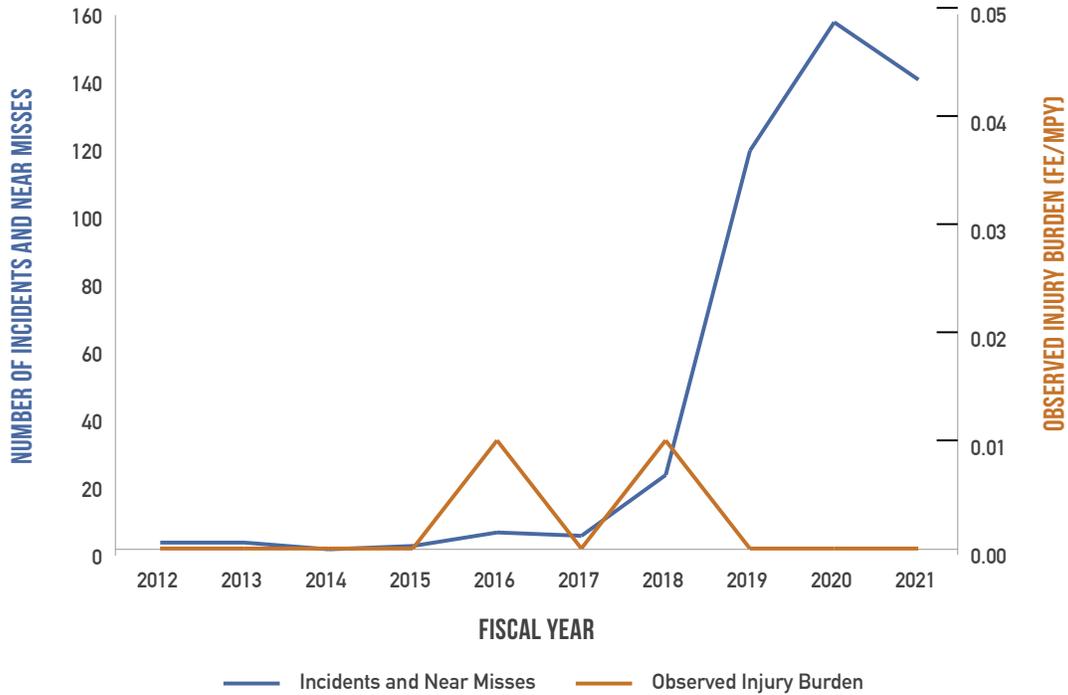
**Table B2: Risk of Injury or Fatality for Uninsured Boilers and Pressure Vessels (2017 – 2021)**

DESCRIPTION	FISCAL YEAR				
	2017	2018	2019	2020	2021
RIF, Old Calculation (FE/mpy)	N/A	0.02	0.03	0.07	0.07
RIF, New Calculation (FE/mpy)	N/A	N/A	0.001	0.001	0.001

The TSSA high-risk threshold 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 B1: Occurrences and Observed Injury Burden for Uninsured Boilers and Pressure Vessels (2012 – 2021)**



**Figure B2: Injuries and Fatalities for Uninsured Boilers and Pressure Vessels (2012 – 2021)**

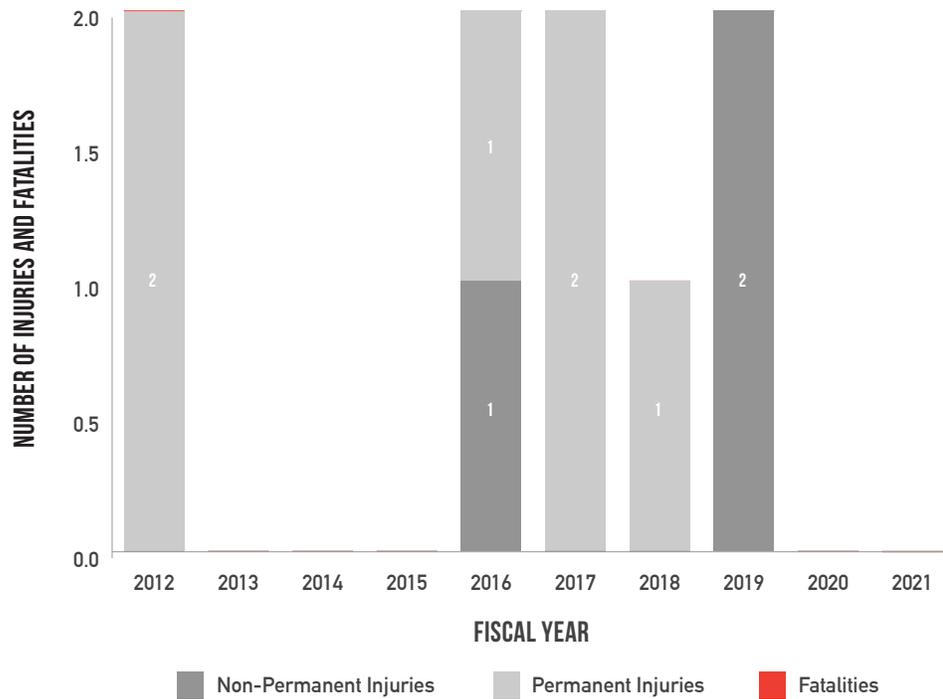
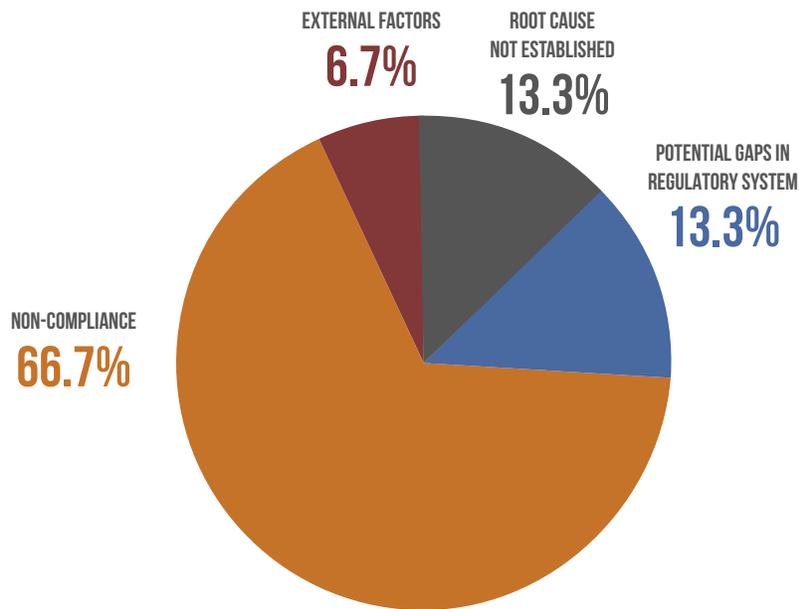


Figure B3: Risk of Injury or Fatality for Uninsured Boilers and Pressure Vessels by Casual Analysis Category (2012 – 2021)



Two thirds of the risk in the past 10 years has been a result of non-compliance.

### Compliance

*Ontario Regulation 220/01, Boilers and Pressure Vessels* assigns periodic inspection responsibility 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.

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.

This fiscal year, the compliance rate for the Boilers and Pressure Vessels program area is not reported since TSSA only inspects a small fraction of boilers and pressure vessels in Ontario while the remainder are inspected by insurance companies. Occurrence data is reported for both all boilers and pressure vessels. However, TSSA reviewing its incident reporting guidelines to ensure that data presented is complete and of high quality.

### Uninsured Equipment

Table B3: Top Compliance Issues by Number of Orders Issued from Outcomes of Periodic Inspections Conducted on Uninsured Boilers and Pressure Vessels (2017 – 2021)

COMPLIANCE ISSUE	PERCENTAGE OF TOTAL NUMBER OF ORDERS ISSUED
Equipment not prepared for TSSA inspection	19.7%
Equipment not maintained in safe working condition	12.1%
Pressure relief device is inadequate	9.1%

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



## Insured Equipment

Until TSSA has completed a full round of review of all insured boilers and pressure vessels, TSSA does not have a baseline for reporting on insured equipment. This is expected in a couple of years.

## 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, 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.

**Table B4: Uninsured Boilers and Pressure Vessels Inspection and Re-Inspection Results (2021)**

DESCRIPTION	PASS	FAIL	OTHER	GRAND TOTAL	PASS RATE (%)
Alteration Inspections	167	1	0	168	99.4%
Initial Inspections	2,637	96	2	2,735	96.5%
Inspections for Certification	2,126	3	157	2,286	99.9%
Non-Mandated/Non-Regulated Inspections	1,347	0	32	1,379	100.0%
Occurrence Inspections	0	0	9	9	N/A
Other Inspections	9,494	123	31	9,648	98.7%
Periodic Inspections	288	27	4	319	91.4%
Re-Inspections	276	37	0	313	88.2%
Repair Inspections	586	10	0	596	98.3%
<b>Boilers and Pressure Vessels Total</b>	<b>16,921</b>	<b>297</b>	<b>235</b>	<b>17,453</b>	<b>98.3%</b>

## Legislation and Regulatory Information

**Table B5: TSSA Boilers and Pressure Vessels Legislation and Regulatory Information (2021)**

LEGISLATION AND REGULATORY INFORMATION AS OF 2020	LATEST REVISION
Ontario Regulation 220/01: Boilers and Pressure Vessels	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

During this fiscal year, there were no Boilers and Pressure Vessels director’s orders, advisories, bulletins, or guidelines issued. See [www.tssa.org](http://www.tssa.org) for a comprehensive listing of legislation and regulatory information.

# Appendix C – 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 100<sup>th</sup> percentile due to rounding off.

## Incidents, Injuries and Risk Prediction

Table C1: State of Safety Measures for Operating Plants (2012 – 2021)

DESCRIPTION	FISCAL YEAR										TOTAL	AVERAGE	TREND (ANNUAL)
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021			
Incidents and Near Miss Occurrences	2	0	2	2	2	5	4	22	10	0	49	5	Increasing
Non-Permanent Injuries	0	0	0	1	0	0	0	0	0	0	1	0	No Trend
Permanent Injuries	0	0	1	1	1	0	0	0	0	0	3	0	No Trend
Fatalities	0	0	0	0	0	0	0	0	0	0	0	0	No Trend
Observed Injury Burden (FE/mpy)	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	N/A	0.002	N/A

Table C2: Risk of Injury or Fatality for Operating Plants (2017 – 2021)

DESCRIPTION	FISCAL YEAR				
	2017	2018	2019	2020	2021
RIF, Old Calculation (FE/mpy)	0.01	0.01	0.01	0.01	0.01
RIF, New Calculation (FE/mpy)	N/A	N/A	0.001	0.001	0.002

The TSSA high-risk threshold is 1.00 FE/mpy.

Figure C1: Occurrences and Observed Injury Burden for Operating Plants (2012 – 2021)

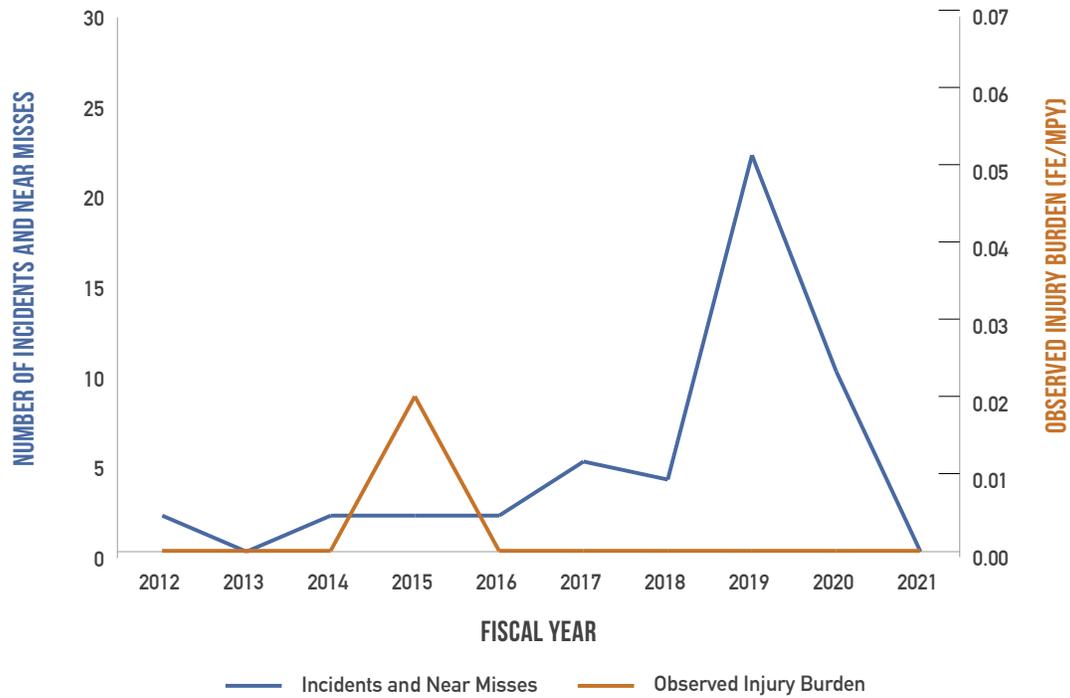


Figure C2: Injuries and Fatalities for Operating Plants (2012 – 2021)

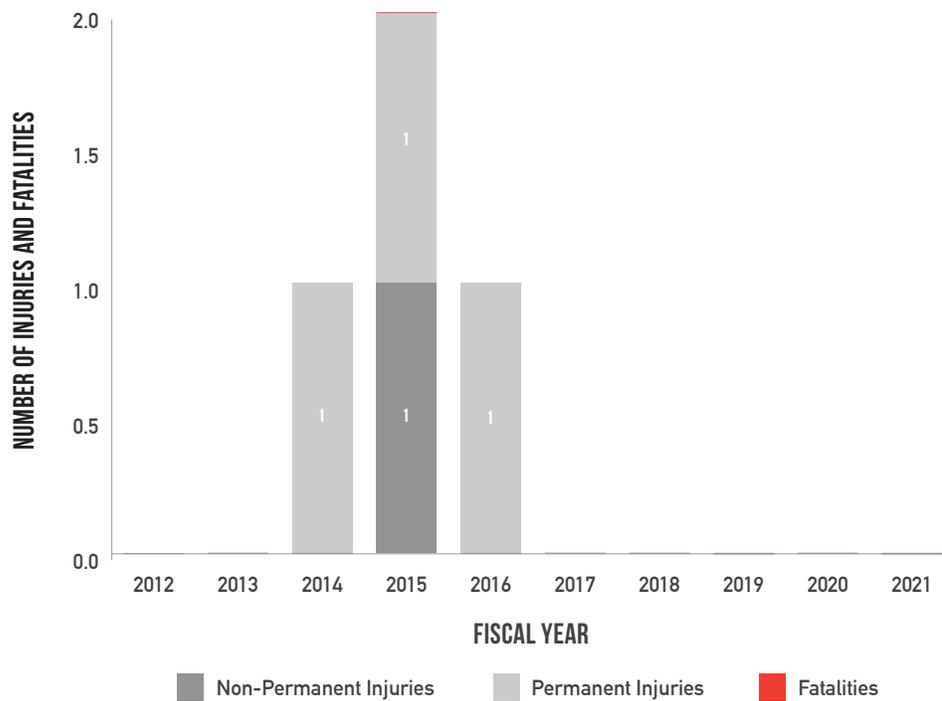
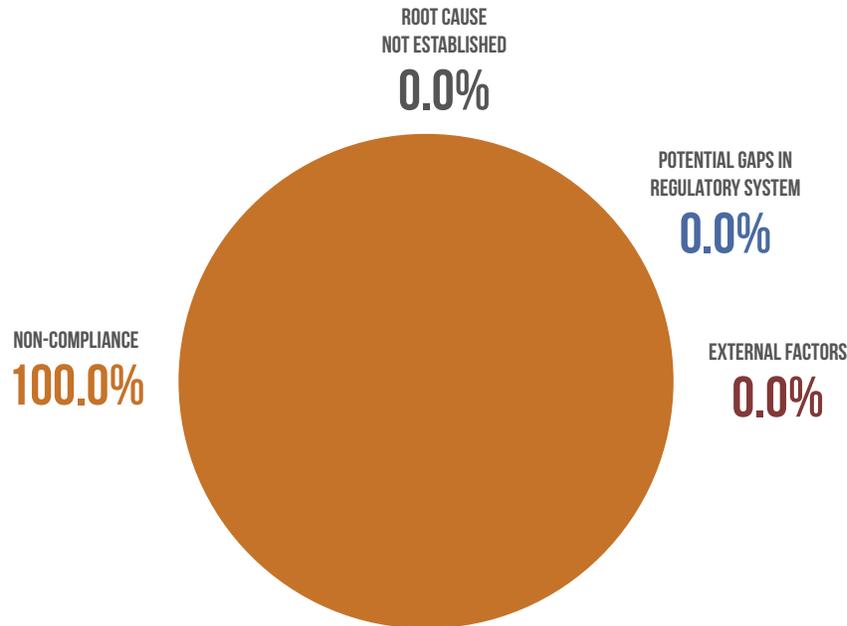


Figure C3: Risk of Injury or Fatality for Operating Plants by Casual Analysis Category (2012 - 2021)



All of the risk in the past 10 years has been a result of non-compliance. Since operating engineer incidents involve the manner in which an operating engineer oversees a plant, external factor occurrences are categorized as Boiler and Pressure Vessel occurrences.

### Risk of Facilities

TSSA conducts periodic inspections of registered operating plants in Ontario. These inspections assist in maintaining a low to negligible risk of injury or fatality to Ontarians that may result from non-compliance with the regulatory requirements. TSSA uses a risk-based inspection scheduling process (RBS)<sup>7</sup> to determine the frequency of inspections of all registered plants. Data collected through these inspections helps prioritize frequency of inspections and proactively manage risk of injury or fatality.

Table C3: Number of Operating Engineers (2021)

DESCRIPTION	NUMBER
Operating engineers	12,026

Table C4: Number of Operating Plants (2021)

DESCRIPTION	NUMBER
Operating plants inventory	3,318
Operating plants that had sufficient inspection history to calculate a risk score	2,844

<sup>7</sup> Mangalam S, Mulamootil LA, Veeramany A, Witt D, and Karavas R. "System and method for inspecting and assessing risk of mechanical equipment and facilities." U.S. Patent No. 13/894,812, May 15, 2013.

Figure C4: Inventory Risk Profiles from Outcomes of Periodic Inspections Conducted on Operating Plants (2017 – 2021)

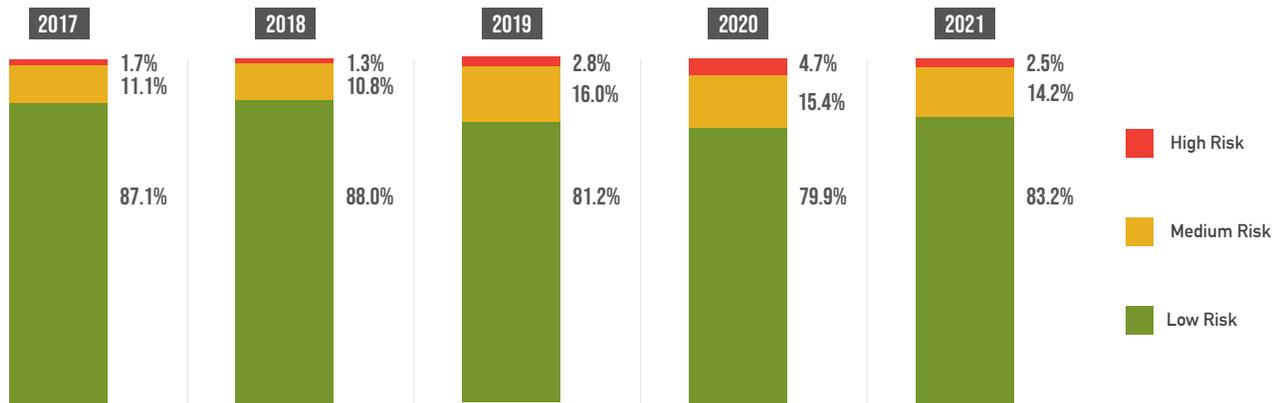


Table C5: Number of High-Risk Operating Plants (2021)

DESCRIPTION	NUMBER	PER CENT OF QUALIFIED PROVINCIAL INVENTORY
High-Risk Operating Plants	72	2.5%

Table C6: Top High-Risk Plant Types (2021)

PLANT TYPE	PERCENTAGE OF TOTAL HIGH-RISK PLANTS
Low Pressure Steam Plant	30.6%
Refrigeration Plant	22.2%
High-Pressure Watertube Low-Water-Volume Power Plant	15.3%

Table C7: Top High-Risk Plant Function Types (2021)

PLANT FUNCTION TYPE	PERCENTAGE OF TOTAL HIGH-RISK PLANTS
Manufacturing Industries	22.2%
Production Industries	22.2%
Public Services	12.5%

## Compliance

The compliance rate is defined as the percentage of periodic inspections with no orders issued compared to the total number of periodic inspections.

Using a risk-based approach (i.e., RBS), the entire inventory is inspected at least once over a two-year period. The RBS model, described in [Appendix N](#)<sup>8</sup> in detail, is based on a historical profile of the nature and significance of non-compliance found at the plants.

<sup>8</sup> [Appendix N](#) is found in Technical Appendices report.

**Figure C5: Yearly Compliance Rates from Outcomes of Periodic Inspections Conducted on Operating Plants (2017 – 2021)**



**Table C8: Five-Year Mean Compliance Rate from Outcomes of Periodic Inspections Conducted on Operating Plants (2017 – 2021)**

DESCRIPTION	FISCAL YEAR 2017 – 2021	TREND (PER YEAR)
Compliance Rate (Mean)	40.9%	No Trend

TSSA deals with observed non-compliance by issuing inspection orders to the owner to address the non-compliance within an appropriate time frame. This process contributes to the preventative management of risk of injury or fatality associated with operating plants.

**Table C9: Top Compliance Issues by Number of Orders Issued from Outcomes of Periodic Inspections Conducted on Operating Plants (2017 – 2021)**

COMPLIANCE ISSUE	PERCENTAGE OF TOTAL NUMBER OF ORDERS ISSUED
Equipment not inspected and posted by an Insurance Company or TSSA	10.1%
Testing of safety devices not recorded	4.7%
Refrigeration plant safety valves over 5 years old not maintained or replaced	4.2%

**Table C10: Top Compliance Issues by Risk of Orders Issued from Outcomes of Periodic Inspections Conducted on Operating Plants (2017 – 2021)**

COMPLIANCE ISSUE	PERCENTAGE OF TOTAL RISK OF ORDERS ISSUED
Registered TSSA seals missing	65.0%
Boiler safety valves over 5 years old not recertified or replaced	7.6%
Refrigeration plant safety valves over 5 years old not maintained or replaced	4.1%

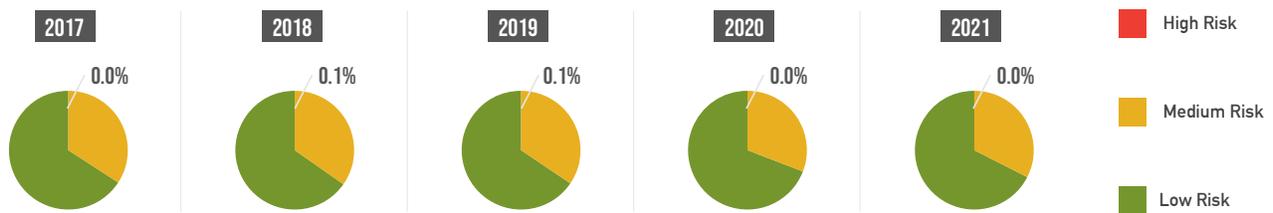
### Risk of Orders

While the compliance rate provides an outcome of the periodic inspection (e.g., pass or fail), the inspection risk spectrum (shown as a pie chart) portrays the potential safety risks associated with non-compliance found during the inspection. The red segments of the spectrums show high levels of risk.

**Table C11: Inspection Risk Spectrum from Outcomes of Periodic Inspections Conducted on Operating Plants (2021)**

INSPECTION RISK SPECTRUM	FISCAL YEAR 2021
High-Risk Issues	0.0%
Low-Risk Issues	67.5%

**Figure C6: Inspection Risk Spectrums from Outcomes of Periodic Inspections Conducted on Operating Plants (2017 – 2021)**



Some examples of minor issues include: the plant not being re-registered after changing its name or ownership; missing signage; the registration certificate not being posted in a conspicuous location; missing information from the logbook; and general housekeeping concerns.

### 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, 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.

**Table C12: Operating Plants Inspection and Re-Inspection Results (2021)**

INSPECTION TYPE	PASS	FAIL	OTHER	GRAND TOTAL	PASS RATE (%)
Initial Inspections	12	128	0	140	8.6%
Non-Mandated/Non-Regulated Inspections	3	1	0	4	75.0%
Other Inspections	49	27	75	151	64.5%
Periodic Inspections	678	1,004	14	1,696	40.3%
Re-Inspections	537	246	49	832	68.6%
Operating Engineers Total	1,279	1,406	138	2,823	47.6%

### Legislation and Regulatory Information

**Table C13: TSSA Operating Engineers Legislation and Regulatory Information (2021)**

LEGISLATION AND REGULATORY INFORMATION	LATEST REVISION
Ontario Regulation 219/01: Operating Engineers	2001
Ontario Regulation 219/01: Director’s Order	2003
Minister’s Order for Operating Engineers Alternate Rules	2020

During this fiscal year, there were no Operating Engineers director’s orders, advisories bulletins or guidelines issued. See [www.tssa.org](http://www.tssa.org) for a comprehensive listing of legislation and regulatory information.



# Appendix D – 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 100<sup>th</sup> percentile due to rounding off.

## Incidents, Injuries and Risk Prediction

Table D1: State of Safety Measures for Amusement Devices (2012 – 2021)

DESCRIPTION	FISCAL YEAR										TOTAL	AVERAGE	TREND (ANNUAL)
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021			
Incidents and Near Miss Occurrences	222	331	521	647	922	439	709	1,195	1,381	98	6,465	647	Increasing
Non-Permanent Injuries	216	313	454	585	848	378	661	1,094	1,233	89	5,871	587	Increasing
Permanent Injuries	5	11	25	24	42	33	23	29	26	1	219	22	No Trend
Fatalities	0	0	0	0	0	0	0	1	0	1	2	0	No Trend
Observed Injury Burden (FE/mpy)	0.05	0.06	0.02	0.08	0.11	0.08	0.11	0.15	0.15	0.12	N/A	0.09	N/A

Table D2: Risk of Injury or Fatality for Amusement Devices (2017 – 2021)

DESCRIPTION	FISCAL YEAR				
	2017	2018	2019	2020	2021
RIF, Old Calculation (FE/mpy)	0.11	0.14	0.25	0.34	0.34
RIF, New Calculation (FE/mpy)	N/A	N/A	0.06	0.08	0.09

The TSSA high-risk threshold is 1.00 FE/mpy.

Figure D1: Occurrences and Observed Injury Burden for Amusement Devices (2012 – 2021)

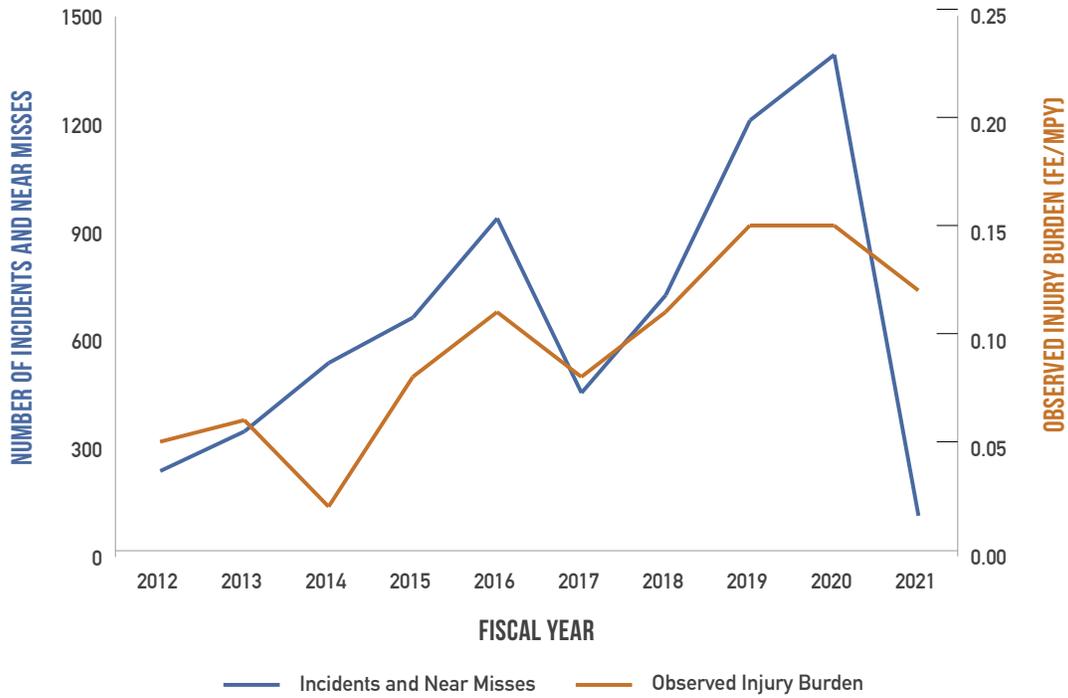


Figure D2: Injuries and Fatalities for Amusement Devices (2012 – 2021)

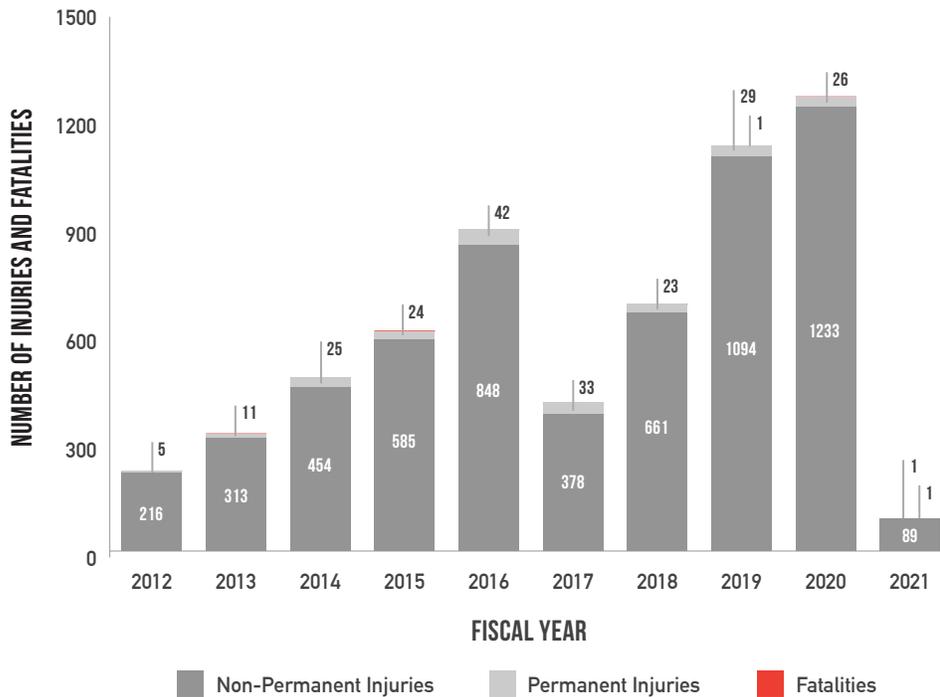
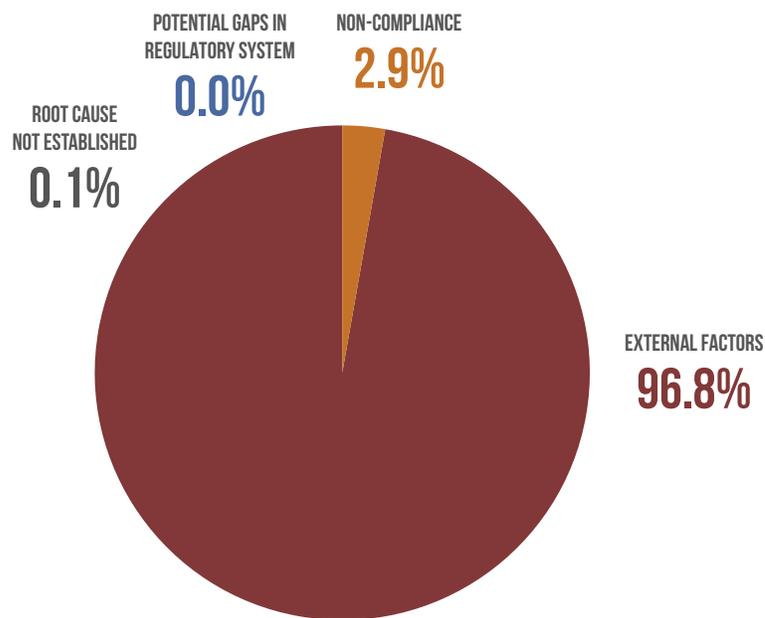


Figure D3: Risk of Injury or Fatality for Amusement Devices by Casual Analysis Category (2012 - 2021)



Over 95 per cent of the risk in the past 10 years has been a result of external factors.

### Risk of Potential Gaps in the Regulatory System

Some typical examples of potential gaps in the regulatory system include: head injuries that might have been avoided through the use of helmets and/or device padding; enhanced railings to prevent egress of riders from the device (e.g., railings along the sides of slides); and additional guarding of moving parts to prevent entrapment (e.g., finger under train wheel).

### Risk of Non-Compliance

Some typical examples of non-compliance include: the operator not obeying the ride height restrictions; a lap bar spring becoming detached; a slip-ring wire coming loose and electrifying the fence; the drive wheel of a Ferris wheel coming loose; and the passenger-carrying unit coming loose due to a broken weld.

### Risks due to External Factors

Some typical examples of external factors include: a passenger on a zip line getting their finger caught in the pulley; a passenger having a finger pinched during closure of the lap bar; a passenger hitting their head while coming down a water slide; a go-kart colliding with another go-kart; and a patron tripping and falling while running towards the ride.

### Risks due to All Causes

Table D3: Human Factors in Amusement Device Occurrences (2012 – 2021)

DESCRIPTION	PERCENTAGE OF OCCURRENCES
Human Factors	91.1%

Table D4: Top Amusement Device Types by Number of Occurrences (2012 – 2021)

DEVICE TYPE	PERCENTAGE OF OCCURRENCES
Water Slides	31.4%
Coaster Rides	22.5%
Zip Lines	13.7%

Table D5: Top Amusement Device Types by Observed Injury Burden (2012 – 2021)

DEVICE TYPE	PERCENTAGE OF OBSERVED INJURY BURDEN
Water Slides	27.0%
Coaster Rides	24.6%
Zip Lines	19.5%

Table D6: Top Occurrence Types by Number of Occurrences for Amusement Devices (2012 – 2021)

OCCURRENCE TYPE	PERCENTAGE OF OCCURRENCES
Physical Impacts	57.5%
Sudden Movements	14.5%
Trips/Falls	11.8%

Table D7: Top Occurrence Types by Observed Injury Burden for Amusement Devices (2012 – 2021)

OCCURRENCE TYPE	PERCENTAGE OF OBSERVED INJURY BURDEN
Physical Impacts	58.4%
Sudden Movements	19.9%
Falls from Height	9.4%

The top occurrence types are expanded below in greater detail.

### *Physical Impacts*

Table D8: Top Amusement Device Types by Number of Occurrences for Physical Impacts (2012 – 2021)

DEVICE TYPE	PERCENTAGE OF OCCURRENCES
Water Slides	32.2%
Zip Lines	22.4%
Coaster Rides	17.7%

Table D9: Top Amusement Device Types by Observed Injury Burden for Physical Impacts (2012 – 2021)

DEVICE TYPE	PERCENTAGE OF OBSERVED INJURY BURDEN
Zip Lines	30.9%
Coaster Rides	19.9%
Go-Karts	17.9%



## Sudden Movements

Table D10: Top Amusement Device Types by Number of Occurrences for Sudden Movements (2012 – 2021)

DEVICE TYPE	PERCENTAGE OF OCCURRENCES
Coaster Rides	57.3%
Circular Rides	12.4%
Water Slides	11.4%

Table D11: Top Amusement Device Types by Observed Injury Burden for Sudden Movements (2012 – 2021)

DEVICE TYPE	PERCENTAGE OF OBSERVED INJURY BURDEN
Coaster Rides	57.1%
Water Slides	18.2%
Inflated Rides	8.3%

## Trips/Falls

Table D12: Top Amusement Device Types by Number of Occurrences for Trips/Falls (2012 – 2021)

DEVICE TYPE	PERCENTAGE OF OCCURRENCES
Water Slides	20.8%
Coaster Rides	20.8%
Circular Rides	18.8%

Table D13: Top Amusement Device Types by Observed Injury Burden for Trips/Falls (2012 – 2021)

DEVICE TYPE	PERCENTAGE OF OBSERVED INJURY BURDEN
Water Slides	64.0%
Coaster Rides	21.6%
Circular Rides	5.5%

## Falls from Height

Table D14: Top Amusement Device Types by Number of Occurrences for Falls from Height (2012 – 2021)

DEVICE TYPE	PERCENTAGE OF OCCURRENCES
Water Slides	68.2%
Circular Rides	8.1%
Coaster Rides	4.7%

Table D15: Top Amusement Device Types by Observed Injury Burden for Falls from Height (2012 – 2021)

DEVICE TYPE	PERCENTAGE OF OBSERVED INJURY BURDEN
Water Slides	96.9%
Inflated Rides	1.6%
Circular Rides	0.7%



## Risk of Devices

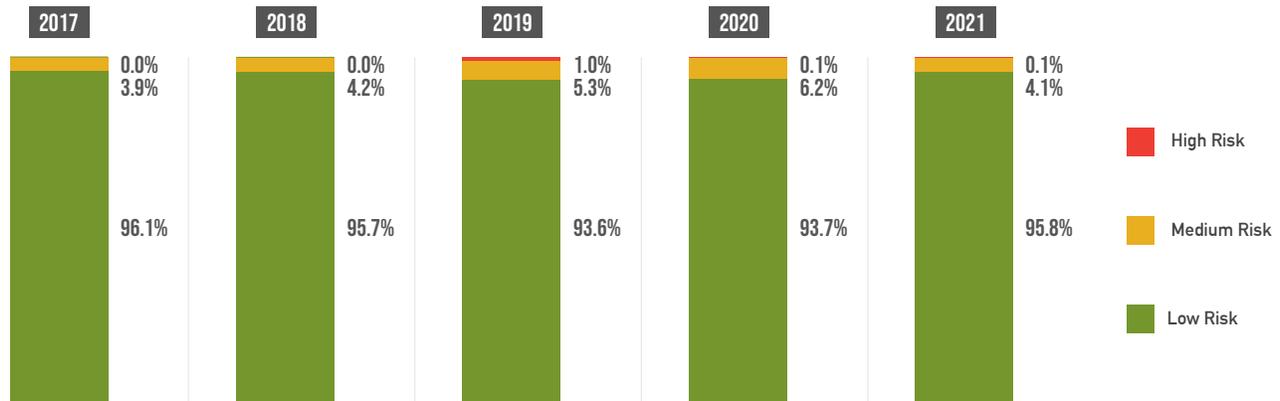
TSSA conducts periodic inspections of all amusement devices at the start of the season to oversee and manage the state of compliance across permitted amusement devices in the province of Ontario. Amusement device operations are generally seasonal in nature with a few devices operating all year round. 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 D16: Number of Amusement Devices (2021)**

DESCRIPTION	NUMBER
Amusement devices inventory	1,693
Amusement devices that had sufficient inspection history to calculate a risk score	3,017

Note that the number of amusement devices that had sufficient inspection history to calculate a risk score is larger than the amusement devices inventory because the larger figure includes devices that can become inactive at any time due to various reasons (eg, a portable device moved out of the province).

**Figure D4: Inventory Risk Profiles from Outcomes of Periodic Inspections Conducted on Amusement Devices (2017 – 2021)**



**Table D17: Number of High-Risk Amusement Devices (2021)**

DESCRIPTION	NUMBER	PERCENT OF QUALIFIED PROVINCIAL INVENTORY
High-Risk Devices	2	0.1%

**Table D18: Top High-Risk Amusement Device Types (2021)**

DEVICE TYPE	PERCENTAGE OF TOTAL HIGH-RISK DEVICES
Circular Rides	50.0%
Water Slides	50.0%

## Compliance

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.

The compliance rate is defined as the percentage of periodic inspections with no orders issued compared to the total number of periodic inspections.

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

**Figure D5: Yearly Compliance Rates from Outcomes of Periodic Inspections Conducted on Amusement Devices (2017 – 2021)**



**Figure D6: Yearly Compliance Rates from Outcomes of Operational Inspections Conducted on Amusement Devices (2017 – 2021)**



**Table D19: Five-Year Mean Compliance Rate from Outcomes of Periodic Inspections Conducted on Amusement Devices (2017 – 2021)**

DESCRIPTION	FISCAL YEAR 2017 – 2021	TREND (ANNUAL)
Compliance Rate (Mean)	54.8%	No Trend

**Table D20: Five-Year Mean Compliance Rate from Outcomes of Operational Inspections Conducted on Amusement Devices (2017 – 2021)**

DESCRIPTION	FISCAL YEAR 2017 – 2021	TREND (ANNUAL)
Compliance Rate (Mean)	85.2%	No Trend

**Table D21: Top Compliance Issues by Number of Orders Issued from Outcomes of Periodic Inspections Conducted on Amusement Devices (2017 – 2021)**

COMPLIANCE ISSUE	PERCENTAGE OF TOTAL NUMBER OF ORDERS ISSUED
No record of training	2.9%
Hole/tear in inflatable structure	2.7%
Amusement device plate not permanently affixed	2.2%

**Table D22: Top Compliance Issues by Number of Orders Issued from Outcomes of Operational Inspections Conducted on Amusement Devices (2017 – 2021)**

COMPLIANCE ISSUE	PERCENTAGE OF TOTAL NUMBER OF ORDERS ISSUED
Insufficient number of ride operators	5.7%
Lap bar restraint is not fully operational	3.9%
No record of training	3.5%

**Table D23: Top Compliance Issues by Risk of Orders Issued from Outcomes of Periodic Inspections Conducted on Amusement Devices (2017 – 2021)**

COMPLIANCE ISSUE	PERCENTAGE OF TOTAL RISK OF ORDERS ISSUED
Tie downs and anchors are not in place	17.2%
Tie downs and anchors are used in an unapproved manner	13.1%
Inadequate lighting for zip line operation	9.6%

**Table D24: Top Compliance Issues by Risk of Orders Issued from Outcomes of Operational Inspections Conducted on Amusement Devices (2017 – 2021)**

COMPLIANCE ISSUE	PERCENTAGE OF TOTAL RISK OF ORDERS ISSUED
Tie downs and anchors are not in place	32.8%
Tie downs and anchors are used in an unapproved manner	23.4%
Lap bar restraint is not fully operational	11.7%



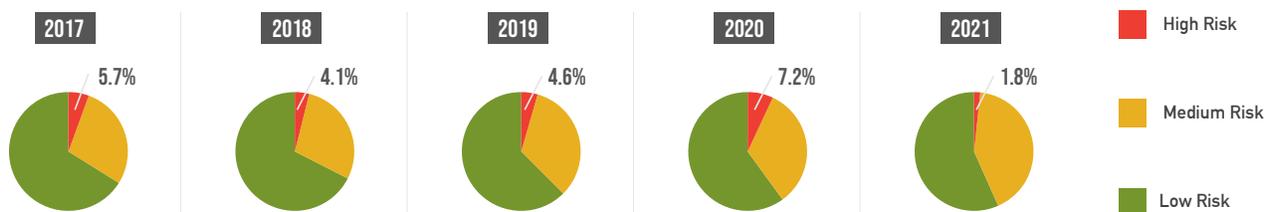
## Risk of Orders

While the compliance rate provides an outcome of the periodic inspection (e.g., pass/fail), the inspection risk spectrum (shown as a pie chart) portrays the potential safety risks associated with non-compliance found during the inspection. The red segments of the spectrums show high levels of risk.

**Table D25: Inspection Risk Spectrum from Outcomes of Periodic Inspections Conducted on Amusement Devices (2021)**

INSPECTION RISK SPECTRUM	FISCAL YEAR 2021
High-Risk Issues	1.8%
Low-Risk Issues	56.6%

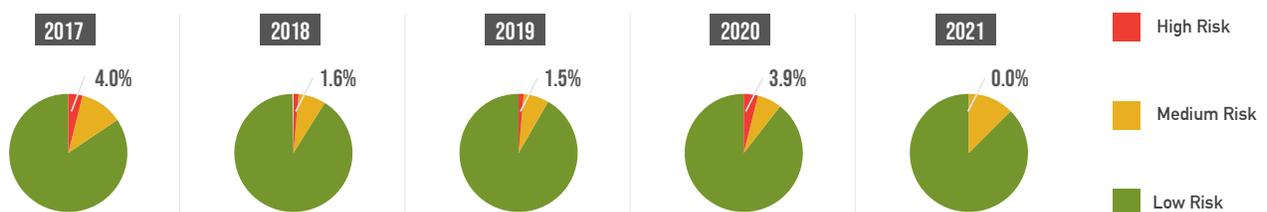
**Figure D7: Inspection Risk Spectrums from Outcomes of Periodic Inspections Conducted on Amusement Devices (2017 – 2021)**



**Table D26: Inspection Risk Spectrum from Outcomes of Operational Inspections Conducted on Amusement Devices (2021)**

INSPECTION RISK SPECTRUM	FISCAL YEAR 2021
High-Risk Issues	0.0%
Low-Risk Issues	87.5%

**Figure D8: Inspection Risk Spectrums from Outcomes of Operational Inspections Conducted on Amusement Devices (2017 – 2021)**



Some typical examples of minor issues include: missing device information plates; missing signage; records of training not in the logbook; missing information from the technical dossier; and passenger-carrying units not identified with markers, letters or colours.

## 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, 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.

**Table D27: Amusement Devices Inspection and Re-Inspection Results (2021)**

INSPECTION TYPE	PASS	FAIL	OTHER	GRAND TOTAL	PASS RATE (%)
Ad Hoc/Unscheduled Inspections	0	5	2	7	0.0%
Initial Inspections	4	16	0	20	20.0%
Occurrence Inspections	1	6	0	7	14.3%
Operational Inspections	7	2	0	9	77.8%
Other Inspections	5	4	0	9	55.6%
Periodic Inspections	188	206	2	396	47.7%
Re-Inspections	17	17	1	35	50.0%
<b>Amusement Devices Total</b>	<b>222</b>	<b>256</b>	<b>5</b>	<b>483</b>	<b>46.4%</b>

## Legislation and Regulatory Information

**Table D28: TSSA Amusement Devices Legislation and Regulatory Information (2021)**

LEGISLATION AND REGULATORY INFORMATION	LATEST REVISION
Ontario Regulation 221/01: Amusement Devices	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

During this fiscal year, there were no Amusement Devices director’s orders, advisories, bulletins or guidelines issued. See [www.tssa.org](http://www.tssa.org) for a comprehensive listing of legislation and regulatory information.

# Appendix E – 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 licences, conducts inspections, performs incident investigations, registers contractors, and certifies mechanics. The Elevating Devices Safety Program consists of three areas: 1) elevators; 2) escalators and moving walks; and 3) passenger ropeways (ski lifts). The various types of 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 100<sup>th</sup> percentile due to rounding off.

## Incidents, Injuries and Risk Prediction

Table E1: State of Safety Measures for Elevators (2012 – 2021)

DESCRIPTION	FISCAL YEAR										TOTAL	AVERAGE	TREND (ANNUAL)
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021			
Incidents and Near Miss Occurrences	340	382	501	463	570	534	684	703	673	558	5,408	541	Increasing
Non-Permanent Injuries	167	146	186	119	169	145	131	114	129	82	1,388	139	Decreasing
Permanent Injuries	12	11	7	7	11	11	4	5	8	4	80	8	Decreasing
Fatalities	2	1	0	1	0	2	1	0	1	0	8	1	No Trend
Observed Injury Burden (FE/mpy)	0.13	0.09	0.03	0.03	0.02	0.18	0.03	0.02	0.16	0.004	N/A	0.07	N/A

Table E2: Risk of Injury or Fatality for Elevators (2017 – 2021)

DESCRIPTION	FISCAL YEAR				
	2017	2018	2019	2020	2021
RIF, Old Calculation (FE/mpy)	0.48	0.70	0.75	1.06	1.06
RIF, New Calculation (FE/mpy)	N/A	N/A	0.06	0.08	0.07

The TSSA high-risk threshold is 1.00 FE/mpy.



Figure E1: Occurrences and Observed Injury Burden for Elevators (2012 – 2021)

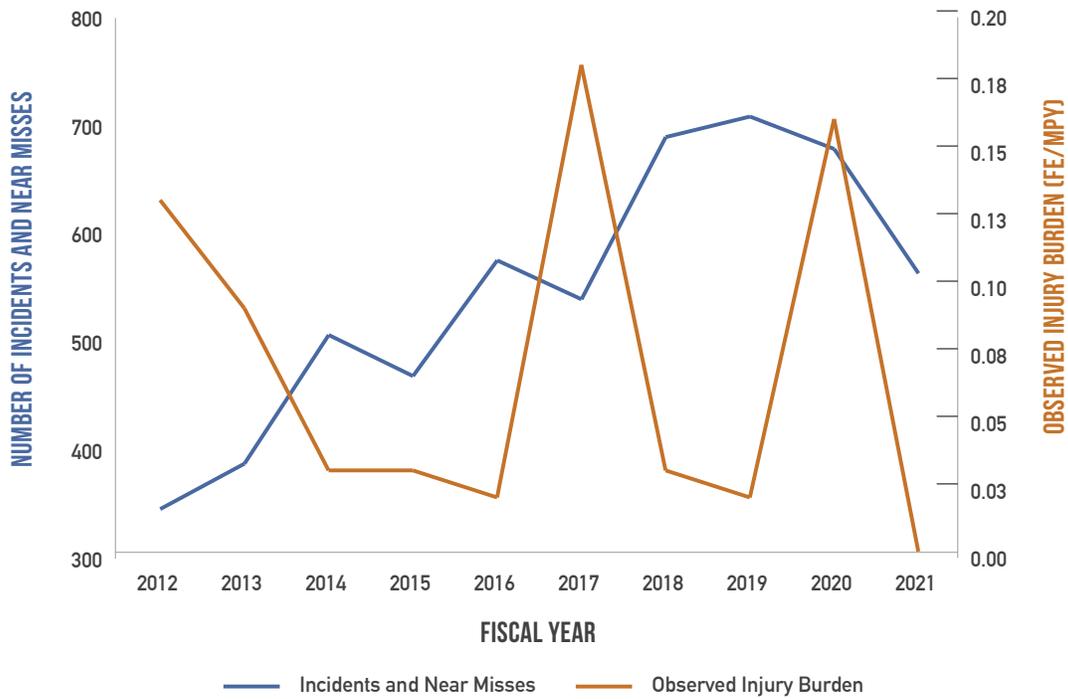


Figure E2: Injuries and Fatalities for Elevators (2012 – 2021)

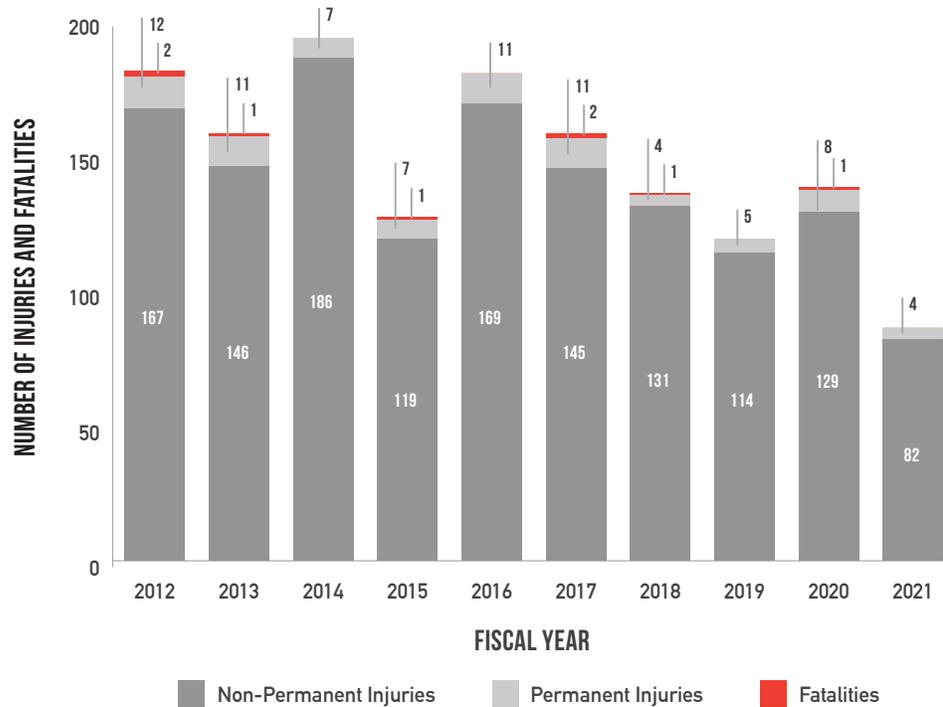
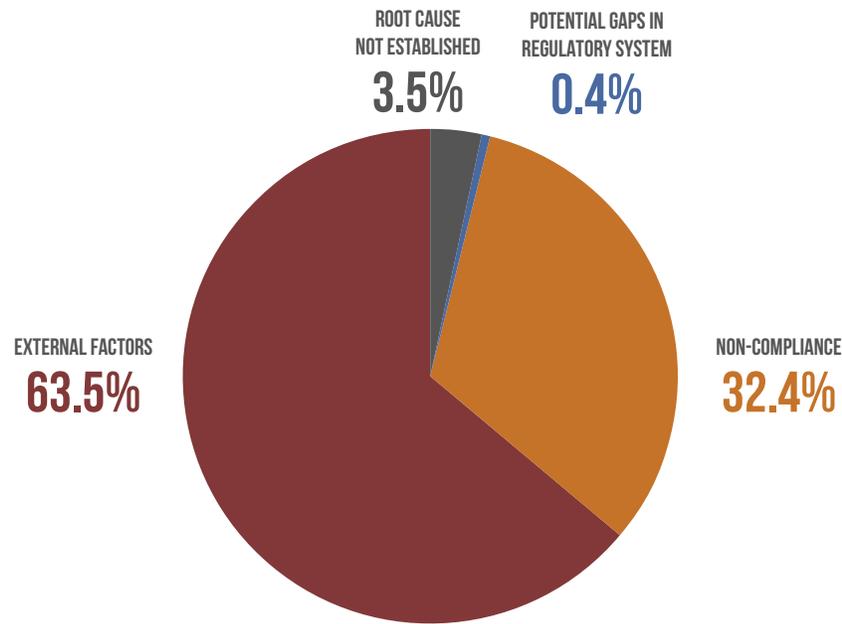


Figure E3: Risk of Injury or Fatality for Elevators by Casual Analysis Category (2012 - 2021)



Over 60 per cent of risk in the past 10 years was a result of external factors.

### Risks due to Potential Gaps in the Regulatory System

Some typical examples of potential gaps in the regulatory system include: improved door closing safety features to prevent injuries to passengers; improved fire protection requirements in the machine room; improved emergency braking requirements; improved out-of-level requirements to help reduce trips and falls; improved fastener locking requirements to prevent parts from coming loose and injuring passengers; improved prevention methods of passengers manually escaping the elevator during an entrapment; and improved procedures to prevent prolonged entrapment of passengers.

### Risks due to Non-Compliance

Some typical examples of non-compliance include: a worm shaft sheared at the brake drum coupling; an emergency brake seized in the open position; a hole in the hydraulic cylinder from corrosion; no employee training records; and a brake replaced by an unauthorized person.

### Risks due to External Factors

Some typical examples of external factors include: a burst pipe flooding the elevator machine room; a child getting their fingers caught in the door; a passenger using their arm to stop a door from closing, resulting in a cut; a passenger with grocery bags tripping on entering the elevator; and the elevator pit flooding due to heavy rain.

### Risks due to All Causes

Table E3: Human Factors in Elevator Occurrences (2012 – 2021)

DESCRIPTION	PERCENTAGE OF OCCURRENCES
Human Factors	30.8%

**Table E4: Top Elevator Location Types by Number of Occurrences (2012 – 2021)**

LOCATION TYPE	PERCENTAGE OF OCCURRENCES
Rental Apartment Buildings	22.2%
Offices	20.2%
Condominiums	19.4%

**Table E5: Top Elevator Location Types by Observed Injury Burden (2012 – 2021)**

LOCATION TYPE	PERCENTAGE OF OBSERVED INJURY BURDEN
Rental Apartment Buildings	29.1%
Offices	23.6%
Condominiums	19.7%

**Table E6: Top Occurrence Types for Elevators by Number of Occurrences (2012 – 2021)**

OCCURRENCE TYPE	PERCENTAGE OF OCCURRENCES
Flooding	43.4%
Door Closings	18.0%
Unintentional Movements	14.2%

**Table E7: Top Occurrence Types for Elevators by Observed Injury Burden (2012 – 2021)**

OCCURRENCE TYPE	PERCENTAGE OF OBSERVED INJURY BURDEN
Entrapments	25.0%
Exposed Hoistways/Wellways	24.3%
Door Closings	20.7%

The top occurrence types are discussed below in greater detail.

### ***Flooding***

**Table E8: Top Elevator Location Types by Number of Occurrences for Flooding (2012 – 2021)**

LOCATION TYPE	PERCENTAGE OF OCCURRENCES
Condominiums	24.9%
Rental Apartment Buildings	24.5%
Offices	16.7%

Observed injury burden due to flooding was negligible.



## Door Closings

Table E9: Top Elevator Location Types by Number of Occurrences for Door Closings (2012 – 2021)

LOCATION TYPE	PERCENTAGE OF OCCURRENCES
Offices	23.7%
Rental Apartment Buildings	16.2%
Commercial	11.4%

Some examples of commercial locations include retail stores and shopping malls.

Table E10: Top Elevator Location Types by Observed Injury Burden for Door Closings (2012 – 2021)

LOCATION TYPE	PERCENTAGE OF OBSERVED INJURY BURDEN
Condominiums	41.6%
Rental Apartment Buildings	31.2%
Offices	13.0%

## Unintentional Movements

Table E11: Top Elevator Location Types by Number of Occurrences for Unintentional Movements (2012 – 2021)

LOCATION TYPE	PERCENTAGE OF OCCURRENCES
Rental Apartment Buildings	22.9%
Offices	22.1%
Condominiums	19.6%

Table E12: Top Elevator Location Types by Observed Injury Burden for Unintentional Movements (2012 – 2021)

LOCATION TYPE	PERCENTAGE OF OBSERVED INJURY BURDEN
Assemblies	55.0%
Rental Apartment Buildings	23.2%
Industrial	16.7%

Assemblies are locations where the public can congregate; some examples include libraries, churches, museums, convention centres, community centres, casinos, theatres, concerts, tourist attractions, and sporting events/facilities.

## Entrapments

The term “entrapment” when used with elevators refers to the situation where passengers cannot get out of the elevator because the doors do not open.

**Table E13: Top Elevator Location Types by Number of Occurrences for Entrapments (2012 – 2021)**

LOCATION TYPE	PERCENTAGE OF OCCURRENCES
Rental Apartment Buildings	21.8%
Offices	19.0%
Condominiums	18.5%

**Table E14: Top Elevator Location Types by Observed Injury Burden for Entrapments (2012 – 2021)**

LOCATION TYPE	PERCENTAGE OF OBSERVED INJURY BURDEN
Student Residences	50.9%
Rental Apartment Buildings	45.2%
Hospitals	3.4%

Entrapment occurrences are typically safe, so long as the passengers remain inside the elevator. Injuries can occur when passengers try to self-extract themselves from the elevator, e.g., obtaining abrasions or crushing injuries or even falling down the elevator shaft. It is always recommended that entrapped passengers signal for help and wait for properly trained rescue personnel to free them from the elevator.

## Exposed Hoistways / Wellways

**Table E15: Top Elevator Location Types by Number of Occurrences for Exposed Hoistways / Wellways (2012 – 2021)**

LOCATION TYPE	PERCENTAGE OF OCCURRENCES
Industrial	24.1%
Offices	19.0%
Rental Apartment Buildings	8.9%

**Table E16: Top Elevator Location Types by Observed Injury Burden for Exposed Hoistways / Wellways (2012 – 2021)**

LOCATION TYPE	PERCENTAGE OF OBSERVED INJURY BURDEN
Offices	70.0%
Commercial	19.7%
Assemblies	10.2%

## Top Areas of Risk

The top areas of risk in the Elevators Safety Program Area this fiscal year were:

1. Elevator risks in hospitals;
2. Elevator risks in retirement and long-term care homes; and
3. Elevator risks in condominiums.

### 1. Elevator Risks in Hospitals

Table E17: State of Safety Measures for Elevator Risks in Hospitals (2012 – 2021)

DESCRIPTION	FISCAL YEAR										TOTAL	AVERAGE	TREND (ANNUAL)
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021			
Incidents and Near Miss Occurrences	33	27	38	32	41	42	40	33	56	41	383	38	No Trend
Non-Permanent Injuries	23	10	17	10	17	13	16	7	19	16	148	15	No Trend
Permanent Injuries	1	1	2	0	2	1	0	0	0	0	7	1	No Trend
Fatalities	0	0	0	0	0	0	0	0	0	0	0	0	No Trend
Observed Injury Burden (FE/mpy)	0.08	0.004	0.44	0.001	0.01	0.03	0.05	0.00	0.001	0.00	N/A	0.06	N/A

Table E18: Risk of Injury or Fatality for Elevator Risks in Hospitals (2017 – 2021)

DESCRIPTION	FISCAL YEAR				
	2017	2018	2019	2020	2021
RIF, Old Calculation (FE/mpy)	N/A	3.49	4.10	5.64	5.99
RIF, New Calculation (FE/mpy)	N/A	N/A	0.27	0.37	0.29

Since most of the occurrences involved doors closing on hospital workers wheeling carts or gurneys, the high-risk threshold used was 1.00 FE/mpy.

Figure E4: Occurrences and Observed Injury Burden for Elevator Risks in Hospitals (2012 – 2021)

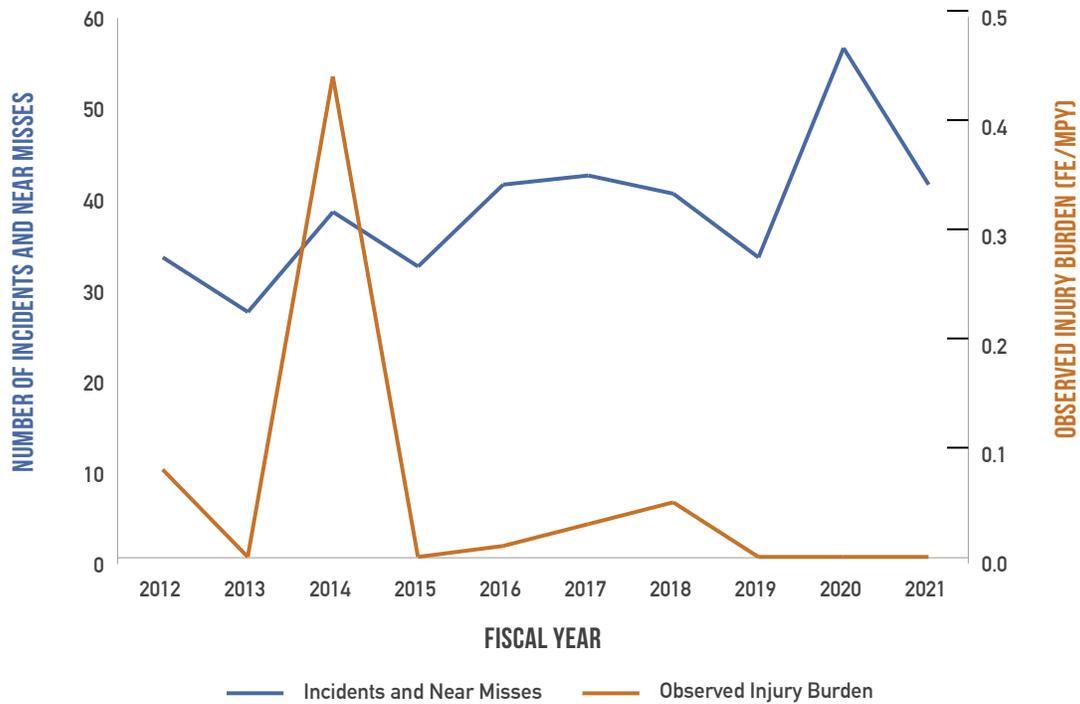


Table E19: Top Occurrence Types by Number of Occurrences for Elevators in Hospitals (2012 – 2021)

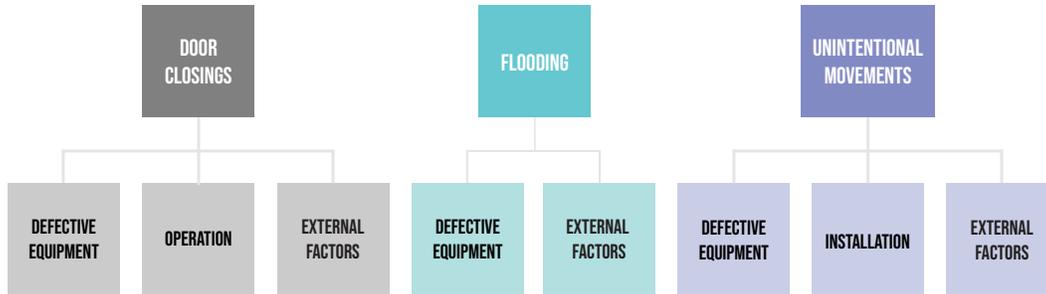
OCCURRENCE TYPE	PERCENTAGE OF OCCURRENCES
Flooding	29.5%
Door Closings	27.7%
Unintentional Movements	16.7%

Table E20: Top Occurrence Types by Observed Injury Burden for Elevators in Hospitals (2012 – 2021)

OCCURRENCE TYPE	PERCENTAGE OF OBSERVED INJURY BURDEN
Entrapments	61.2%
Door Closings	20.5%
Trips/Falls	6.8%

The figure below illustrates the contributing causes for elevator safety issues identified in hospitals. The primary safety issue was door closing occurrences which were driven mainly by elevator door speeds that did not provide adequate time for an individual to enter or exit the elevator in a safe manner, particularly when a worker was wheeling a cart or gurney.

**Figure E5: Top Contributing Causes of Elevator Safety Issues in Hospitals (2012 – 2021)**



## 2. Elevator Risks in Retirement and Long-Term Care Homes

Table E21: State of Safety Measures for Elevator Risks in Retirement and Long-Term Care Homes (2012 – 2021)

DESCRIPTION	FISCAL YEAR										TOTAL	AVERAGE	TREND (ANNUAL)
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021			
Incidents and Near Miss Occurrences	20	17	13	17	25	17	33	19	24	16	201	20	No Trend
Non-Permanent Injuries	8	7	5	4	8	7	12	10	3	5	69	7	No Trend
Permanent Injuries	2	1	0	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/mpy)	0.01	0.003	0.005	0.00	0.00	0.00	0.001	0.03	0.00	0.003	N/A	0.004	N/A

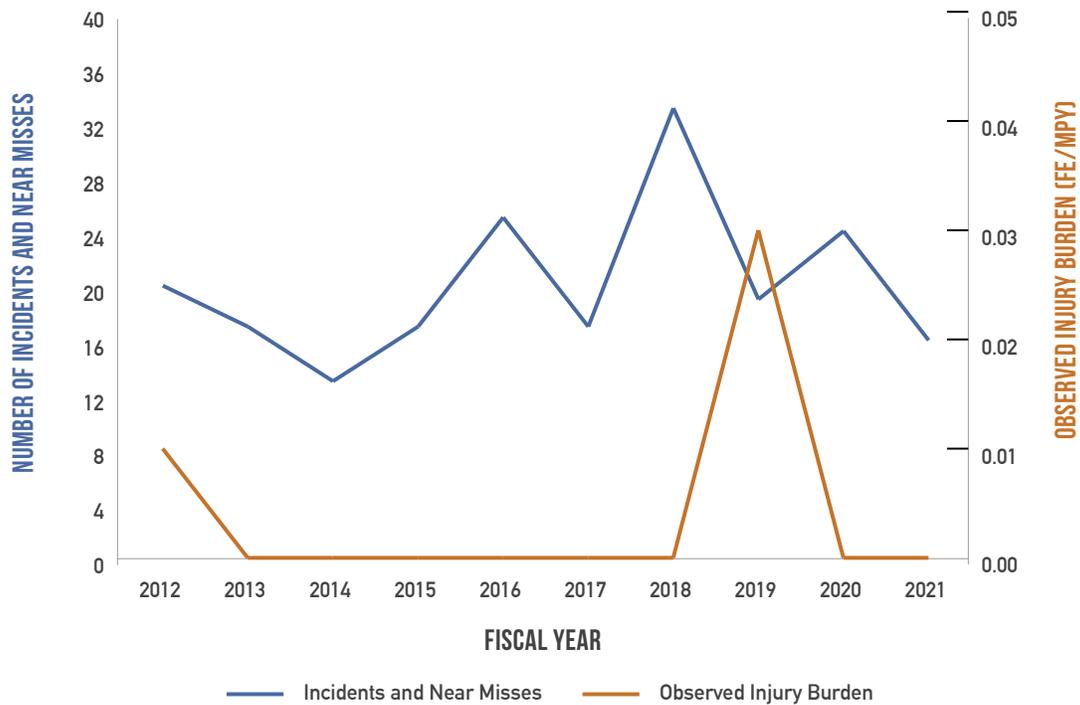
Over the past few years, inspectors have been reviewing and updating building type data as part of their inspections. As a result, some devices have changed building types and therefore data presented here may not match previous editions of the report.

Table E22: Risk of Injury or Fatality for Elevator Risks in Retirement and Long-Term Care Homes (2017 – 2021)

DESCRIPTION	FISCAL YEAR				
	2017	2018	2019	2020	2021
RIF, Old Calculation (FE/mpy)	0.82	0.70	0.72	2.11	2.07
RIF, New Calculation (FE/mpy)	N/A	N/A	0.06	0.14	0.14

The TSSA high-risk threshold is 0.30 FE/mpy for this Ontario sensitive sub-population.

**Figure E6: Occurrences and Observed Injury Burden for Elevator Risks in Retirement and Long-Term Care Homes (2012 – 2021)**



**Table E23: Top Occurrence Types by Number of Occurrences for Elevators in Retirement and Long-Term Care Homes (2012 – 2021)**

OCURRENCE TYPE	PERCENTAGE OF OCCURRENCES
Flooding	34.3%
Door Closings	28.4%
Unintentional Movements	13.4%

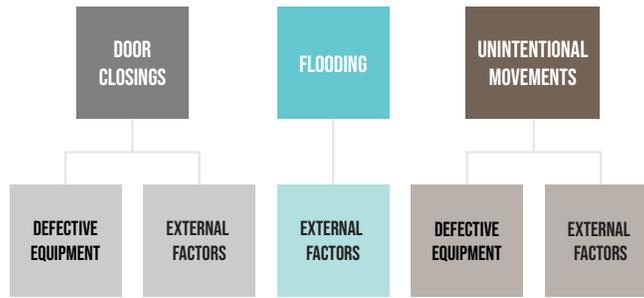
**Table E24: Top Occurrence Types by Observed Injury Burden for Elevators in Retirement and Long-Term Care Homes (2012 – 2021)**

OCURRENCE TYPE	PERCENTAGE OF OBSERVED INJURY BURDEN
Door Closings	86.0%
Trips/Falls	13.1%
Unintentional Movements	0.2%

The primary safety issue was elevator car doors closing on passengers. Door closing occurrences were driven mainly by elevator door speeds that did not provide adequate time for the resident to enter or exit the elevator in a safe manner. This risk was further exacerbated when the resident was reliant on a mobility aid. The figure below illustrates the contributing causes for elevator safety issues identified in retirement and long-term care homes.



**Figure E7: Top Contributing Causes of Elevator Safety Issues in Retirement and Long-Term Care Homes (2012 – 2021)**



### 3. Elevator Risks in Condominiums

Table E25: State of Safety Measures for Elevator Risks in Condominiums (2012 – 2021)

DESCRIPTION	FISCAL YEAR										TOTAL	AVERAGE	TREND (ANNUAL)
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021			
Incidents and Near Miss Occurrences	42	66	77	79	99	97	127	164	153	145	1,049	105	Increasing
Non-Permanent Injuries	23	17	22	10	26	25	14	15	24	14	190	19	No Trend
Permanent Injuries	2	6	2	1	1	0	1	1	1	0	15	2	No Trend
Fatalities	1	0	0	0	0	1	0	0	0	0	2	0	No Trend
Observed Injury Burden (FE/mpy)	0.27	0.02	0.002	0.001	0.01	0.27	0.05	0.01	0.00	0.00	N/A	0.06	N/A

Over the past few years, inspectors have been reviewing and updating building type data as part of their inspections. As a result, some devices have changed building types and therefore data presented here may not match previous editions of the report.

Table E26: Risk of Injury or Fatality for Elevator Risks in Condominiums (2017 – 2021)

DESCRIPTION	FISCAL YEAR				
	2017	2018	2019	2020	2021
RIF, Old Calculation (FE/mpy)	0.61	0.40	0.42	0.70	0.72
RIF, New Calculation (FE/mpy)	N/A	N/A	0.03	0.05	0.05

The TSSA high-risk threshold is 1.00 FE/mpy.

Figure E8: Occurrences and Observed Injury Burden for Elevator Risks in Condominiums (2012 – 2021)

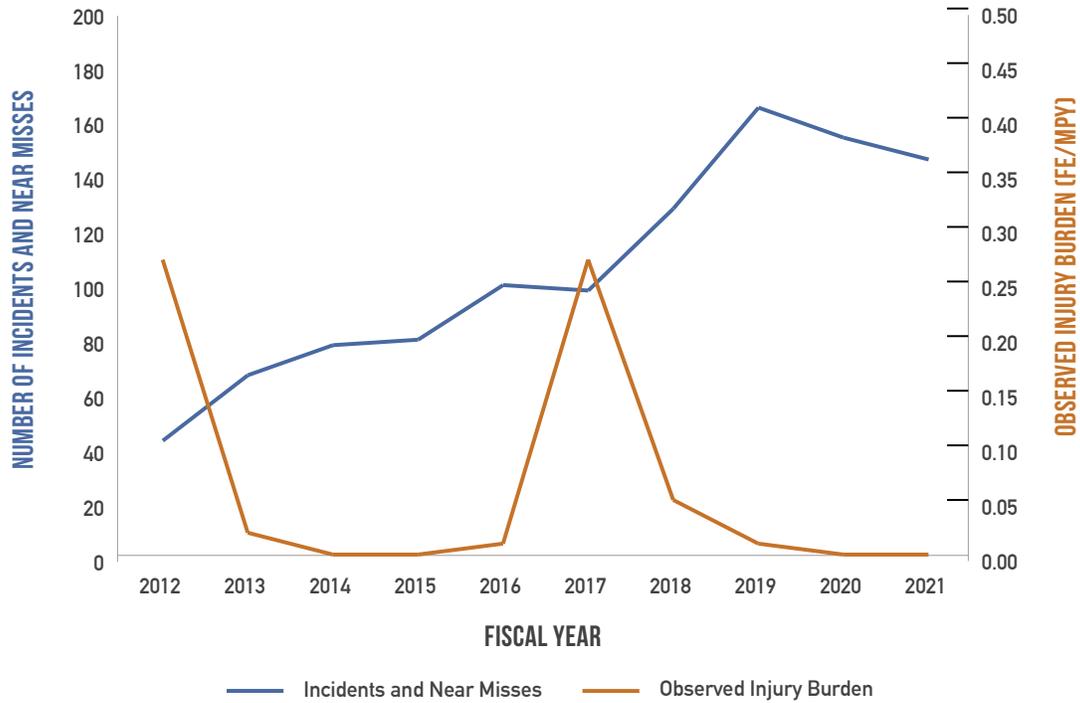


Table E27: Top Occurrence Types by Number of Occurrences for Elevators in Condominiums (2012 – 2021)

OCCURRENCE TYPE	PERCENTAGE OF OCCURRENCES
Flooding	55.8%
Unintentional Movements	14.4%
Door Closings	10.4%

Table E28: Top Occurrence Types by Observed Injury Burden for Elevators in Condominiums (2012 – 2021)

OCCURRENCE TYPE	PERCENTAGE OF OBSERVED INJURY BURDEN
Door Closings	43.7%
Fires	7.3%
Trips/Falls	5.2%



The figure below illustrates the contributing causes for elevator safety issues identified in condominiums.

**Figure E9: Top Contributing Causes of Elevator Safety Issues in Condominiums (2012 – 2021)**



## 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 E29: Number of Elevators (2021)

DESCRIPTION	NUMBER
Elevators inventory	61,038
Elevators that had sufficient inspection history to calculate a risk score	48,420

Figure E10: Inventory Risk Profiles from Outcomes of Periodic Inspections Conducted on Elevators (2017 – 2021)

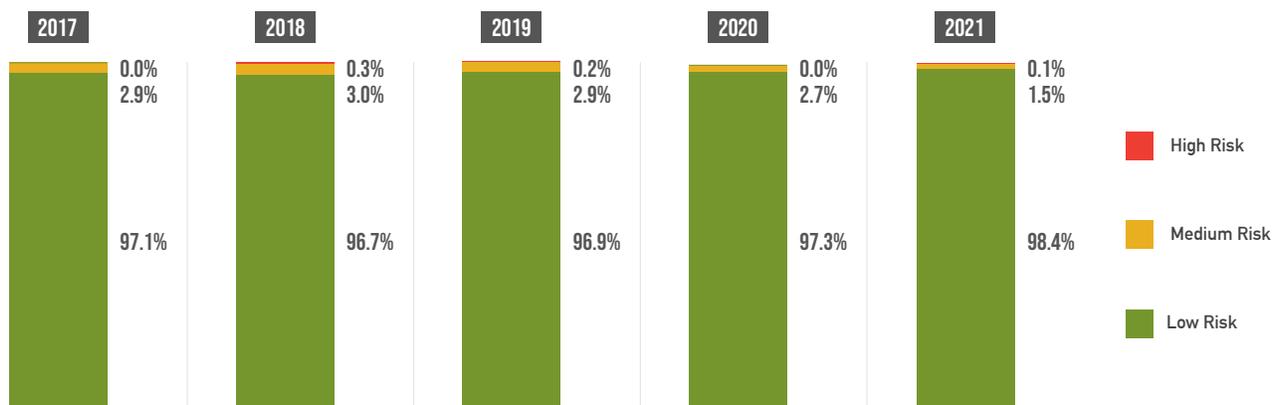


Table E30: Number of High-Risk Elevators (2021)

DESCRIPTION	NUMBER	PERCENT OF QUALIFIED PROVINCIAL INVENTORY
High-Risk Devices	38	0.1%

Table E31: Top High-Risk Elevator Location Types (2021)

LOCATION TYPE	PERCENTAGE OF TOTAL HIGH-RISK ELEVATORS
Rental Apartments	26.3%
Assemblies	21.1%
Offices	18.4%

## Compliance

The compliance rate is defined as the percentage of periodic inspections with no orders issued compared to the total number of periodic inspections.

**Figure E11: Yearly Compliance Rates from Outcomes of Periodic Inspections Conducted on Elevators (2017 – 2021)**



**Table E32: Five-Year Mean Compliance Rate from Outcomes of Periodic Inspections Conducted on Elevators (2017 – 2021)**

DESCRIPTION	FISCAL YEARS 2017 – 2021	TREND (ANNUAL)
Compliance Rate (Mean)	19.3%	No Trend

**Table E33: Top Compliance Issues by Number of Orders Issued from Outcomes of Periodic Inspections Conducted on Elevators (2017 – 2021)**

COMPLIANCE ISSUE	PERCENTAGE OF TOTAL NUMBER OF ORDERS ISSUED
Late annual periodic task for emergency power and lowering operation	2.9%
Late annual periodic task for firefighter emergency operation	2.2%
Current elevator device licence not posted	1.8%

**Table E34: Top Compliance Issues by Risk of Orders Issued from Outcomes of Periodic Inspections Conducted on Elevators (2017 – 2021)**

COMPLIANCE ISSUE	PERCENTAGE OF TOTAL RISK OF ORDERS ISSUED
Drive machine brakes inadequate stopping and holding capacity	18.5%
Machine brake requiring repair or replacement	7.6%
No reference point for oil level	5.1%

## Risk of Orders

While the compliance rate provides an outcome of the periodic inspection (e.g., pass or fail), the inspection risk spectrum (shown as pie charts) portrays the potential safety risks associated with non-compliance. The red segments of the spectrums show high levels of risk.

**Table E35: Inspection Risk Spectrum from Outcomes of Periodic Inspections Conducted on Elevators (2021)**

INSPECTION RISK SPECTRUM	FISCAL YEAR 2021
High-Risk Issues	0.2%
Low-Risk Issues	44.7%

**Figure E12: Inspection Risk Spectrums from Outcomes of Periodic Inspections Conducted on Elevators (2017 – 2021)**



Some typical examples of minor issues include: overdue periodic testing; the car top not being cleaned; missing data plate for counterweight; current licence not posted in a conspicuous location; and pit lighting being inoperative.

## 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, 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.

**Table E36: Elevators Inspection and Re-Inspection Results (2021)**

INSPECTION TYPE	PASS	FAIL	OTHER	GRAND TOTAL	PASS RATE (%)
Ad Hoc/Unscheduled Inspections	490	900	110	1,500	35.3%
Initial Inspections	824	2,066	0	2,890	28.5%
Minor Alteration Inspections	1,783	1,341	0	3,124	57.1%
Non-Mandated/Non-Regulated Inspections	406	418	7	831	49.3%
Occurrence Inspections	34	118	50	202	22.4%
Other Inspections	21	149	72	242	12.4%
Periodic Inspections	2,966	12,081	251	15,298	19.7%
Re-Inspections	8,734	17,504	287	26,525	33.3%
Elevators Total	15,258	34,577	777	50,612	30.6%

## Legislation and Regulatory Information

**Table E37: TSSA Elevators Legislation and Regulatory Information (2021)**

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 Elevators director’s orders, bulletins or guidelines issued.

The following advisories were issued:

- 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.

See [www.tssa.org](http://www.tssa.org) for a comprehensive listing of legislation and regulatory information.

# Appendix F – 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 licences, conducts inspections, performs incident investigations, registers contractors, and certifies mechanics. The Elevating Devices Safety Program consists of three areas: 1) elevators; 2) escalators and moving walks; and 3) 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 100<sup>th</sup> percentile due to rounding off.

## Incidents, Injuries and Risk Prediction

Table F1: State of Safety Measures for Escalators and Moving Walks (2012 – 2021)

DESCRIPTION	FISCAL YEAR										TOTAL	AVERAGE	TREND (ANNUAL)
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021			
Incidents and Near Miss Occurrences	522	519	642	592	742	702	726	785	676	385	6,291	629	No Trend
Non-Permanent Injuries	362	384	438	383	470	441	458	519	456	203	4,114	411	No Trend
Permanent Injuries	4	3	3	7	5	4	0	4	1	3	34	3	No Trend
Fatalities	0	0	0	0	0	0	0	0	0	0	0	0	No Trend
Observed Injury Burden (FE/mpy)	0.02	0.01	0.002	0.01	0.02	0.002	0.003	0.004	0.003	0.01	N/A	0.01	N/A

Table F2: Risk of Injury or Fatality for Escalators and Moving Walks (2017 – 2021)

DESCRIPTION	FISCAL YEAR				
	2017	2018	2019	2020	2021
RIF, Old Calculation (FE/mpy)	0.07	0.07	0.06	0.05	0.05
RIF, New Calculation (FE/mpy)	N/A	N/A	0.01	0.01	0.01

The TSSA high-risk threshold is 1.00 FE/mpy.

Figure F1: Occurrences and Observed Injury Burden for Escalators and Moving Walks (2012 – 2021)

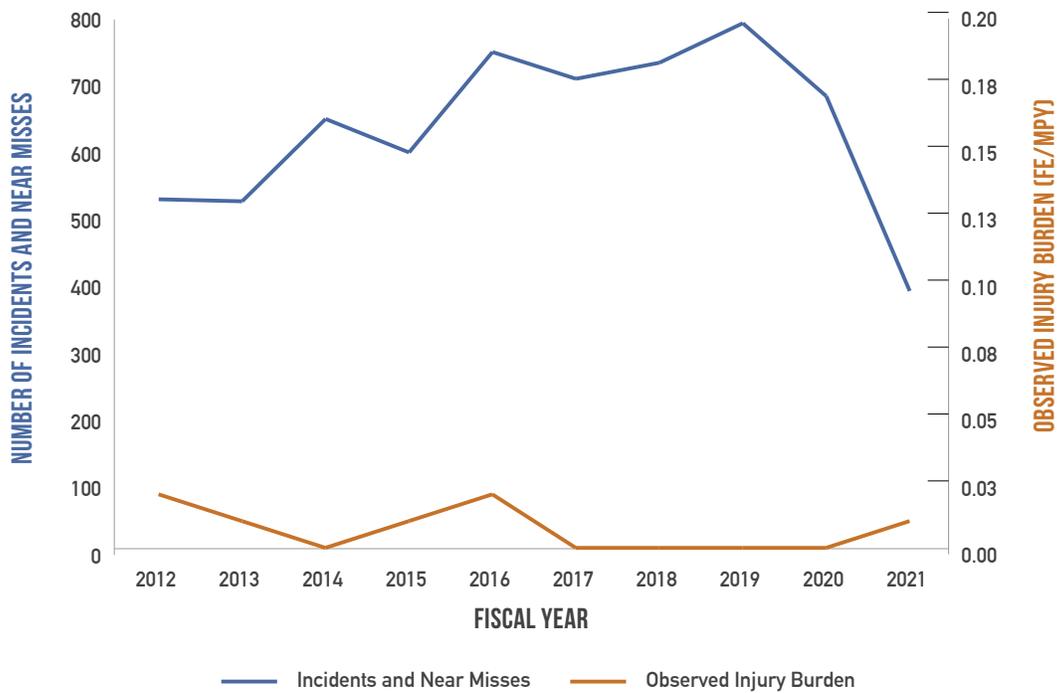


Figure F2: Injuries and Fatalities for Escalators and Moving Walks (2012 – 2021)

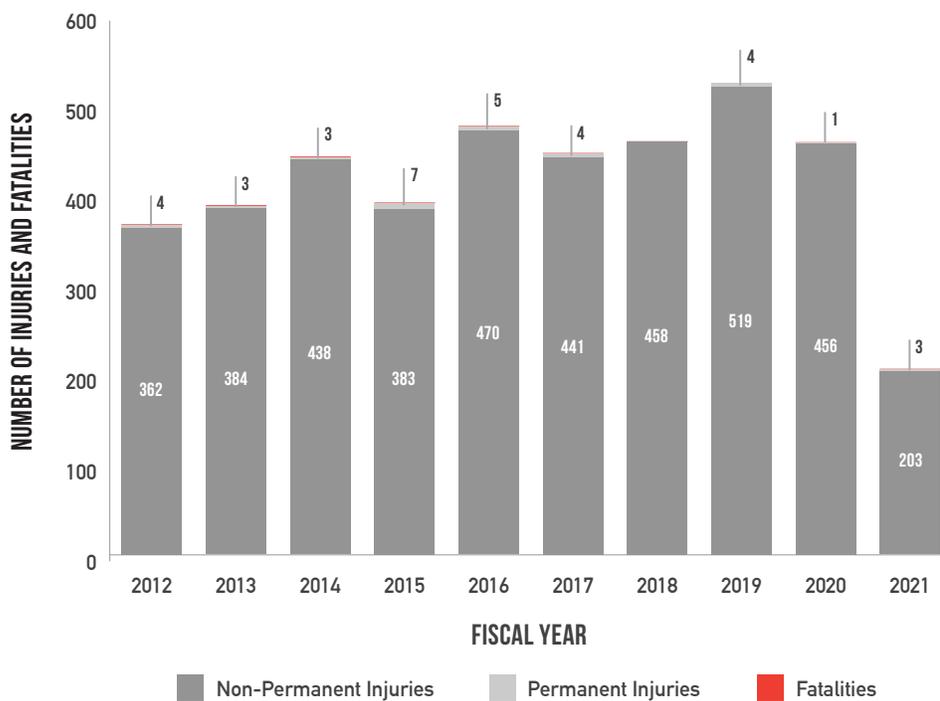
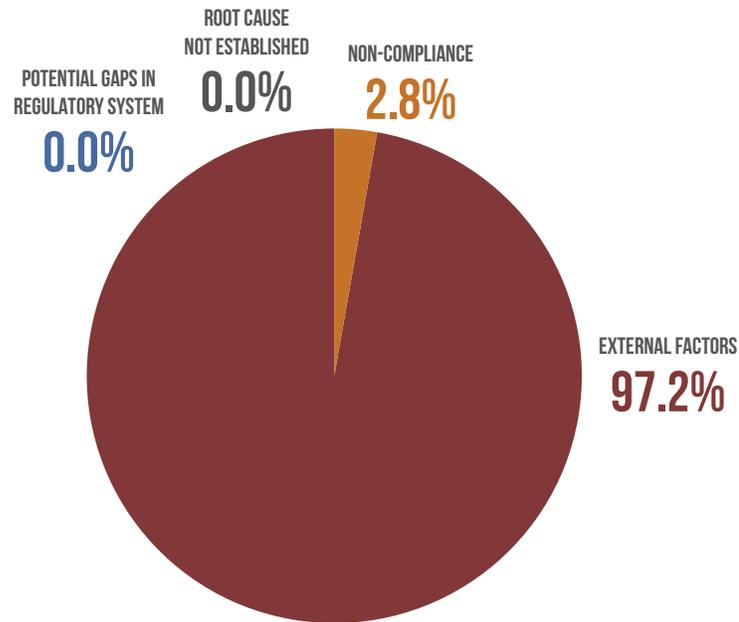


Figure F3: Risk of Injury or Fatality for Escalators and Moving Walks by Casual Analysis Category (2012 - 2021)



Over 95 per cent of risk in the past 10 years was a result of external factors.

### Risks due to Potential Gaps in the Regulatory System

Some typical examples of potential gaps in the regulatory system include: improving warning signage or preventing access to stationary escalators to prevent injury to passengers (escalators are more dangerous than stairs because of varying step heights near the ends); improving design of comb teeth or improving warning signage to prevent entrapments; and improving fastener locking requirements to prevent parts coming loose and injuring passengers.

### Risks due to Non-Compliance

Some typical examples of non-compliance include: a relay coil failure in a controller; steps piled up on broken comb plates causing the handrail to stop; bull gear bolts loosened and sheared; and a step chain that jumped out of the drive sprocket.

### Risks due to External Factors

Some typical examples of external factors include: a passenger with a walker losing their balance and falling down the escalator; a passenger walking on a moving escalator, missing a step, and falling; a passenger getting their shoe caught in the escalator; a child running up the down escalator tripping and falling; and an infant falling out of a stroller.

### Risks due to All Causes

Table F3: Human Factors in Escalators and Moving Walks Occurrences (2012 – 2021)

DESCRIPTION	PERCENTAGE OF OCCURRENCES
Human Factors	92.8%

Table F4: Top Escalators and Moving Walks Location Types by Number of Occurrences (2012 – 2021)

LOCATION TYPE	PERCENTAGE OF OCCURRENCES
Mass Transportation	61.8%
Commercial	30.4%
Offices	4.2%

Table F5: Top Escalators and Moving Walks Location Types by Observed Injury Burden (2012 – 2021)

LOCATION TYPE	PERCENTAGE OF OBSERVED INJURY BURDEN
Commercial	41.4%
Mass Transportation	38.4%
Offices	18.1%

Table F6: Top Occurrence Types for Escalators and Moving Walks by Number of Occurrences (2012 – 2021)

OCCURRENCE TYPE	PERCENTAGE OF OCCURRENCES
Trips/Falls	82.2%
Entrapments	10.6%
Flooding	2.2%

Table F7: Top Occurrence Types for Escalators and Moving Walks by Observed Injury Burden (2012 – 2021)

OCCURRENCE TYPE	PERCENTAGE OF OBSERVED INJURY BURDEN
Trips/Falls	91.4%
Entrapments	5.5%
Unintentional Movements	1.9%

The top occurrence types are discussed below in greater detail.

### *Trips/Falls*

Table F8: Top Escalators and Moving Walks Location Types by Number of Occurrences for Trips/Falls (2012 – 2021)

LOCATION TYPE	PERCENTAGE OF OCCURRENCES
Mass Transportation	63.9%
Commercial	29.4%
Offices	3.5%

Table F9: Top Escalators and Moving Walks Location Types by Observed Injury Burden for Trips/Falls (2012 – 2021)

LOCATION TYPE	PERCENTAGE OF OBSERVED INJURY BURDEN
Commercial	42.8%
Mass Transportation	38.2%
Offices	18.2%



## Entrapments

Note that the term “entrapment” when used with escalators has a different meaning than when used with elevators. In this case, it refers to the consequence that could result when a user’s body parts, clothing, footwear or accessories becomes physically caught in the moving parts of an escalator or moving walk.

**Table F10: Top Escalators and Moving Walks Location Types by Number of Occurrences for Entrapments (2012 – 2021)**

LOCATION TYPE	PERCENTAGE OF OCCURRENCES
Mass Transportation	59.2%
Commercial	32.3%
Offices	5.1%

**Table F11: Top Escalators and Moving Walks Location Types by Observed Injury Burden for Entrapments (2012 – 2021)**

LOCATION TYPE	PERCENTAGE OF OBSERVED INJURY BURDEN
Mass Transportation	48.0%
Commercial	26.5%
Assemblies	25.0%

## Flooding

**Table F12: Top Escalators and Moving Walks Location Types by Number of Occurrences for Flooding (2012 – 2021)**

LOCATION TYPE	PERCENTAGE OF OCCURRENCES
Mass Transportation	48.9%
Commercial	28.8%
Offices	16.5%

Observed injury burden due to flooding was negligible.

## Unintentional Movements

**Table F13: Top Escalators and Moving Walks Location Types by Number of Occurrences for Unintentional Movements (2012 – 2021)**

LOCATION TYPE	PERCENTAGE OF OCCURRENCES
Mass Transportation	44.2%
Commercial	37.2%
Offices	15.1%

**Table F14: Top Escalators and Moving Walks Location Types by Observed Injury Burden for Unintentional Movements (2012 – 2021)**

LOCATION TYPE	PERCENTAGE OF OBSERVED INJURY BURDEN
Offices	74.6%
Commercial	20.9%
Learning Institutions	4.3%

Some examples of learning institutions include schools, colleges and universities.



## 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 F15: Number of Escalators and Moving Walks (2021)

DESCRIPTION	NUMBER
Escalators and moving walks inventory	2,278
Escalators and moving walks that had sufficient inspection history to calculate a risk score	1,605

Figure F4: Inventory Risk Profiles from Outcomes of Periodic Inspections Conducted on Escalators and Moving Walks (2017 – 2021)

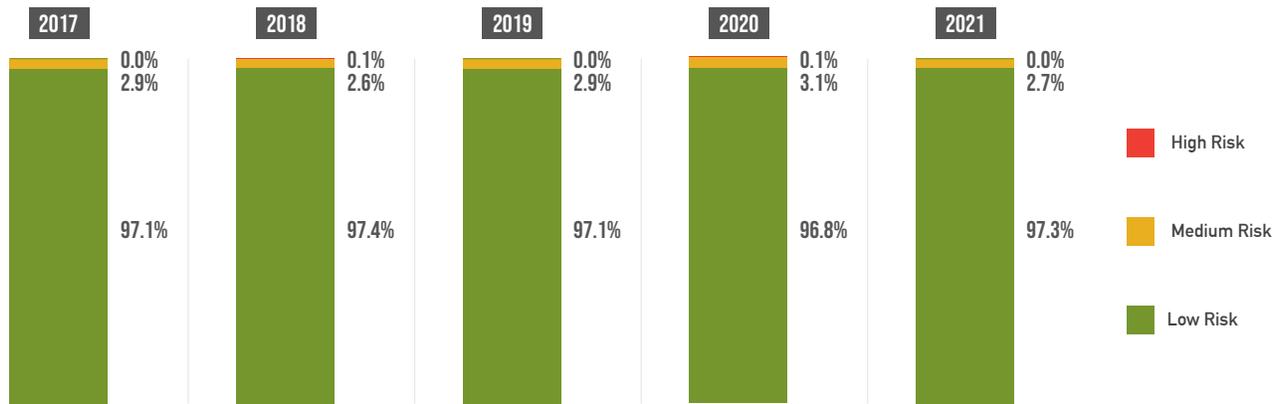


Table F16: Number of High-Risk Escalators and Moving Walks (2021)

DESCRIPTION	NUMBER	PERCENT OF QUALIFIED PROVINCIAL INVENTORY
High-Risk Devices	0	0.0%

## Compliance

The compliance rate is defined as the percentage of periodic inspections with no orders issued compared to the total number of periodic inspections.

**Figure F5: Yearly Compliance Rates from Outcomes of Periodic Inspections Conducted on Escalators and Moving Walks (2017 – 2021)**



**Table F17: Five-Year Mean Compliance Rate from Outcomes of Periodic Inspections Conducted on Escalators and Moving Walks (2017 – 2021)**

DESCRIPTION	FISCAL YEARS 2017 – 2021	TREND (ANNUAL)
Compliance Rate (Mean)	12.4%	No Trend

**Table F18: Top Compliance Issues by Number of Orders Issued from Outcomes of Periodic Inspections Conducted on Escalators and Moving Walks (2017 – 2021)**

COMPLIANCE ISSUE	PERCENTAGE OF TOTAL NUMBER OF ORDERS ISSUED
Late annual periodic task for skirt/step performance index	7.1%
Late maintenance for escalator cleaning	2.4%
Late annual periodic test for escalator clearance between step and skirt-loaded gap	2.2%

**Table F19: Top Compliance Issues by Risk of Orders Issued from Outcomes of Periodic Inspections Conducted on Escalators and Moving Walks (2017 – 2021)**

COMPLIANCE ISSUE	PERCENTAGE OF TOTAL RISK OF ORDERS ISSUED
Inadequate brake torque	18.0%
Incorrect no-loading stopping distance	9.2%
Issues with step/skirt performance index test	3.2%

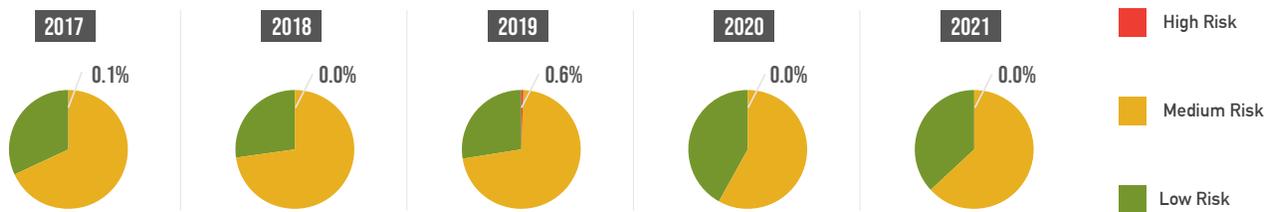
## Risk of Orders

While the compliance rate provides an outcome of the periodic inspection (e.g., pass/fail), the inspection risk spectrum (shown as a pie chart) portrays the potential safety risks associated with non-compliance found during the inspection. The red segments of the spectrums show high levels of risk.

**Table F20: Inspection Risk Spectrum from Outcomes of Periodic Inspections Conducted on Escalators and Moving Walks (2021)**

INSPECTION RISK SPECTRUM	FISCAL YEAR 2021
High-Risk Issues	0.0%
Low-Risk Issues	36.7%

**Figure F6: Inspection Risk Spectrums from Outcomes of Periodic Inspections Conducted on Escalators and Moving Walks (2017 – 2021)**



Some typical examples of minor issues include: overdue periodic testing; missing signage; inoperative lighting in the machine space; the brake adjustment procedure not being posted; and records of authorized trained personnel not available.

## 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, 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.



**Table F21: Escalators and Moving Walks Inspection and Re-Inspection Results (2021)**

INSPECTION TYPE	PASS	FAIL	OTHER	GRAND TOTAL	PASS RATE (%)
Ad Hoc/Unscheduled Inspections	2	29	16	47	6.5%
Initial Inspections	10	32	0	42	23.8%
Minor Alteration Inspections	41	14	0	55	74.5%
Non-Mandated/Non-Regulated Inspections	19	13	0	32	59.4%
Occurrence Inspections	4	11	7	22	26.7%
Other Inspections	0	6	20	26	0.0%
Periodic Inspections	180	652	11	843	21.6%
Re-Inspections	366	828	9	1,203	30.7%
<b>Escalators and Moving Walks Total</b>	<b>622</b>	<b>1,585</b>	<b>63</b>	<b>2,270</b>	<b>28.2%</b>

## Legislation and Regulatory Information

**Table F22: TSSA Escalators and Moving Walks Legislation and Regulatory Information (2021)**

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.

See [www.tssa.org](http://www.tssa.org) for a comprehensive listing of legislation and regulatory information.

# Appendix G – Passenger Ropeways (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 licences, conducts inspections, performs incident investigations, registers contractors, and certifies mechanics. The Elevating Devices Safety Program consists of three areas: 1) elevators; 2) escalators and moving walks; and 3) 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 100<sup>th</sup> percentile due to rounding off.

## Incidents, Injuries and Risk Prediction

Table G1: State of Safety Measures for Ski Lifts (2012 – 2021)

DESCRIPTION	FISCAL YEAR										TOTAL	AVERAGE	TREND (ANNUAL)
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021			
Incidents and Near Miss Occurrences	132	83	88	66	72	71	87	83	90	33	805	81	No Trend
Non-Permanent Injuries	117	70	66	52	54	60	64	66	61	25	635	64	No Trend
Permanent Injuries	0	0	3	2	2	3	2	1	2	2	17	2	No Trend
Fatalities	0	0	0	0	0	0	0	0	0	0	0	0	No Trend
Observed Injury Burden (FE/mpy)	0.003	0.003	0.03	0.02	0.03	0.01	0.01	0.005	0.001	0.01	N/A	0.01	N/A

Table G2: Risk of Injury or Fatality for Ski Lifts (2017 – 2021)

DESCRIPTION	FISCAL YEAR				
	2017	2018	2019	2020	2021
RIF, Old Calculation (FE/mpy)	0.02	0.02	0.02	0.01	0.01
RIF, New Calculation (FE/mpy)	N/A	N/A	0.01	0.01	0.01

The TSSA high-risk threshold is 1.00 FE/mpy.

Figure G1: Occurrences and Observed Injury Burden for Ski Lifts (2012 – 2021)

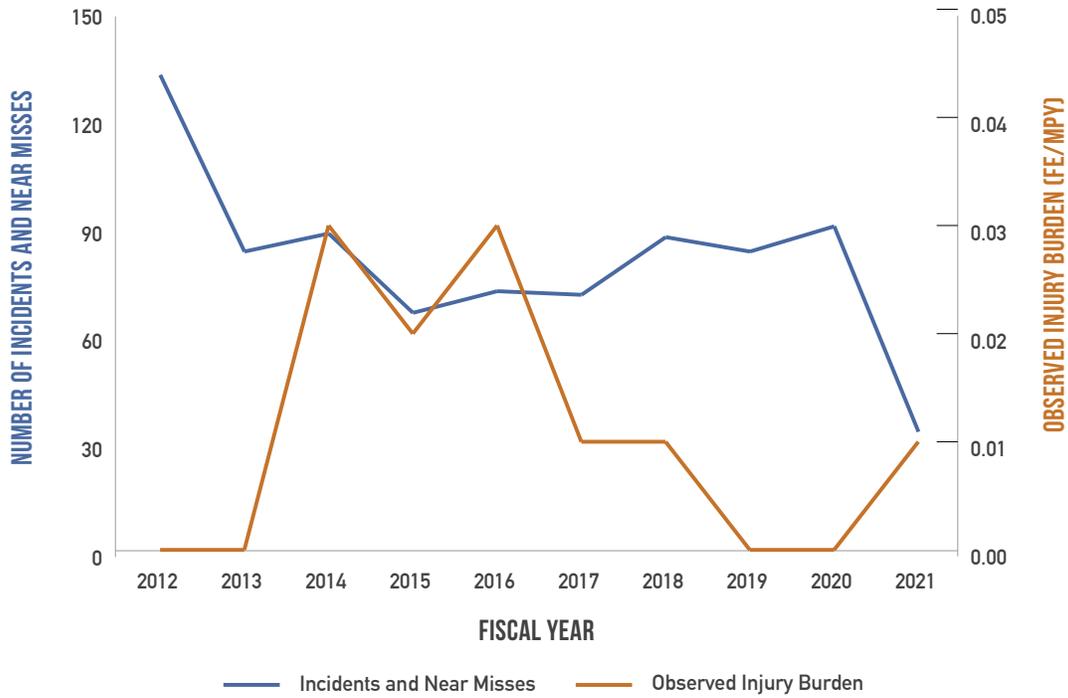


Figure G2: Injuries and Fatalities for Ski Lifts (2012 – 2021)

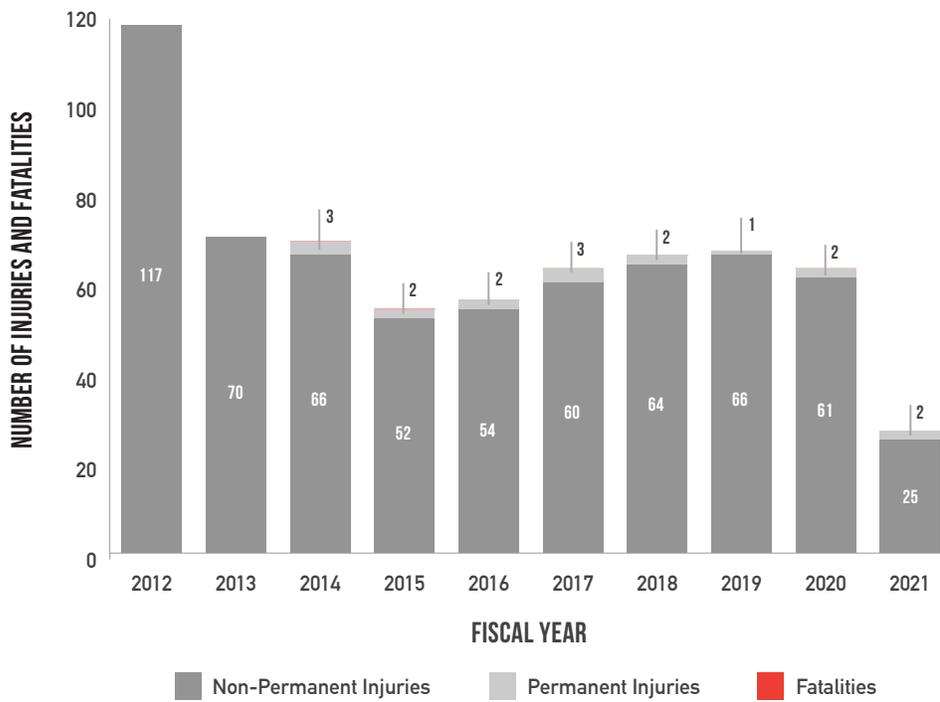
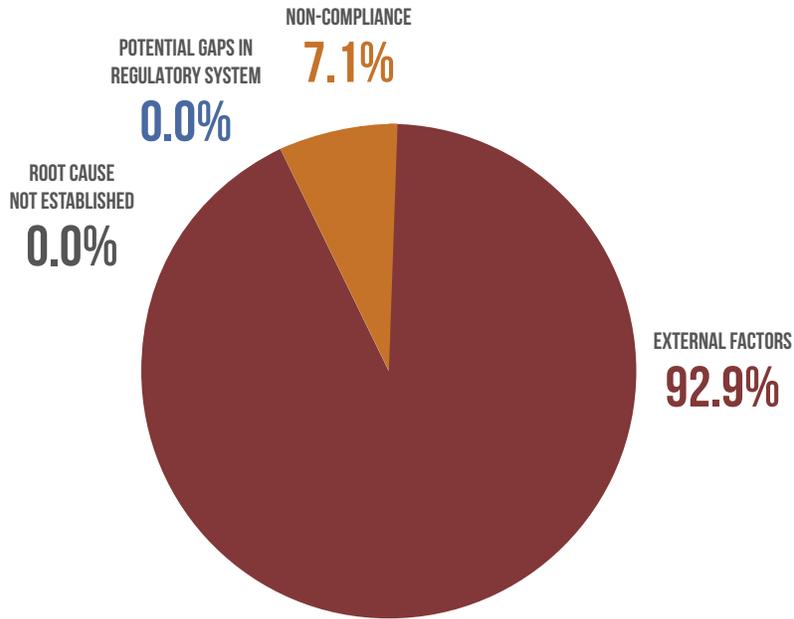


Figure G3: Risk of Injury or Fatality for Ski Lifts by Causal Analysis Category (2012 - 2021)



Over 90 per cent of risk in the past 10 years was a result of external factors.

### Risks due to Potential Gaps in the Regulatory System

There was only one example of a potential gap in the regulatory system: improving the design requirements of ski lifts to remove parts that could potentially entrap the passenger.

### Risks due to Non-Compliance

Some typical examples of non-compliance include: a cracked seat pivot pin keeper tab; a bull wheel cracked shaft; a broken gearbox pinion shaft; stitching broken at a tow ring; and a broken heat pad in an electrical panel.

### Risks due to External Factors

Some typical examples of external factors include: a passenger's friend lifting the bar and hitting him in the lip resulting in a cut; a passenger falling while loading and hurting their ankle; a passenger's skis getting tangled with another skier's resulting in a sprained ankle; a child not seated properly resulting in the child sliding out and hanging from the seat; and a child being hit in the head by the handle of the ski tow.

### Risks due to All Causes

Table G3: Human Factors in Ski Lifts Occurrences (2012 – 2021)

DESCRIPTION	PERCENTAGE OF OCCURRENCES
Human Factors	92.0%

**Table G4: Top Ski Lift Types by Number of Occurrences (2012 – 2021)**

DEVICE TYPE	PERCENTAGE OF OCCURRENCES
Chair Lifts	82.7%
Passenger Conveyors	7.1%
Bar Lifts	6.3%

**Table G5: Top Ski Lift Types by Observed Injury Burden (2012 – 2021)**

DEVICE TYPE	PERCENTAGE OF OBSERVED INJURY BURDEN
Chair Lifts	80.5%
Rope Tows	11.9%
Passenger Conveyors	4.5%

**Table G6: Top Occurrence Types for Ski Lifts by Number of Occurrences (2012 – 2021)**

OCCURRENCE TYPE	PERCENTAGE OF OCCURRENCES
Trips/Falls	42.9%
Physical Impacts	28.0%
Falls from Height	18.4%

**Table G7: Top Occurrence Types for Ski Lifts by Observed Injury Burden (2012 – 2021)**

OCCURRENCE TYPE	PERCENTAGE OF OBSERVED INJURY BURDEN
Physical Impacts	31.0%
Trips/Falls	27.0%
Entanglements	23.5%

The top occurrence types are discussed below in greater detail.

### ***Trips/Falls***

**Table G8: Top Ski Lift Types by Number of Occurrences for Trips/Falls (2012 – 2021)**

DEVICE TYPE	PERCENTAGE OF OCCURRENCES
Chair Lifts	83.2%
Passenger Conveyors	10.1%
Rope Tows	5.2%

**Table G9: Top Ski Lift Types by Observed Injury Burden for Trips/Falls (2012 – 2021)**

DEVICE TYPE	PERCENTAGE OF OBSERVED INJURY BURDEN
Chair Lifts	45.1%
Rope Tows	40.4%
Passenger Conveyors	11.1%



## Physical Impacts

Table G10: Top Ski Lift Types by Number of Occurrences for Physical Impacts (2012 – 2021)

DEVICE TYPE	PERCENTAGE OF OCCURRENCES
Chair Lifts	72.9%
Bar Lifts	17.3%
Passenger Conveyors	5.8%

Table G11: Top Ski Lift Types by Observed Injury Burden for Physical Impacts (2012 – 2021)

DEVICE TYPE	PERCENTAGE OF OBSERVED INJURY BURDEN
Chair Lifts	90.6%
Bar Lifts	6.8%
Passenger Conveyors	2.6%

## Falls from Height

Table G12: Top Ski Lift Types by Number of Occurrences for Falls from Height (2012 – 2021)

DEVICE TYPE	PERCENTAGE OF OCCURRENCES
Chair Lifts	94.6%
Bar Lifts	2.0%
Rope Tows	2.0%

Table G13: Top Ski Lift Types by Observed Injury Burden for Falls from Height (2012 – 2021)

DEVICE TYPE	PERCENTAGE OF OBSERVED INJURY BURDEN
Chair Lifts	100.0%

## Entanglement

Table G14: Top Ski Lift Types by Number of Occurrences for Entanglements (2012 – 2021)

DEVICE TYPE	PERCENTAGE OF OCCURRENCES
Chair Lifts	98.2%
Bar Lifts	1.8%

Table G15: Top Ski Lift Types by Observed Injury Burden for Entanglements (2012 – 2021)

DEVICE TYPE	PERCENTAGE OF OBSERVED INJURY BURDEN
Chair Lifts	100.0%

## 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 G16: Number of Ski Lifts (2021)

DESCRIPTION	NUMBER
Ski lifts inventory	233
Ski lifts that had sufficient inspection history to calculate a risk score	246

Figure G4: Inventory Risk Profiles from Outcomes of Periodic Inspections Conducted on Ski Lifts (2017 – 2021)

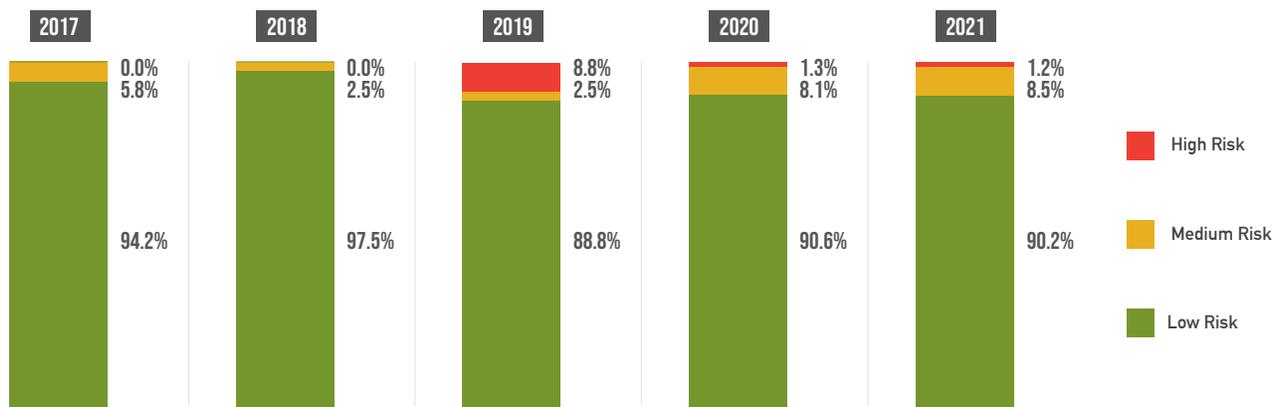


Table G17: Number of High-Risk Ski Lifts (2021)

DESCRIPTION	NUMBER	PERCENT OF QUALIFIED PROVINCIAL INVENTORY
High-Risk Devices	3	1.2%

Table G18: Top High-Risk Ski Lift Types (2021)

DEVICE TYPE	PERCENTAGE OF TOTAL HIGH-RISK SKI LIFTS
Bar Lifts	100.0%

## Compliance

The compliance rate is defined as the percentage of periodic inspections with no orders issued compared to the total number of periodic inspections.

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

Figure G5: Yearly Compliance Rates from Outcomes of Periodic Inspections Conducted on Ski Lifts (2017 – 2021)



Figure G6: Yearly Compliance Rates from Outcomes of Operational Inspections Conducted on Ski Lifts (2017 – 2021)



Table G19: Five-Year Mean Compliance Rate from Outcomes of Periodic Inspections Conducted on Ski Lifts (2017 – 2021)

DESCRIPTION	FISCAL YEARS 2017 – 2021	TREND (ANNUAL)
Compliance Rate (Mean)	42.6%	No Trend

Table G20: Five-Year Mean Compliance Rate from Outcomes of Operational Inspections Conducted on Ski Lifts (2017 – 2021)

DESCRIPTION	FISCAL YEARS 2017 – 2021	TREND (ANNUAL)
Compliance Rate (Mean)	69.5%	No Trend

Table G21: Top Compliance Issues by Number of Orders Issued from Outcomes of Periodic Inspections Conducted on Ski Lifts (2017 – 2021)

COMPLIANCE ISSUE	PERCENTAGE OF TOTAL NUMBER OF ORDERS ISSUED
Evacuation training has not been conducted	3.9%
Gap between the belt guides is too large	2.6%
Overhanging tree limbs	2.3%

Table G22: Top Compliance Issues by Number of Orders Issued from Outcomes of Operational Inspections Conducted on Ski Lifts (2017 – 2021)

COMPLIANCE ISSUE	PERCENTAGE OF TOTAL NUMBER OF ORDERS ISSUED
Personnel not adequately trained	31.2%
Operator not trained for specific device	14.9%
Device operated by untrained personnel	11.3%



**Table G23: Top Compliance Issues by Risk of Orders Issued from Outcomes of Periodic Inspections Conducted on Ski Lifts (2017 – 2021)**

COMPLIANCE ISSUE	PERCENTAGE OF TOTAL RISK OF ORDERS ISSUED
Inadequate clearance to carrier	15.7%
Safety gate too far from unload point	8.9%
Conveyor rigid skirting required	8.3%

**Table G24: Top Compliance Issues by Risk of Orders Issued from Outcomes of Operational Inspections Conducted on Ski Lifts (2017 – 2021)**

COMPLIANCE ISSUE	PERCENTAGE OF TOTAL RISK OF ORDERS ISSUED
Safety gate too far from unload point	34.8%
Inadequate clearance to carrier	30.5%
Conveyor rigid skirting required	16.1%

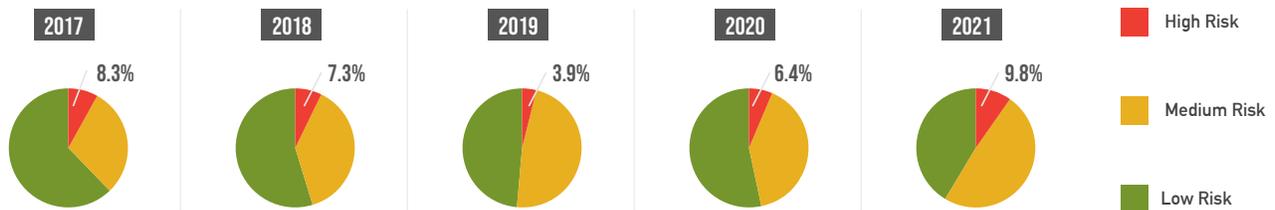
### Risk of Orders

While the compliance rate provides an outcome of the periodic inspection (e.g., pass/fail), the inspection risk spectrum (shown as a pie chart) portrays the potential safety risks associated with non-compliance found during the inspection. The red segments of the spectrums show high levels of risk.

**Table G25: Inspection Risk Spectrum from Outcomes of Periodic Inspections Conducted on Ski Lifts (2021)**

INSPECTION RISK SPECTRUM	FISCAL YEAR 2021
High-Risk Issues	9.8%
Low-Risk Issues	41.2%

**Figure G7: Inspection Risk Spectrums from Outcomes of Periodic Inspections Conducted on Ski Lifts (2017 – 2021)**



**Table G26: Inspection Risk Spectrum from Outcomes of Operational Inspections Conducted on Ski Lifts (2021)**

INSPECTION RISK SPECTRUM	FISCAL YEAR 2021
High-Risk Issues	0.0%
Low-Risk Issues	95.5%

**Figure G8: Inspection Risk Spectrums from Outcomes of Operational Inspections Conducted on Ski Lifts (2017 – 2021)**



Some typical examples of minor issues include: the machine room lighting not being guarded; missing signage; general housekeeping requirements not being met; towers not being identified with successive numbers; and start, run, stop, and speed control switches not being permanently marked.

### 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, 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.

**Table G27: Passenger Ropeways (Ski Lifts) Inspection and Re-Inspection Results (2021)**

INSPECTION TYPE	PASS	FAIL	OTHER	GRAND TOTAL	PASS RATE (%)
Ad Hoc/Unscheduled Inspections	1	1	0	2	50.0%
Alteration Inspections	7	1	0	8	87.5%
Initial Inspections	6	6	0	12	50.0%
Occurrence Inspections	0	1	0	1	0.0%
Operational Inspections	22	0	0	22	100.0%
Periodic Inspections	30	72	0	102	29.4%
Re-Inspections	35	23	1	59	60.3%
<b>Ski Lifts Total</b>	<b>101</b>	<b>104</b>	<b>1</b>	<b>206</b>	<b>49.3%</b>

### Legislation and Regulatory Information

**Table G28: TSSA Passenger Ropeways (Ski Lifts) Legislation and Regulatory Information (2021)**

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 Ski Lifts director’s orders, advisories, bulletins or guidelines issued. The following guideline was issued:

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

See [www.tssa.org](http://www.tssa.org) for a comprehensive listing of legislation and regulatory information.



# Appendix H – 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 perform 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 100<sup>th</sup> percentile due to rounding off.

## Incidents, Injuries and Risk Prediction

Table H1: State of Safety Measures for Fuels (2012 – 2021)

DESCRIPTION	FISCAL YEAR										TOTAL	AVERAGE	TREND (ANNUAL)
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021			
Incidents and Near Miss Occurrences <sup>9</sup>	946	1,258	1,333	1,090	898	991	996	1,059	853	674	10,098	1,010	Decreasing
Non-Permanent Injuries	51	37	102	27	53	55	40	24	20	16	425	43	Decreasing
Permanent Injuries	9	10	12	15	18	15	11	20	9	3	122	12	No Trend
Fatalities	2	4	10	4	1	2	1	1	2	3	30	3	No Trend
Observed Injury Burden (FE/mpy)	0.11	0.42	0.57	0.24	0.09	0.12	0.16	0.17	0.08	0.11	N/A	0.21	N/A
Pipeline Strike Occurrences <sup>10</sup>	2,426	2,347	2,372	2,471	2,366	2,296	2,379	2,301	2,167	2,165	23,290	2,329	Decreasing

Table H2: Risk of Injury or Fatality for Fuels (2017 – 2021)

DESCRIPTION	FISCAL YEAR				
	2017	2018	2019	2020	2021
RIF, Old Calculation (FE/mpy)	1.76	1.89	1.70	2.09	2.09
RIF, New Calculation (FE/mpy)	N/A	N/A	0.29	0.22	0.22

The TSSA high-risk threshold is 1.00 FE/mpy.

<sup>9</sup> The numbers in this row exclude pipeline strikes.

<sup>10</sup> The numbers in this row include pipeline strikes only. Data not included in Incidents & Near Miss Occurrences row above.

Figure H1: Occurrences and Observed Injury Burden for Fuels (2012 – 2021)

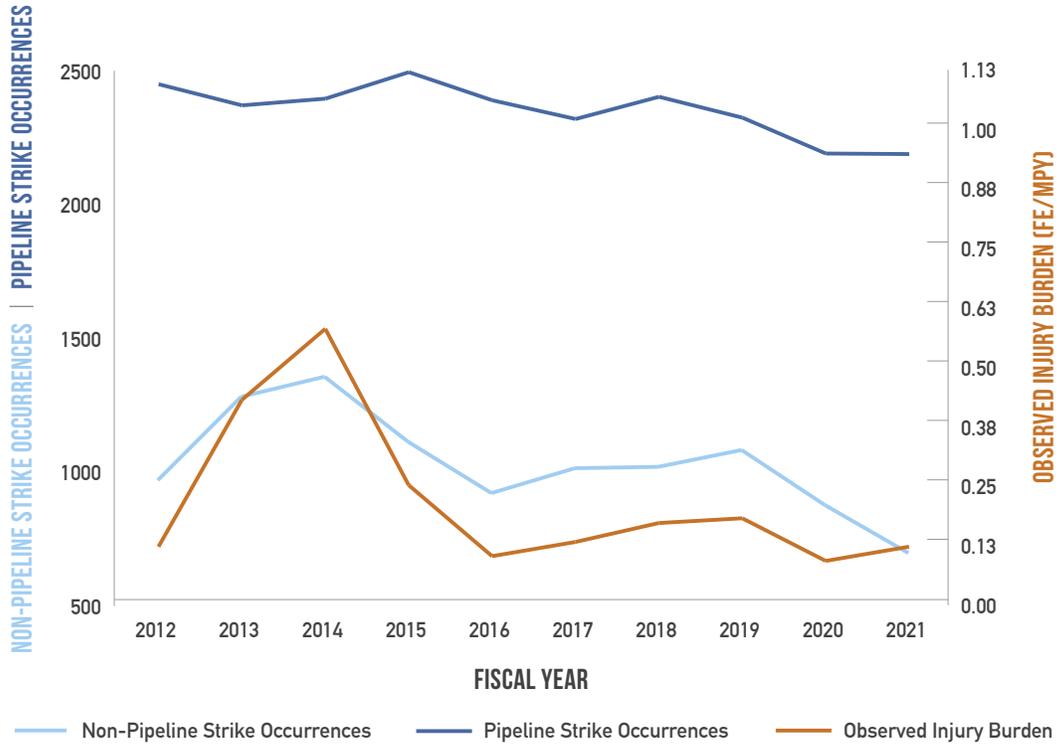


Figure H2: Injuries and Fatalities for Fuels (2012 – 2021)

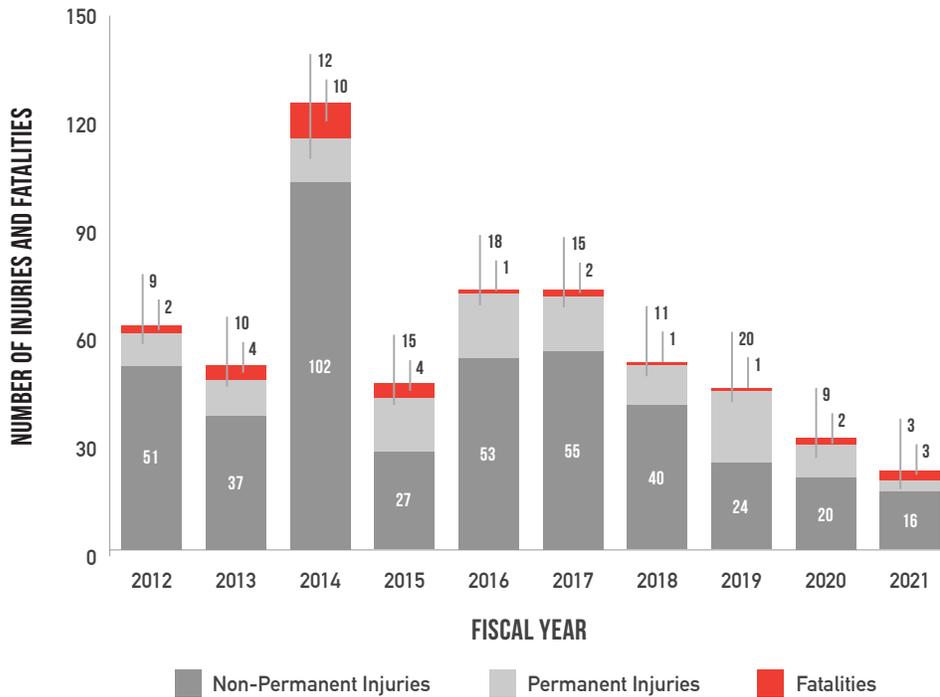
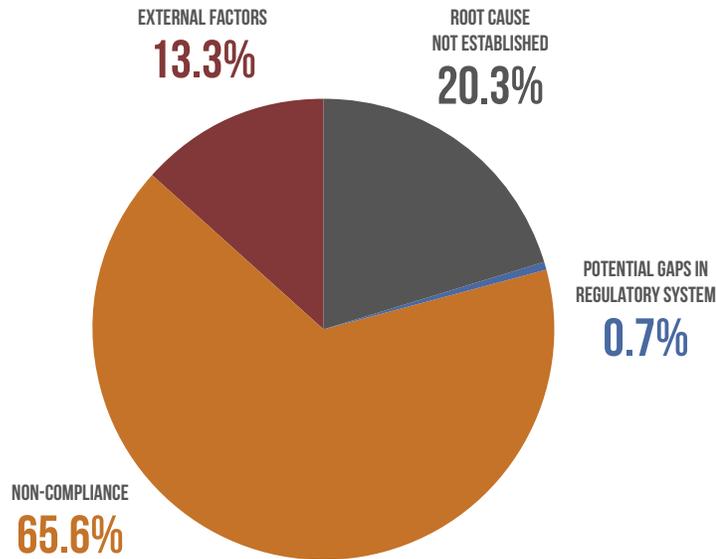


Figure H3: Risk of Injury or Fatality for Fuels by Casual Analysis Category (2012 - 2021)



Over 65 per cent of risk in the past 10 years was a result of non-compliance.

### Risks due to Potential Gaps in the Regulatory System

Some typical examples of potential gaps in the regulatory system include: an improperly sized kitchen exhaust fan that caused negative pressure, resulting in a downdraft in the stove; uncertified equipment installed; a natural gas meter set damaged by a vehicle due to inadequate crash protection; and a faulty relief valve that resulted in a vapour release.

### Risks due to Non-Compliance

Some typical examples of non-compliance include: no maintenance performed on a water heater since installation resulting in failed component parts; logs not installed properly in a natural gas fireplace resulting in a carbon monoxide (CO) release; a chimney liner installed too short, resulting in soot being released inside a residence; an appliance not installed to manufacturer's certified instructions; a worn out gasket; vent ducting not securely fastened; and a commercial kitchen fire as a result of a grease-laden exhaust hood.

### Risks due to External Factors

Some typical examples of external factors include: a chimney damaged in a wind storm blocking the exhaust; high winds causing a downdraft; freezing rain causing the combustion air outlet to be partially blocked, resulting in a CO release; a rooftop HVAC unit buried under heavy snow; and vandalism of a meter set.

### 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 result in, a damaged 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.

## Top Areas of Risk

The top areas of risk in the Fuels Safety Program this fiscal year were:

1. Fuel risks in retirement and long-term care homes;
2. Fuel risks in private dwellings; and
3. Fuel risks in business units.

### 1. Fuel Risks in Retirement and Long-Term Care Homes

Table H3: State of Safety Measures for Fuel Risks<sup>11</sup> in Retirement and Long-Term Care Homes (2012 – 2021)

DESCRIPTION	FISCAL YEAR										TOTAL	AVERAGE	TREND (ANNUAL)
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021			
Incidents and Near Miss Occurrences	10	17	13	8	7	7	12	7	12	2	95	10	No Trend
Non-Permanent Injuries	12	6	0	0	0	0	0	0	0	0	18	9	No Trend
Permanent Injuries	0	0	0	0	0	1	1	0	0	0	2	0	No Trend
Fatalities	0	0	0	0	0	0	0	0	0	0	0	0	No Trend
Observed Injury Burden (FE/mpy)	0.00	0.02	0.00	0.00	0.00	0.004	0.01	0.00	0.00	0.00	N/A	0.003	N/A

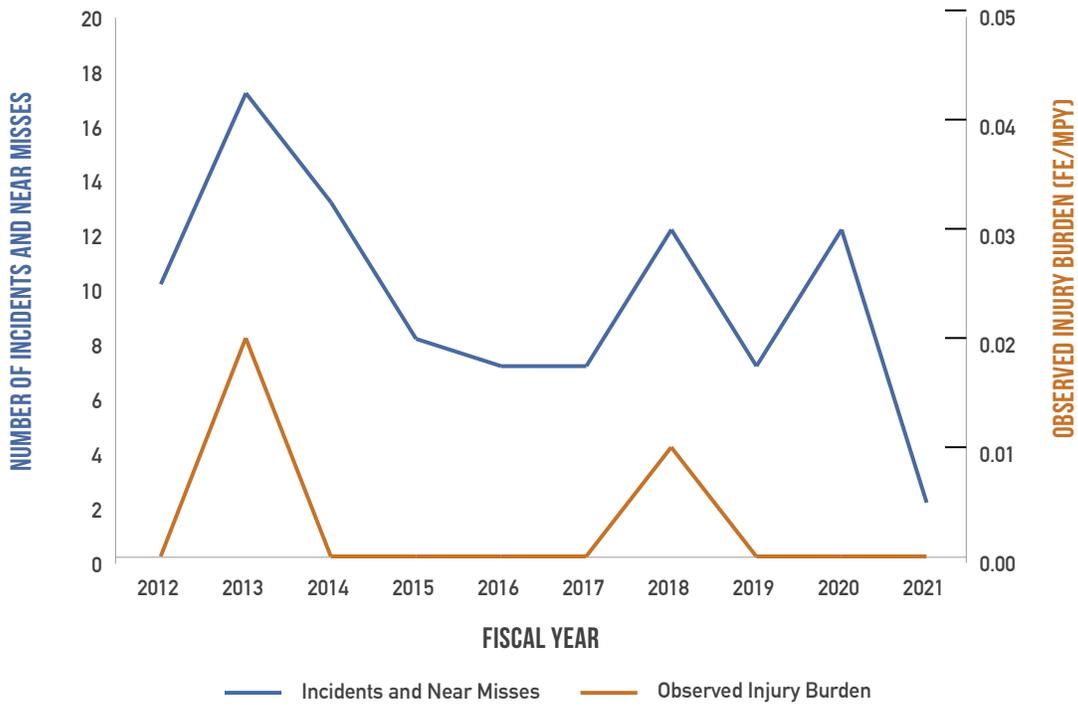
Table H4: Risk of Injury or Fatality for Fuel Risks in Retirement and Long-Term Care Homes (2017 – 2021)

DESCRIPTION	FISCAL YEAR				
	2017	2018	2019	2020	2021
RIF, Old Calculation (FE/mpy)	N/A	0.26	2.58	3.34	3.29
RIF, New Calculation (FE/mpy)	N/A	N/A	0.41	0.32	0.21

The TSSA high-risk threshold is 0.30 FE/mpy for this Ontario sensitive sub-population.

<sup>11</sup> Includes occurrences and injuries resulting from CO release, fire, explosion, and/or vapour release.

**Figure H4: Occurrences and Observed Injury Burden for Fuel Risks in Retirement and Long-Term Care Homes (2012 – 2021)**



**Table H5: Occurrence Types for Fuel Risks in Retirement and Long-Term Care Homes (2012 – 2021)**

OCURRENCE TYPE	PERCENTAGE OF OCCURRENCES
CO Releases	49.9%
Fires	24.9%
Vapour Releases	21.6%
Explosions	3.6%

Comprehensive drilldowns have been provided for CO releases, fires, explosions, and vapour releases.

## CO Releases

Table H6: Injuries and Fatalities for CO Releases in Retirement and Long-Term Care Homes (2012 – 2021)

DESCRIPTION	FISCAL YEARS 2012 – 2021
Non-Permanent Injuries	18
Permanent Injuries	0
Fatalities	0

Table H7: Risk of Injury or Fatality for CO Releases in Retirement and Long-Term Care Homes (2021)

DESCRIPTION	FISCAL YEAR 2021
RIF (FE/mpy)	0.14

Table H8: Top Equipment Types for CO Releases in Retirement and Long-Term Care Homes (2012 – 2021)

EQUIPMENT TYPE	PERCENTAGE OF OCCURRENCES
Boilers	5.4%
Rooftop HVAC Units	5.4%
Water Heaters	2.7%

## Explosions

Table H9: Injuries and Fatalities for Explosions in Retirement and Long-Term Care Homes (2012 – 2021)

DESCRIPTION	FISCAL YEARS 2012 – 2021
Non-Permanent Injuries	0
Permanent Injuries	1
Fatalities	0

Table H10: Risk of Injury or Fatality for Explosions in Retirement and Long-Term Care Homes (2021)

DESCRIPTION	FISCAL YEAR 2021
RIF (FE/mpy)	0.02

Table H11: Top Equipment Types for Explosions in Retirement and Long-Term Care Homes (2012 – 2021)

EQUIPMENT TYPE	PERCENTAGE OF OCCURRENCES
Barbecues	33.3%



## Fires

Table H12: Injuries and Fatalities for Fires in Retirement and Long-Term Care Homes (2012 – 2021)

DESCRIPTION	FISCAL YEARS 2012 – 2021
Non-Permanent Injuries	0
Permanent Injuries	1
Fatalities	0

Table H10: Risk of Injury or Fatality for Explosions in Retirement and Long-Term Care Homes (2021)

DESCRIPTION	FISCAL YEAR 2021
RIF (FE/mpy)	0.05

Table H11: Top Equipment Types for Explosions in Retirement and Long-Term Care Homes (2012 – 2021)

EQUIPMENT TYPE	PERCENTAGE OF OCCURRENCES
Barbecues	7.1%

## Vapour Releases

Table H15: Injuries and Fatalities for Vapour Releases in Retirement and Long-Term Care Homes (2012 – 2021)

DESCRIPTION	FISCAL YEARS 2012 – 2021
Non-Permanent Injuries	0
Permanent Injuries	0
Fatalities	0

Table H16: Risk of Injury or Fatality for Vapour Releases in Retirement and Long-Term Care Homes (2021)

DESCRIPTION	FISCAL YEAR 2021
RIF (FE/mpy)	0.00

There is insufficient data to determine contributing causes of fuel-related safety issues in retirement and long-term care homes.

## 2. Fuel Risks in Private Dwellings

Private dwellings are residential locations which, for the purposes of this report, include detached and semi-detached houses, duplexes and townhouses. In addition, TSSA is monitoring other configurations of residences to better understand their fuel-related risks.

**Table H17: State of Safety Measures for Fuel Risks<sup>12</sup> in Private Dwellings (2012 – 2021)**

DESCRIPTION	FISCAL YEAR										TOTAL	AVERAGE	TREND (ANNUAL)
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021			
Incidents and Near Miss Occurrences	493	655	688	594	409	476	520	626	451	382	5,294	529	Decreasing
Non-Permanent Injuries	20	23	24	10	21	30	34	18	14	13	207	21	No Trend
Permanent Injuries	7	7	7	6	12	5	4	10	7	3	68	7	No Trend
Fatalities	2	4	9	3	1	2	1	1	2	3	28	3	No Trend
Observed Injury Burden (FE/mpy)	0.12	0.53	0.57	0.26	0.10	0.12	0.20	0.13	0.09	0.14	N/A	0.23	N/A

This fiscal year, TSSA used a GIS API<sup>13</sup> to classify building types for Fuels occurrences. This automated classification may yield slight differences in occurrence counts when compared with different versions of the report.

**Table H18: Risk of Injury or Fatality for Fuel Risks in Private Dwellings (2017 – 2021)**

DESCRIPTION	FISCAL YEAR				
	2017	2018	2019	2020	2021
RIF, Old Calculation (FE/mpy)	2.55	3.73	3.42	4.32	4.34
RIF, New Calculation (FE/mpy)	N/A	N/A	0.24	0.16	0.16

The TSSA high-risk threshold is 1.00 FE/mpy.

These occurrences resulted in CO releases, fires, explosions, and/or vapour releases.

<sup>12</sup> Includes occurrences and injuries resulting from CO release, fire, explosion, and/or vapour release.

<sup>13</sup> GIS APIs (Geographic Information System Application Programming Interfaces) are a collection of library modules that resemble various functionalities of GIS software through programming.

Figure H5: Occurrences and Observed Injury Burden for Fuel Risks in Private Dwellings (2012 – 2021)

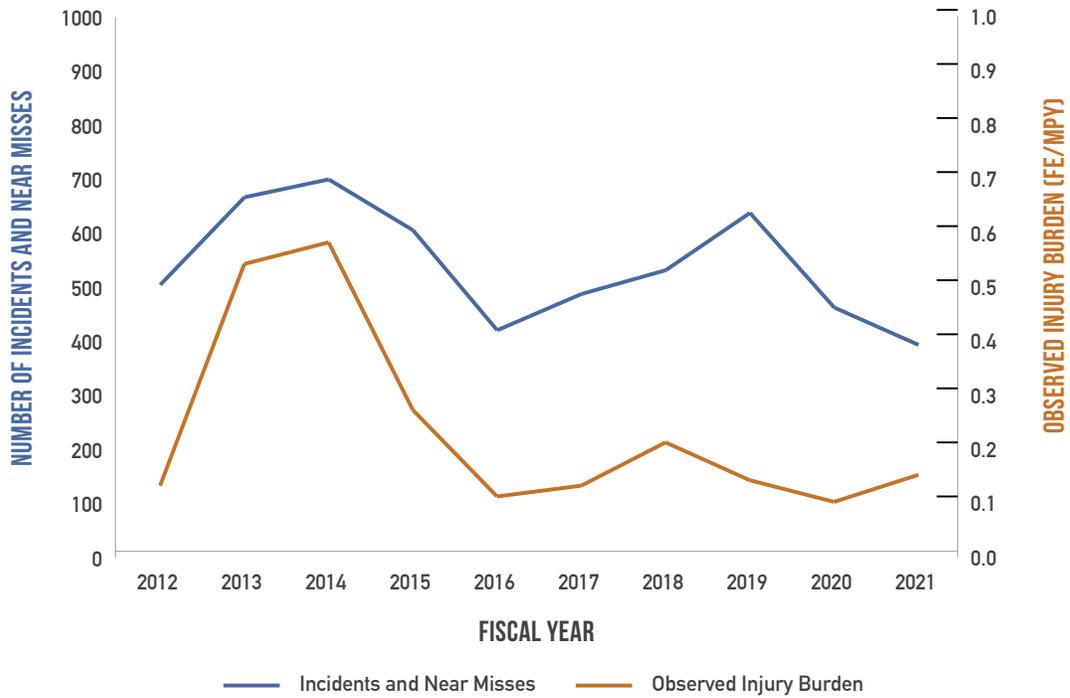


Table H19: Occurrence Types for Fuel Risks in Private Dwellings (2012 – 2021)

OCCURRENCE TYPE	PERCENTAGE OF OCCURRENCES
CO Releases	50.2%
Vapour Releases	26.9%
Fires	18.7%
Explosions	4.2%

Comprehensive drilldowns have been provided for CO releases, fires, explosions, and vapour releases.

## CO Releases

Table H20: Injuries and Fatalities for CO Releases in Private Dwellings (2012 – 2021)

DESCRIPTION	FISCAL YEARS 2012 – 2021
Non-Permanent Injuries	187
Permanent Injuries	2
Fatalities	13

Table H21: Risk of Injury or Fatality for CO Releases in Private Dwellings (2021)

DESCRIPTION	FISCAL YEAR 2021
RIF (FE/mpy)	0.06

Table H22: Top Equipment Types for CO Releases in Private Dwellings (2012 – 2021)

EQUIPMENT TYPE	PERCENTAGE OF OCCURRENCES
Furnaces	31.0%
Water Heaters	16.9%
Boilers	14.2%

Table H23: Percentage of Fatalities due to CO Release that Occur in Private Dwellings Compared to Overall CO Fatalities (2021)

DESCRIPTION	FISCAL YEARS 2012 – 2021
Private Dwellings	92.9%

## Explosions

Table H24: Injuries and Fatalities for Explosions in Private Dwellings (2012 – 2021)

DESCRIPTION	FISCAL YEARS 2012 – 2021
Non-Permanent Injuries	9
Permanent Injuries	28
Fatalities	5

Table H25: Risk of Injury or Fatality for Explosions in Private Dwellings (2021)

DESCRIPTION	FISCAL YEAR 2021
RIF (FE/mpy)	0.04

Table H26: Top Equipment Types for Explosions in Private Dwellings (2012 – 2021)

EQUIPMENT TYPE	PERCENTAGE OF OCCURRENCES
Fireplaces	20.5%
Water Heaters	7.4%
Furnaces	6.3%



## Fires

Table H27: Injuries and Fatalities for Fires in Private Dwellings (2012 – 2021)

DESCRIPTION	FISCAL YEARS 2012 – 2021
Non-Permanent Injuries	2
Permanent Injuries	28
Fatalities	6

Table H28: Risk of Injury or Fatality for Fires in Private Dwellings (2021)

DESCRIPTION	FISCAL YEAR 2021
RIF (FE/mpy)	0.05

Table H29: Top Equipment Types for Fires in Private Dwellings (2012 – 2021)

EQUIPMENT TYPE	PERCENTAGE OF OCCURRENCES
Furnaces	16.7%
Fireplaces	6.1%
Barbecues	5.3%

## Vapour Releases

Table H30: Injuries and Fatalities for Vapour Releases in Private Dwellings (2012 – 2021)

DESCRIPTION	FISCAL YEARS 2012 – 2021
Non-Permanent Injuries	0
Permanent Injuries	3
Fatalities	3

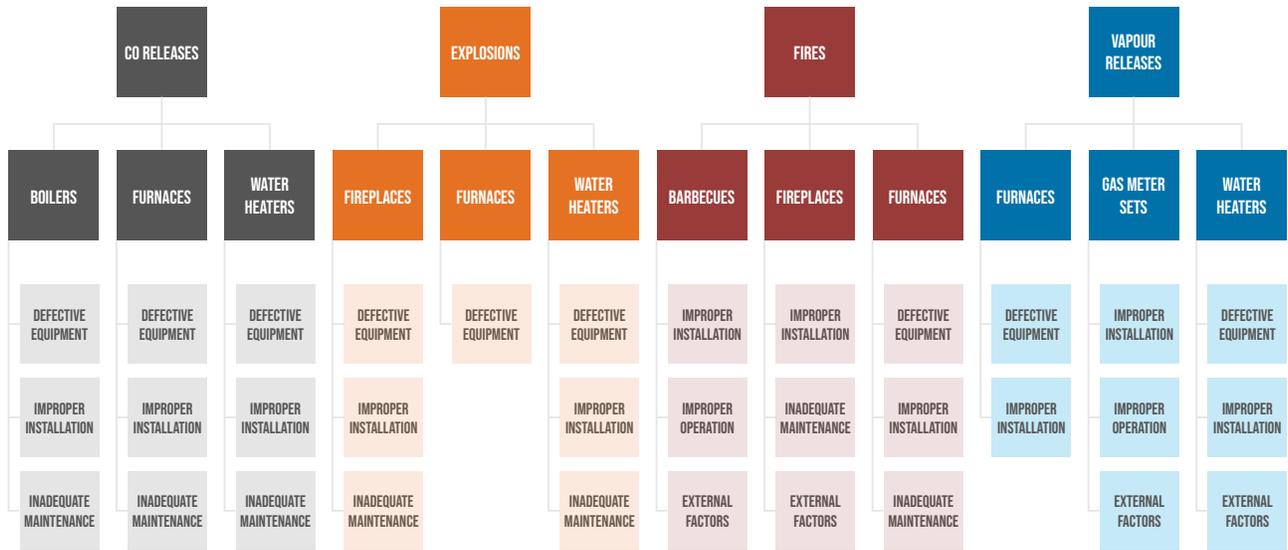
Table H31: Risk of Injury or Fatality for Vapour Releases in Private Dwellings (2021)

DESCRIPTION	FISCAL YEAR 2021
RIF (FE/mpy)	0.01

Table H32: Top Equipment Types for Vapour Releases in Private Dwellings (2012 – 2021)

EQUIPMENT TYPE	PERCENTAGE OF OCCURRENCES
Gas Meter Sets	20.8%
Water Heaters	7.9%
Furnaces	4.6%

Figure H6: Top Contributing Causes of Fuel-Related Safety Issues in Private Dwellings (2012 - 2021)



### 3. Fuel Risks in Business Units

Business units include commercial plazas and various retail, service, supply, and office locations. They exclude food service locations, manufacturing facilities and warehouses.

**Table H33: State of Safety Measures for Fuel Risks<sup>14</sup> in Business Units (2012 – 2021)**

DESCRIPTION	FISCAL YEAR										TOTAL	AVERAGE	TREND (ANNUAL)
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021			
Incidents and Near Miss Occurrences	56	89	90	57	66	69	77	91	71	167	833	83	Increasing
Non-Permanent Injuries	4	4	2	1	7	0	2	3	2	0	25	3	No Trend
Permanent Injuries	0	0	1	0	1	0	1	5	0	0	8	1	No Trend
Fatalities	0	0	0	0	0	0	0	0	0	0	0	0	No Trend
Observed Injury Burden (FE/mpy)	0.00	0.00	0.001	0.00	0.001	0.00	0.00	0.20	0.00	0.00	N/A	0.02	N/A

This fiscal year, TSSA used a GIS API<sup>15</sup> to classify building types for Fuels occurrences. This automated classification may yield slight differences in occurrence counts when compared with different versions of the report.

**Table H34: Risk of Injury or Fatality for Fuel Risks in Business Units (2017 – 2021)**

DESCRIPTION	FISCAL YEAR				
	2017	2018	2019	2020	2021
RIF, Old Calculation (FE/mpy)	0.68	0.73	0.70	0.99	1.11
RIF, New Calculation (FE/mpy)	N/A	N/A	0.04	0.03	0.03

The TSSA high-risk threshold is 1.00 FE/mpy.

<sup>14</sup> Includes occurrences and injuries resulting from CO release, fire, explosion, and/or vapour release.

<sup>15</sup> GIS APIs (Geographic Information System Application Programming Interfaces) are a collection of library modules that resemble various functionalities of GIS software through programming.

Figure H7: Occurrences and Observed Injury Burden for Fuel Risks in Business Units (2012 – 2021)

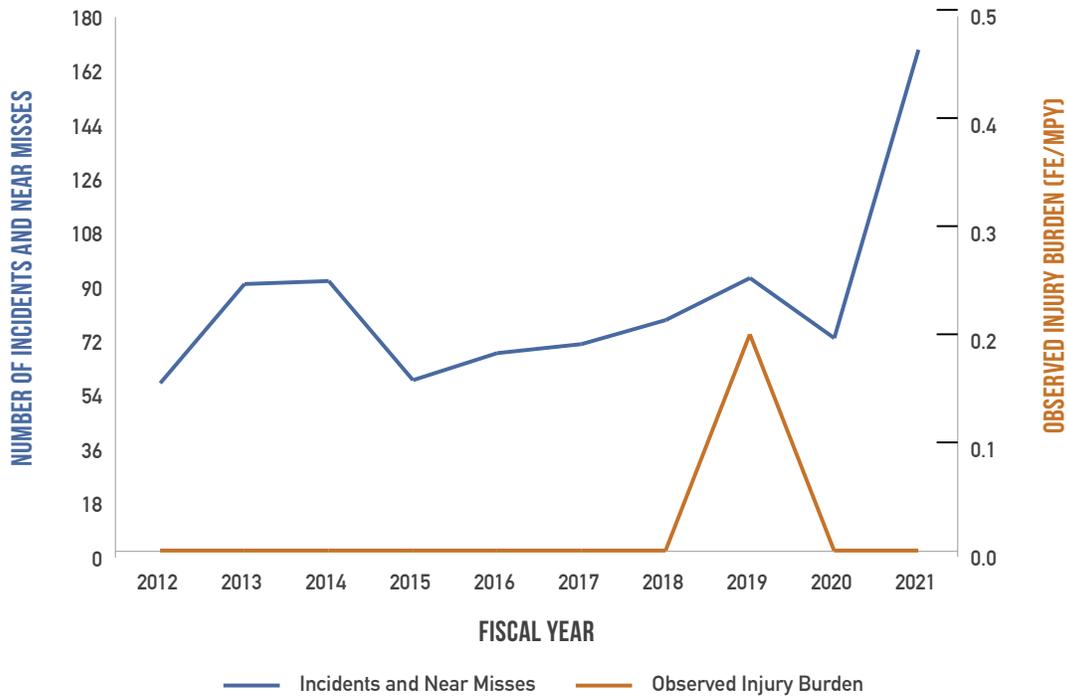


Table H35: Upstream and Downstream Occurrences for Fuel Risks in Business Units (2012 – 2021)

DESCRIPTION	FISCAL YEARS 2012 – 2021
Upstream	16.4%
Downstream	83.6%

Upstream occurrences (i.e., outside of the commercial establishment on fuel distributor meters and service lines) involved gas supply equipment, such as piping, pipelines and regulators, and resulted in vapour release.

Table H36: Upstream Occurrence Types for Fuel Risks in Business Units (2012 – 2021)

DESCRIPTION	FISCAL YEARS 2012 – 2021
Vehicle Collisions	74.1%
Non-Vehicle Occurrences	25.9%

Vehicles colliding with gas supply equipment typically included passenger motor vehicles, snow removal equipment, construction equipment, and forklifts.

**Table H37: Upstream Occurrence Types  
for Fuel Risks in Business Units (2012 – 2021)**

OCCURRENCE TYPE	PERCENTAGE OF OCCURRENCES
Vapour Releases	94.6%
Fires	2.7%
CO Releases	2.7%

**Table H38: Downstream Occurrence Types  
for Fuel Risks in Business Units (2012 – 2021)**

OCCURRENCE TYPE	PERCENTAGE OF OCCURRENCES
Vapour Releases	45.2%
CO Releases	29.7%
Fires	14.6%

**Table H39: Top Downstream Equipment Types  
for CO Releases in Business Units (2012 – 2021)**

EQUIPMENT TYPE	PERCENTAGE OF OCCURRENCES
Boilers	22.5%
Rooftop HVAC Units	14.2%
Furnaces	13.6%

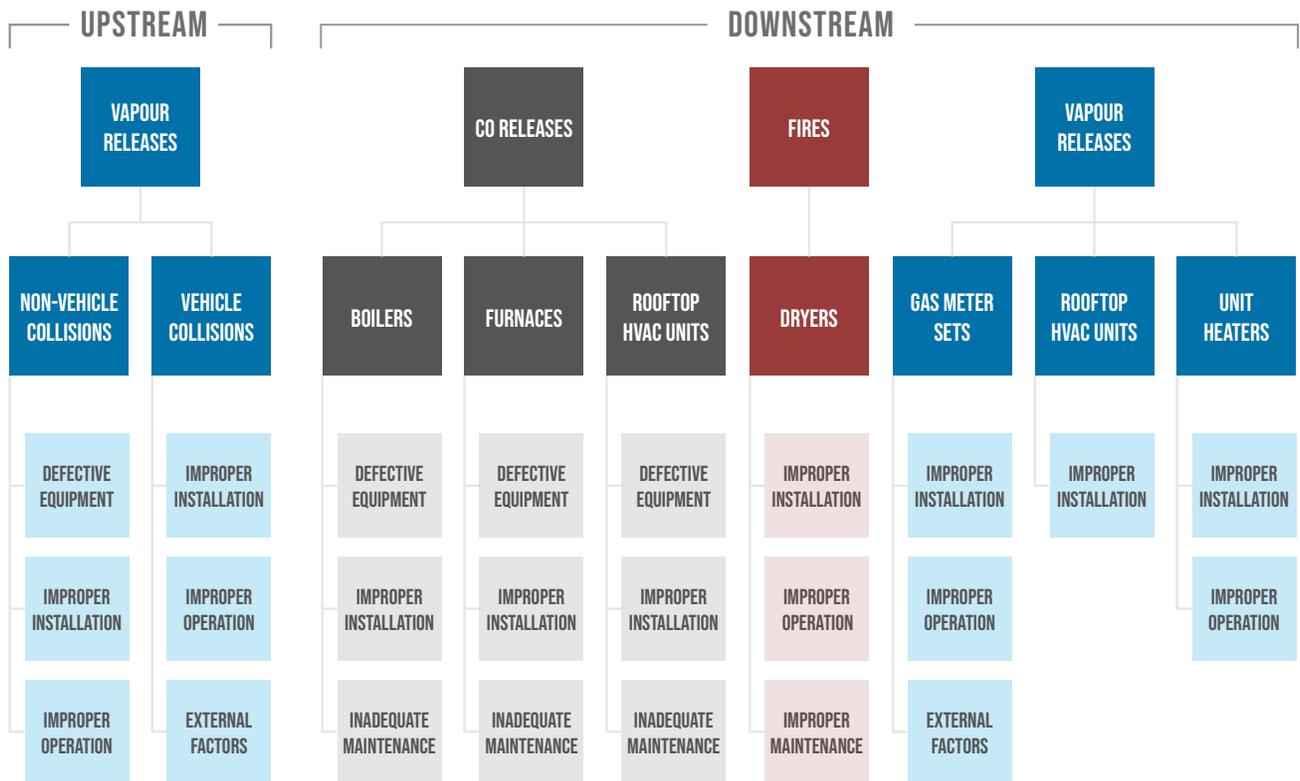
**Table H40: Top Downstream Equipment Types  
for Fires in Business Units (2012 – 2021)**

EQUIPMENT TYPE	PERCENTAGE OF OCCURRENCES
Dryers	18.1%

**Table H41: Top Downstream Equipment Types  
for Vapour Releases in Business Units (2012 – 2021)**

EQUIPMENT TYPE	PERCENTAGE OF OCCURRENCES
Gas Meter Sets	49.8%
Unit Heaters	18.7%
Rooftop HVAC Units	3.5%

Figure H8: Top Contributing Causes of Fuel-Related Safety Issues in Business Units (2012 – 2021)



## 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 H42: Number of Licensed Liquid Fuels Sites (2021)

DESCRIPTION	NUMBER
Licensed liquid fuels sites inventory	4,177
Licensed liquid fuels sites that had sufficient inspection history to calculate a risk score	3,522

Figure H9: Inventory Risk Profiles from Outcomes of Periodic Inspections Conducted on Licensed Liquid Fuels Sites (2017 – 2021)

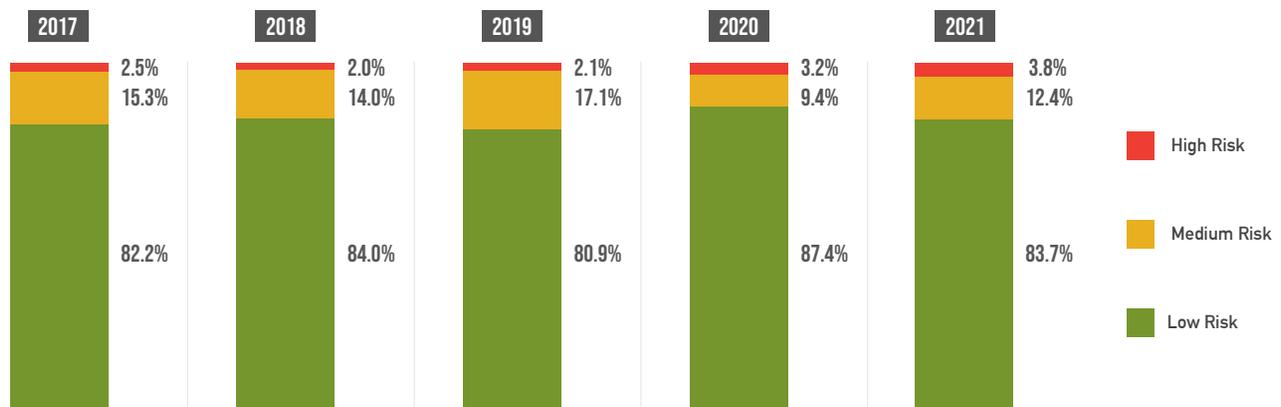


Table H43: Number of High-Risk Licensed Liquid Fuels Sites (2021)

DESCRIPTION	NUMBER	PERCENT OF QUALIFIED PROVINCIAL INVENTORY
High-Risk Sites	135	3.8%

Table H44: Top High-Risk Licensed Liquid Fuels Site Types (2021)

SITE TYPE	PERCENTAGE OF TOTAL HIGH-RISK SITES
Gas Stations	81.5%
Marinas	15.6%
Bulk Plants	3.0%

## Compliance

The compliance rate is defined as the percentage of periodic inspections with no orders issued compared to the total number of periodic inspections.

Figure H10: Yearly Compliance Rates from Outcomes of Periodic Inspections Conducted at Licensed Liquid Fuels Sites (2017 – 2021)



Table H45: Five-Year Mean Compliance Rate from Outcomes of Periodic Inspections Conducted at Licensed Liquid Fuels Sites (2017 – 2021)

DESCRIPTION	FISCAL YEARS 2017 – 2021	TREND (ANNUAL)	COMMENTS
Compliance Rate (Mean)	41.6%	Decreasing	Worsening

Table H46: Top Compliance Issues by Number of Orders Issued from Outcomes of Periodic Inspections Conducted on Liquid Fuels Licensed Sites (2017 – 2021)

COMPLIANCE ISSUE	PERCENTAGE OF TOTAL NUMBER OF ORDERS ISSUED
Defective equipment needs to be repaired or replaced	18.2%
Shear valve and leak detection system maintenance documentation missing	11.5%
Leak testing not being performed	5.5%

Table H47: Top Compliance Issues by Risk of Orders Issued from Outcomes of Periodic Inspections Conducted on Liquid Fuels Licensed Sites (2017 – 2021)

COMPLIANCE ISSUE	PERCENTAGE OF TOTAL RISK OF ORDERS ISSUED
Failure to notify a TSSA inspector after an occurrence	2.2%
Uncertified persons working on equipment	1.6%
Operating sealed equipment	1.6%

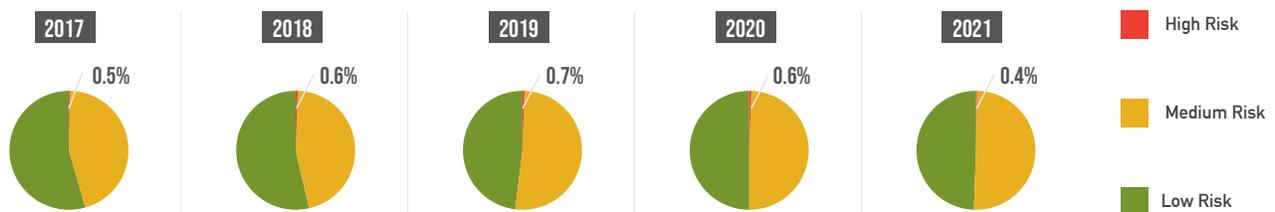
## Risk of Orders

While the compliance rate provides an outcome of the periodic inspection (e.g., pass or fail), the inspection risk spectrum (shown as pie charts) portrays the potential safety risks associated with non-compliance. The red segments of the spectrums show high levels of risk.

**Table H48: Inspection Risk Spectrum from Outcomes of Periodic Inspections Conducted at Licensed Liquid Fuels Sites (2021)**

INSPECTION RISK SPECTRUM	FISCAL YEAR 2021
High-Risk Issues	0.4%
Low-Risk Issues	49.3%

**Figure H11: Inspection Risk Spectrums from Outcomes of Periodic Inspections Conducted on Liquid Fuels Licensed Sites (2017 – 2021)**



Some typical examples of minor issues include: above ground storage tanks not being permanently marked; missing signage; testing not being performed; licence not being displayed; and underground storage tanks not being removed after being out of service for two years.

## 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 H42: Number of Licensed Liquid Fuels Sites (2021)

DESCRIPTION	NUMBER
Licensed propane sites inventory	1,319
Licensed propane sites that had sufficient inspection history to calculate a risk score	1,013

Figure H12: Inventory Risk Profiles from Outcomes of Periodic Inspections Conducted on Licensed Propane Sites (2017 – 2021)

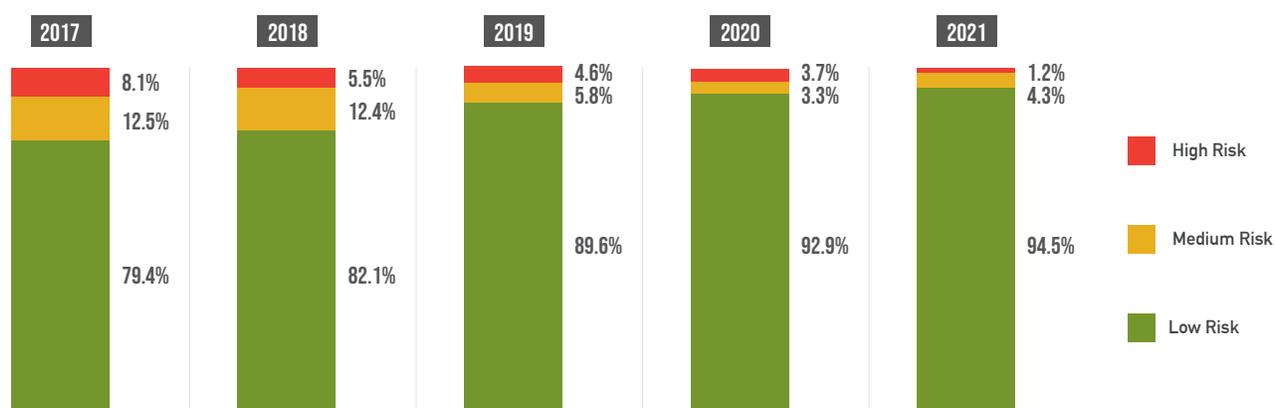


Table H50: Number of High-Risk Licensed Propane Sites (2021)

DESCRIPTION	NUMBER	PERCENT OF QUALIFIED PROVINCIAL INVENTORY
High-Risk Sites	12	1.2%

Table H51: Top High-Risk Licensed Propane Site Types (2021)

SITE TYPE	PERCENTAGE OF TOTAL HIGH-RISK SITES
Cylinder Refill Centres	58.3%
Propane Filling Plants → 5000 USWG	33.3%
Vehicle Refill Centres	8.3%

## Compliance

The compliance rate is defined as the percentage of periodic inspections with no orders issued compared to the total number of periodic inspections.

Figure H13: Yearly Compliance Rates from Outcomes of Periodic Inspections Conducted at Licensed Propane Sites (2017 – 2021)



Table H52: Five-Year Mean Compliance Rate from Outcomes of Periodic Inspections Conducted at Licensed Propane Sites (2017 – 2021)

DESCRIPTION	FISCAL YEARS 2017 – 2021	TREND (ANNUAL)	COMMENTS
Compliance Rate (Mean)	73.4%	Increasing	Improving

Table H53: Top Compliance Issues by Number of Orders Issued from Outcomes of Periodic Inspections Conducted on Licensed Propane Sites (2016 – 2020)

COMPLIANCE ISSUE	PERCENTAGE OF TOTAL NUMBER OF ORDERS ISSUED
Readily ignitable materials around container	9.3%
Portable fire extinguisher not installed	5.4%
Piping and tubing not protected with paint or coating	4.7%

Table H54: Top Compliance Issues by Risk of Orders Issued from Outcomes of Periodic Inspections Conducted on Licensed Propane Sites (2017 – 2021)

COMPLIANCE ISSUE	PERCENTAGE OF TOTAL NUMBER OF ORDERS ISSUED
No notification to inspector after occurrence	34.3%
Match, candle or flame used to check for propane leak	25.6%
Employee handling propane without certificate	20.2%



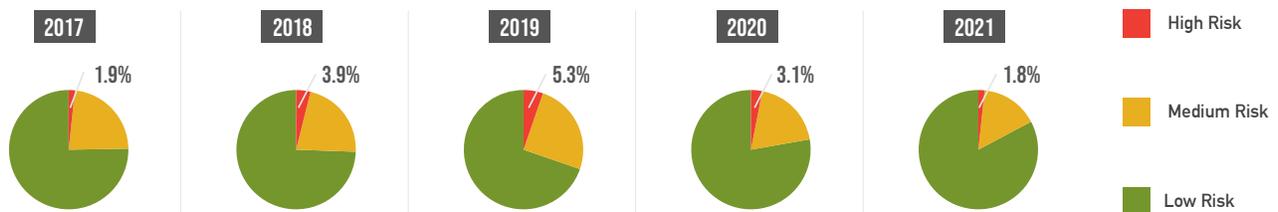
## Risk of Orders

While the compliance rate provides an outcome of the periodic inspection (e.g., pass or fail), the inspection risk spectrum (shown as pie charts) portrays the potential safety risks associated with non-compliance. The red segments of the spectrums show high levels of risk.

**Table H55: Inspection Risk Spectrum from Outcomes of Periodic Inspections Conducted at Licensed Propane Sites (2021)**

INSPECTION RISK SPECTRUM	FISCAL YEAR 2021
High-Risk Issues	1.8%
Low-Risk Issues	82.7%

**Figure H14: Inspection Risk Spectrum from Outcomes of Periodic Inspections Conducted on Licensed Propane Sites (2017 – 2021)**



Some typical examples of minor issues include: missing signage; unpainted steel tanks; readily ignitable materials including vegetation being too close to containers; inadequate fencing; and licences not being displayed.

In the spirit of continuous improvement of TSSA's risk-based inspection scheduling, TSSA is heeding the advice of the Auditor General of Ontario, which noted that information used in Risk and Safety Management Plans (RSMPs) could also be used to inform inspection frequencies. For example, RSMPs list the land usage surrounding propane facilities. As such, the risk threshold for facilities in high density residential zones is 10 per cent of that in remote/industrial locations and the threshold near sensitive receptors is 3 per cent of the industrial threshold. In this way, TSSA can target inspection resources to facilities with the greatest potential for harm.

## Fuels Contractors

## Heating Contractors

### Compliance

TSSA conducts periodic audits on heating contractors in the province of Ontario to oversee and manage their state of compliance. The compliance rate is defined as the percentage of heating contractor audits with no orders issued compared to the total number of heating contractor audits.

Figure H15: Yearly Compliance Rates from Outcomes of Periodic Audits Conducted on Heating Contractors (2017 – 2021)



Table H56: Five-Year Mean Compliance Rate from Outcomes of Periodic Audits Conducted on Heating Contractors (2017 – 2021)

DESCRIPTION	FISCAL YEARS 2017 – 2021	TREND (ANNUAL)
Compliance Rate (Mean)	61.5%	No Trend

Table H57: Top compliance Issues by Number of Orders Issued from Outcomes of Periodic Audits Conducted on Heating contractors (2017 – 2021)

COMPLIANCE ISSUE	PERCENTAGE OF TOTAL NUMBER OF ORDERS ISSUED
Unacceptable condition - no immediate hazard	27.1%
Equipment not installed per manufacturer's certified instructions	9.2%
Equipment not installed per Code requirements	4.2%

Table H58: Top Compliance Issues by Risk of Orders Issued from Outcomes of Periodic Audits Conducted on Heating Contractors (2017 – 2021)

COMPLIANCE ISSUE	PERCENTAGE OF TOTAL NUMBER OF ORDERS ISSUED
Tag is missing after pressure test	37.0%
Contractor working beyond scope of certification	2.0%
Interior metal gas piping and tubing is not electrically bonded	1.2%

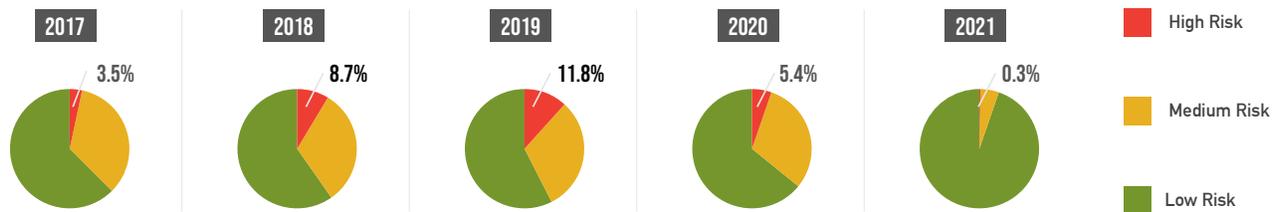
## Risk of Orders

While the compliance rate provides an outcome of the periodic audit (e.g., pass or fail), the audit risk spectrum (shown as pie charts) portrays the potential safety risks associated with non-compliance. The red segments of the spectrums show high levels of risk.

**Table H59: Inspection Risk Spectrum from Outcomes of Periodic Audits Conducted on Heating Contractors (2021)**

INSPECTION RISK SPECTRUM	FISCAL YEAR 2021
High-Risk Issues	0.3%
Low-Risk Issues	94.5%

**Figure H16: Audit Risk Spectrum from Outcomes of Periodic Audits Conducted on Heating Contractors (2017 – 2021)**



Some typical examples of minor issues include: the registration not being displayed in a conspicuous location; equipment not being installed per manufacturer's instructions; use of unapproved equipment; drip or dirt pockets not readily accessible for cleaning; and the installer not leaving the manufacturer's instructions with the user.

## Petroleum Contractors

### Compliance

TSSA conducts periodic audits on petroleum contractors in the province of Ontario to oversee and manage their state of compliance. The compliance rate is defined as the percentage of petroleum contractor audits with no orders issued compared to the total number of petroleum contractor audits.

Figure H17: Yearly Compliance Rates from Outcomes of Periodic Audits Conducted on Petroleum Contractors (2017 – 2021)



Table H60: Five-Year Mean Compliance Rate from Outcomes of Periodic Audits Conducted on Petroleum Contractors (2017 – 2021)

DESCRIPTION	FISCAL YEARS 2017 – 2021	TREND (ANNUAL)
Compliance Rate (Mean)	88.2%	No Trend

Table H61: Top Compliance Issues by Number of Orders Issued from Outcomes of Periodic Audits Conducted on Petroleum Contractors (2017 – 2021)

COMPLIANCE ISSUE	PERCENTAGE OF TOTAL NUMBER OF ORDERS ISSUED
Combustible materials around dispenser	7.1%
Above ground storage tank not protected from vehicular impact	6.5%
Defective equipment or component not properly maintained	5.8%

Table H62: Top Compliance Issues by Risk of Orders Issued from Outcomes of Periodic Audits Conducted on Petroleum Contractors (2017 – 2021)

COMPLIANCE ISSUE	PERCENTAGE OF TOTAL NUMBER OF ORDERS ISSUED
Employees not being instructed to comply with Act and Regulation	51.2%
No notification of unacceptable condition	25.7%
Contractor not registered	5.9%

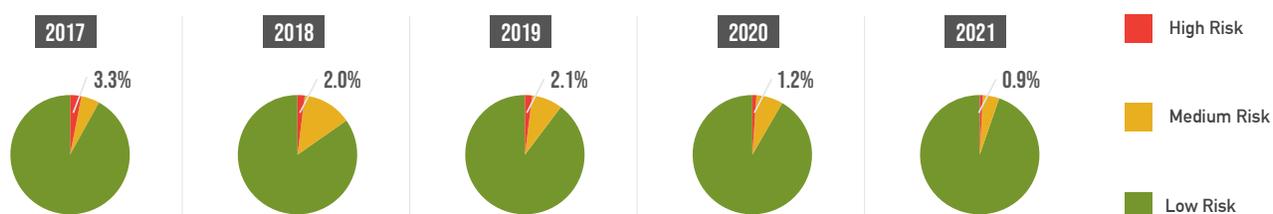
## Risk of Orders

While the compliance rate provides an outcome of the periodic audit (e.g., pass or fail), the audit risk spectrum (shown as pie charts) portrays the potential safety risks associated with non-compliance. The red segments of the spectrums show high levels of risk.

**Table H63: Inspection Risk Spectrum from Outcomes of Periodic Audits Conducted on Petroleum Contractors (2021)**

INSPECTION RISK SPECTRUM	FISCAL YEAR 2021
High-Risk Issues	0.9%
Low-Risk Issues	94.7%

**Figure H18: Audit Risk Spectrum from Outcomes of Periodic Audits Conducted on Petroleum Contractors (2017 – 2021)**



Some examples of minor issues included: aboveground storage tanks not being permanently marked; aboveground storage tanks not being protected against vehicular impact; contractor vehicles not being marked with the name and registration number; missing signage; and the application for licence renewal being made after it had already expired.

## 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, 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.

**Table H64: Fuels Inspection and Re-Inspection Results (2021)**

INSPECTION TYPE	PASS	FAIL	OTHER	GRAND TOTAL	PASS RATE (%)
Ad Hoc/Unscheduled Inspections	841	444	0	1,285	65.4%
Alteration Inspections	11	0	0	11	100.0%
Complaint Inspections	394	40	0	434	90.8%
Initial Inspections	3,294	339	12	3,645	90.7%
Non-Mandated/Non-Regulated Inspections	0	0	471	471	N/A
Occurrence Inspections	0	0	3,077	3,077	N/A
Other Inspections	484	3,366	25	3,875	12.6%
Periodic Inspections	2,651	578	17	3,246	82.1%
Re-Inspections	1,342	1,846	30	3,218	42.1%
Fuels Total	9,017	6,613	3,632	19,262	57.7%

## Legislation and Regulatory Information

Table H65: TSSA Fuels Legislation and Regulatory Information (2021)

LEGISLATION AND REGULATORY INFORMATION AS OF 2020	LATEST REVISION
<b>Oil and Gas Pipeline Systems</b>	
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
<b>Propane Storage and Handling</b>	
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
<b>Gaseous Fuels</b>	
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
<b>Fuel Oil</b>	
Ontario Regulation 213/01: Fuel Oil	2001
Ontario Regulation 213/01: Director's Order	2001
Fuel Oil CAD Amendment FS-219-16	2016
<b>Compressed Gas</b>	
Ontario Regulation 214/01: Compressed Gas	2007
Compressed Gas CAD Amendment FS-143-09	2009
<b>Liquid Fuels</b>	
Ontario Regulation 217/01: Liquid Fuels	2001
Liquid Fuels CAD Amendment FS-235-18	2019
Minister's Exemption Liquid Fuels Regulation 217/01	2020
<b>Requirements for Contractors</b>	
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

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

- FS-247-19 R1 – Introduction of TSSA's Fuel Oil Distributor Audit Program; and
- FS-188-11 R4 – Propane Facility Licence Process.

See [www.tssa.org](http://www.tssa.org) for a comprehensive listing of legislation and regulatory information.