



Annual Public Safety Performance Report

For the Period May 1, 2009 to April 30, 2010





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Preface

The *Annual Public Safety Performance Report* is published by the Technical Standards and Safety Authority (TSSA) to provide readers with an overview of the state of compliance and safety in the areas it oversees. It is based on the information collected through its safety activities. The *Annual Public Safety Performance Report* contains enhanced reporting, information on historic trends and TSSA actions taken to continually improve compliance and manage public safety issues.

The *Annual Public Safety Performance Report* is structured consistently across all the public safety programs regulated by TSSA. Each program is divided into its respective program areas, which are then split into two main reporting sections:

- Public Safety Analysis; and
- Public Safety Decisions.

Public Safety Analysis

This section provides the readership with an overview of the activities undertaken by TSSA from May 1, 2009 to April 30, 2010 specific to inspecting occurrences, and periodic inspections and audits across the various regulated technologies and tradespersons. This overview includes measurement indicators and metrics that illustrate the body of work that TSSA has carried out in the province to proactively manage compliance and determine the causes of any incidents or failures that could have led to or have had health impacts on the public.

This section also provides the results of a detailed analysis on trends and outcomes of these activities. The analysis gives readers a perspective on the state of compliance and the associated state of safety over a continuous period of time and as based on information available to TSSA. Specific indicators and metrics allowing the readers to understand and evaluate the outcomes of TSSA activities are included. These will be monitored, periodically reported to various stakeholders and presented in future annual public safety performance reports.

TSSA's risk-informed decision-making (RIDM) framework utilizes best-practice risk assessment and decision support tools to analyze public safety risks and establish appropriate actions to manage them. The results of various risk analysis studies are also included in the analysis section.

Public Safety Decisions

This section describes TSSA actions that have been implemented or are being planned in response to the results of the public safety analysis carried out from May 1, 2009 to April 30, 2010 and observed trends. TSSA also engages in proactively managing anticipated public safety risks by engaging external stakeholders in gathering information and analysis. This section includes specific cases of proactive TSSA decision-making to improve compliance and/or address public safety issues.

Characterization of Trends

Charts depicting trends in the public safety analysis sections include actual data points based on quarterly observations during the last two to six fiscal years and show a smoothed local curve of best fit that is statistically determined.

Statistical analysis was conducted on the actual data points to determine the existence of trends that show the tendency of the data over the entire time period considered. If the statistical analysis revealed insufficient evidence to support the existence of a trend, statements have been made accordingly. Additional commentary has been provided on localized changes in patterns stemming from the curve of best fit where appropriate.

Readers are cautioned that the results of the statistical trend analysis may not appear consistent with the perceived visual appearance of the curve of best fit. The smooth curve primarily aids assessment of the linearity of the data and indicates any localized changes in pattern. In order to obtain a comprehensive understanding of the behaviour of data over the entirety of the measured period, relevant statistical tests were conducted to establish the nature of the trends.

It is also possible that the presented curves of best fit can highlight local trends that may not be reflected in the long-term statistical trend tests. The reader is cautioned that the statistical trends are global in nature; they are based on a



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longer period and analyze the behaviour of the data as a whole. Trend tests on smaller time frames have been conducted where relevant; such results are presented and contextualized with respect to recent actions and/or decisions.

Historical trends with respect to occurrences and their associated health impacts do not consider the exposed population as TSSA may not have accurate information in this respect. This is particularly relevant in safety programs where TSSA does not specifically license and/or inspect devices, such as home heating appliances; however, the reader is provided with a broad understanding of the population of devices that are regulated to give a perspective on the significance of trends with respect to health impacts.

Assumptions and Sources of Uncertainty

It is important for the readers to note that, while in general, analysis on trends has been provided over a six year period, some trends may be based on a shorter time period due to improvements in data gathering and analysis systems. In such cases, the historic database was not designed and maintained consistently across all programs to be compatible with current improved systems. This restricted the ability to consolidate information from the entire time period used for analysis in those cases as described. Where consolidation was possible, a mapping was used to document how the old outcomes are fit into the new outcomes. This mapping is provided in Appendix C of the report.

In producing this report, TSSA makes every effort to ensure high level of data integrity and continuously works towards improving the integrity of all data collected for the purposes of reporting. TSSA uses a rigorous quality assurance procedure to ensure that the analysis results are accurate and reflective of the observations of its inspections and engineering staff. Although TSSA strives to achieve high levels of data integrity at all times, it is sometimes necessary to make restatements to data reported in previous fiscal years. These variances are typically a result of time-frame factors such as information received subsequent to the issuance of the report, localized reporting lags for periodic data and other issues. All such restatements are noted and, in the event of a material restatement, a thorough explanation is provided.



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Executive Summary

Public Safety Analysis

Boilers and Pressure Vessels, and Operating Engineers Safety Program

Boilers and Pressure Vessels

Incident/Near-Miss Occurrence Inspections

- There were eight occurrences in fiscal year 2009/2010.
- There are no statistically significant trends in the occurrences or their health impacts over the last six fiscal years.

Periodic Inspections

- There were 504 periodic inspections conducted in fiscal year 2009/2010.
- 91.67% of these periodic inspections passed on the first visit.
- There are no statistically significant trends in periodic inspections over the last six fiscal years.

Operating Engineers

Incident/Near-Miss Occurrence Inspections

- There were no occurrences in fiscal year 2009/2010.
- There are no statistically significant trends in the occurrences or their health impacts over the last six fiscal years.

Periodic Inspections

- There were 1,665 periodic inspections conducted in fiscal year 2009/2010.
- 43.18% of these periodic inspections passed on the first visit.
- The average number of inspection orders per inspection has demonstrated a downward trend over the last six fiscal years.
- There is an upward trend in the percentage of inspections with the outcome 'Follow-up' and a downward trend in the percentage of inspections with the outcome 'Complete' over the last six fiscal years.

Elevating Devices and Amusement Devices Safety Program

Amusement Devices

Incident/Near-Miss Occurrence Inspections

- There were 101 occurrences reported to TSSA in fiscal year 2009/2010, with a health impact of five serious injuries and 87 minor injuries.
- There are no statistically significant trends in the health impacts of occurrences over the last six fiscal years.
- There are no statistically significant trends in the root causes of occurrences over the last three fiscal years.

Periodic Inspections

- There were 1,519 periodic inspections conducted in fiscal year 2009/2010.
- 60.24% of these periodic inspections passed on the first visit.
- There are no statistically significant trends in periodic inspections over the last six fiscal years.

Elevators

Incident/Near-Miss Occurrence Inspections

- There were 211 occurrences reported to TSSA in fiscal year 2009/2010, with a health impact of six serious injuries and 112 minor injuries.
- There is a downward trend in the number of serious injuries on elevators over the last six fiscal years.



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- There are upward trends in the percentage of occurrences with the root causes 'External Factors' and 'Human Factors', and downward trends in the percentage of occurrences with the root causes of 'Equipment/Component/Material' and 'Training' over the last three fiscal years.

Periodic Inspections

- There were 16,387 periodic inspections conducted in fiscal year 2009/2010.
- 33.86% of these periodic inspections passed on the first visit.
- The average number of inspection orders per inspection does not demonstrate a significant trend over the last six fiscal years.
- There are upward trends in the percentage of inspections with the outcome 'Passed on First Visit' and 'Shutdown', and a downward trend in the percentage of inspections with the outcome 'Follow-up' over the last six fiscal years.
- The percentage of inspections passing on first visit has demonstrated an upward trend during the last three fiscal years as a result of *Director's Order 218/07*.

Escalators and Moving Walks

Incident/Near-Miss Occurrence Inspections

- There were 535 occurrences reported to TSSA in fiscal year 2009/2010, with a health impact of one fatality, seven serious injuries, and 362 minor injuries.
- There are no statistically significant trends in the health impacts of occurrences over the last six fiscal years.
- There is an upward trend in the percentage of occurrences with the root cause 'Human Factors', and downward trends in the percentage of occurrences with the root causes 'Design', 'Equipment/Component/Material', and 'Unable to Establish Root Cause' over the last three fiscal years.

Periodic Inspections

- There were 603 periodic inspections conducted in fiscal year 2009/2010.
- 24.38% of these periodic inspections passed on the first visit.
- The average number of inspection orders per inspection does not demonstrate a significant trend over the last six fiscal years.
- There is an upward trend in the percentage of inspections with the outcome 'Shutdown' over the last six fiscal years.
- The percentage of inspections passing on first visit has demonstrated an upward trend during the last three fiscal years as a result of *Director's Order 218/07*.

Ski Lifts

Incident/Near-Miss Occurrence Inspections

- There were 96 occurrences reported to TSSA in fiscal year 2009/2010, with a health impact of three serious injuries and 84 minor injuries.
- There are no statistically significant trends in the health impacts of occurrences over the last six fiscal years.
- There are no statistically significant trends in the root causes of occurrences over the last three fiscal years.

Periodic Inspections

- There were 117 periodic inspections conducted in fiscal year 2009/2010.
- 35.04% of these periodic inspections passed on the first visit.
- The average number of inspection orders per inspection does not demonstrate a significant trend over the last six fiscal years.
- There are no statistically significant trends in periodic inspections over the last six fiscal years.

Fuels Safety Program

Incident/Near-Miss Occurrence Inspections

- There were 2,349 pipeline strike occurrences reported to TSSA in fiscal year 2009/2010.



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- There were no health impacts associated with these pipeline strike occurrences.
- There are upward trends in the percentage of occurrences with the root causes 'Design' and 'Management', and downward trends in the percentage of occurrences with the root causes 'Human Factors' and 'Procedures' over the last three and a half fiscal years for pipeline strike occurrences.
- There were 1,322 other types of occurrences reported to TSSA in fiscal year 2009/2010.
- The health impacts associated with these occurrences were one fatality, 14 serious injuries, and 23 minor injuries.
- There are no statistically significant trends in the number of health impacts over the last six fiscal years.
- There are no statistically significant trends in the root causes of occurrences over the last three and a half fiscal years.

Licensed Site Periodic Inspections

- There were 2,254 periodic inspections conducted in fiscal year 2009/2010.
- 51.24% of these periodic inspections passed on the first visit.
- The average number of inspection orders per inspection has demonstrated a downward trend over the last six fiscal years.
- There is an upward trend in the percentage of inspections with the outcome 'Passed on First Visit', and a downward trend in the percentage of inspections with the outcome 'Follow-up' over the last six fiscal years.

Ad Hoc Inspections

- There were 2,452 ad hoc inspections conducted in fiscal year 2009/2010 at places such as construction sites, residences, campsites, private petroleum sites, etc.
- 28.55% of these ad hoc inspections passed on the first visit.
- The average number of inspection orders per inspection does not demonstrate a statistically significant trend over the last six fiscal years.
- There is an upward trend in the percentage of inspections with the outcome 'Cease and Desist', and a downward trend in the percentage of inspections with the outcome 'Follow-up' over the last six fiscal years.

Contractor Audits

- There were 2,652 contractor audits conducted in fiscal year 2009/2010.
- 73.60% of these audits passed on the first visit.
- The average number of inspection orders per audit does not demonstrate a statistically significant trend over the last six fiscal years.
- There is an upward trend in the percentage of inspections with the outcome 'Cease and Desist', and a downward trend in the percentage of inspections with the outcome 'Follow-up' over the last six fiscal years.

Upholstered and Stuffed Articles

Inspections

- There were 1,892 inspections conducted in fiscal year 2009/2010.
- There were 9,651 inspection orders issued during these inspections.



Public Safety Decisions

Boilers and Pressure Vessels, and Operating Engineers Safety Program

Boilers and Pressure Vessels

Improving Compliance

A new audit process was successfully introduced with two petrochemical companies, with more companies scheduled to follow. In accordance with TSSA's strategic plan to expand shared responsibility for safety, technical training seminars were delivered by TSSA on topics ranging from Ontario boiler and pressure vessels regulation requirements, pressure piping installation requirements, welding qualifications and effective quality control systems.

Managing Safety Issues

TSSA continues to explore a suitable process for receiving and collecting data electronically from insurers for insured pressure equipment.

Regulatory Improvements

Certificates of Recognition were issued to the task force members, of whom TSSA was a participant, for the development of the new *Refrigeration Code* section *CSA B52 for Carbon Dioxide* used as a refrigerant. This newly published supplement to the standard has already been applied to new refrigeration plants in Ontario.

Operating Engineers

Improving Compliance

By identifying those plants that demonstrate a higher level of non-compliance, TSSA continues to ensure that its resources are focused on safety matters of greatest importance.

Managing Safety Issues

The Operating Engineers program area addressed issues relating to steam turbine governors, thermal oil plants and power engineers during the year.

Regulatory Improvements

Revisions and amendments to *Ontario Regulation 219/01, Power Engineering* (formerly Operating Engineers), developed in 2006 in consultation with industry have been submitted to the Ministry of Consumer Services (MCS) for approval.

Elevating Devices and Amusement Devices Safety Program

Amusement Devices

Improving Compliance

TSSA held its annual amusement devices technical training workshop for engineers, inspectors and industry members. By promoting safety requirements to relevant stakeholders, events such as these are expected to result in a positive impact on safety outcomes.

Managing Safety Issues

TSSA has continued to enhance its public education program through broad-reaching public education campaigns.

Regulatory Improvements

TSSA issued *Incident Reporting Guideline 531/09* to provide guidance on the new incident reporting requirements in the amusement devices regulation.



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TSSA is actively involved with the Canadian Standards Association and the American Society for Testing and Materials in the harmonization of the amusement device standards. Work continues and completion is anticipated the fall of 2010.

Elevators

Improving Compliance

TSSA focused on reducing follow-ups and hence improving compliance by introducing various strategies, both as deterrents and as enablers. While this has resulted in the number of shut-downs increasing, the number of inspections passed on first visit has increased.

Managing Safety Issues

TSSA issued *Information Bulletin 243/10* which reminds owners of the importance of oil loss monitoring and advises them of upcoming code changes. Oil loss monitoring is a means to determine the integrity of the hydraulic elevator system and to identify if there is any loss of oil which would indicate a leaking cylinder.

Regulatory Improvements

In response to a request from stakeholders, TSSA issued *Incident Reporting Guideline 230/09* which provides guidance on the new incident reporting requirements in the *Elevating Devices Regulation*. It is expected these guidelines will result in more comprehensive information in incident reports.

TSSA issued *Code Adoption Document (CAD) Amendment 238/09* which adopts the revised *B355 Code for Lifts for Persons with Physical Disabilities*. Such amendments help industry keep abreast of safety enhancements introduced and helps ensure that new equipment is in compliance with the current code.

Escalators and Moving Walks

Improving Compliance

TSSA has enhanced its efforts to achieve greater levels of compliance for escalators and moving walk using the same methods as those described above for elevators.

Managing Safety Issues

Based on the recommendations of the escalator entrapment risk reduction group, TSSA issued *Enforcement Procedure 241/10* reminding owners of escalators and moving walks of the importance of the monthly application of a friction reducing agent to escalator skirts on certain older escalators.

Regulatory Improvements

TSSA issued *Incident Reporting Guideline 230/09* which provides guidance on the new incident reporting requirements in the elevating devices sector.

Ski Lifts

Improving Compliance

TSSA continues to use its risk-based inspection program to prioritize and direct its resources in inspecting ski lifts in Ontario. Based on the results of the inspections, there are presently no significant compliance issues requiring TSSA response.

Managing Safety Issues

'Human Factors' continues to be the dominant root cause category relative to all the other causal categories of occurrence. TSSA continues to partner with industry to deliver the *Look, Load & Lower* campaign, raising rider responsibility and safety awareness.



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Regulatory Improvements

TSSA issued *Incident Reporting Guideline 214/09* which provides guidance on the new incident reporting requirements for passenger ropeways in the *Elevating Devices Regulation*.

Fuels Safety Program

Improving Compliance

Compliance information relating to contractors continues to focus TSSA's inspectors on less compliant contractors.

Managing Safety Issues

Carbon monoxide remained a topic of focus as it relates to residential natural draft boilers. Data has been collected, and TSSA issues revised Director's Orders annually relating to new and used installations.

Through a risk reduction group, a manufacturer's disposable cylinder was removed from the Canadian market due to safety and environmental concerns.

Regulatory Improvements

As part of its continuous improvement, TSSA issued several Director's Orders or advisories covering a broad range of items from clarifications of the Code to technical requirements of various types of installations.

Upholstered and Stuffed Articles

Highlights from fiscal year 2009/2010 include identifying and confiscating various products containing used materials that were imported from foreign manufacturers, and continuing to work with Canada Customs to ensure that used furniture and mattresses are not being imported for sale in Ontario.



Boilers and Pressure Vessels, and Operating Engineers

Boilers and Pressure Vessels

Boilers and pressure vessels include equipment that produces and distributes hot water, steam, compressed air, and other compressed liquids and gases used in commerce and industry. TSSA is responsible for regulating all pressure retaining components manufactured or used in Ontario, with a commitment to ensuring the safety of boilers, pressure vessels and piping systems. TSSA conducts periodic inspections on uninsured boilers and pressure vessels, of which there are approximately 3,000 in Ontario. The remaining insured boilers and pressure vessels are inspected by insurance companies licensed to underwrite boiler and machinery insurance. TSSA is responsible for the certification of the inspectors employed by the insurance companies.

Incidents involving this type of equipment and associated piping are infrequent. Nevertheless, cracked and corroded vessels or piping can leak or rupture, producing a variety of safety problems, including poisonings, suffocations, fires or explosions. Ruptures can be catastrophic and may immediately threaten life and property. The safe design, installation, operation, and maintenance of 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 life cycle of equipment in this sector.

Public Safety Analysis

Occurrence Analysis

Table BPV-1 summarizes the occurrences involving boilers and pressure vessels reported to TSSA. It presents the number of occurrences that were reported to TSSA in accordance with the reporting guidelines provided to the stakeholders. These occurrences can be categorized as an incident or a near-miss, and the table includes their occurrence inspection status at the end of the fiscal year. The number of victims and their injury severity from these occurrences are also included.

Table BPV-1: Activity breakdown for boilers and pressure vessels occurrences.

Occurrence Detail	May 1, 2009 – April 30, 2010
Number of Incidents	8
Number of Near-Misses	0
Occurrences Within TSSA Jurisdiction	8
• Completed Causal Analysis	4
• Unable to Establish Root Cause	0
• In Progress	4
• Not Requiring Formal Inspection	0
Total Occurrences	8
Occurrences Outside TSSA Jurisdiction	1
Number of Fatalities	0
Number of Serious Injuries	0
Number of Minor Injuries	0

Occurrence Related Trends

Figure BPV-1 charts the number of boilers and pressure vessels fatalities and serious injuries over the last six fiscal years. As illustrated, there have been no fatalities involving boilers and pressure vessels within TSSA's jurisdiction during this period. Two serious injuries have been reported in the last six years, revealing no statistically significant trend.



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Figure BPV-1: Boilers and pressure vessels fatalities and serious injuries over the last six fiscal years (analyzed occurrences).

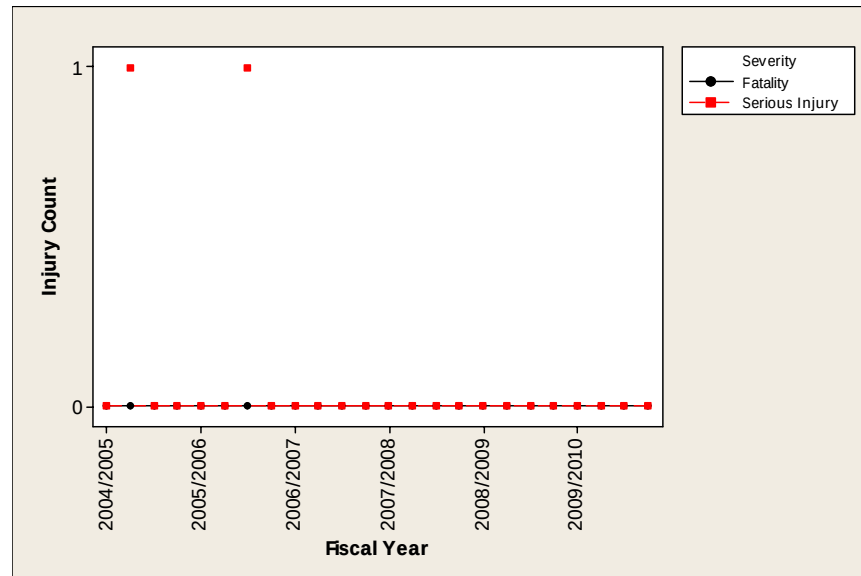
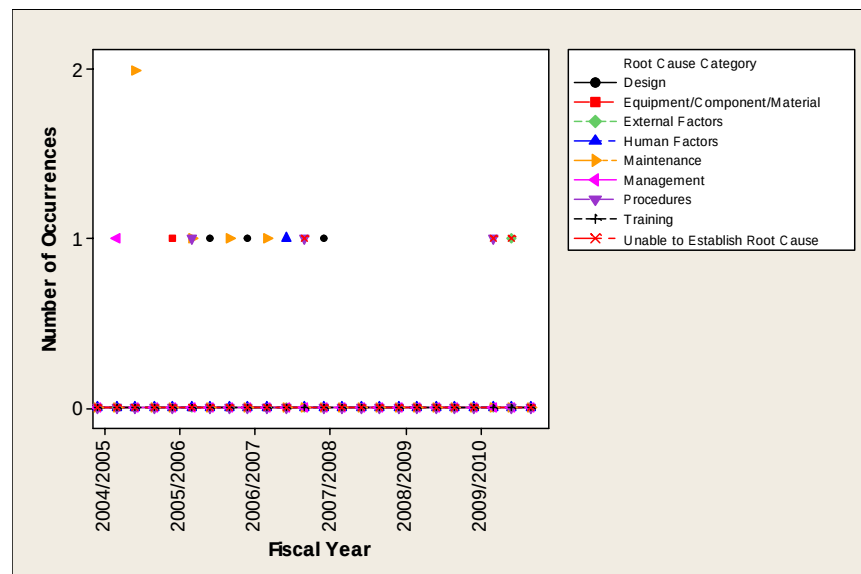


Figure BPV-2 illustrates the distribution of root causes for inspected occurrences over the last six fiscal years. A statistical analysis reveals that all of the root cause categories do not demonstrate significant trends over the last six fiscal years. The occurrences in this program are relatively rare.

Figure BPV-2: Boilers and pressure vessels occurrences by root cause category.



Compliance Analysis

Periodic Inspections

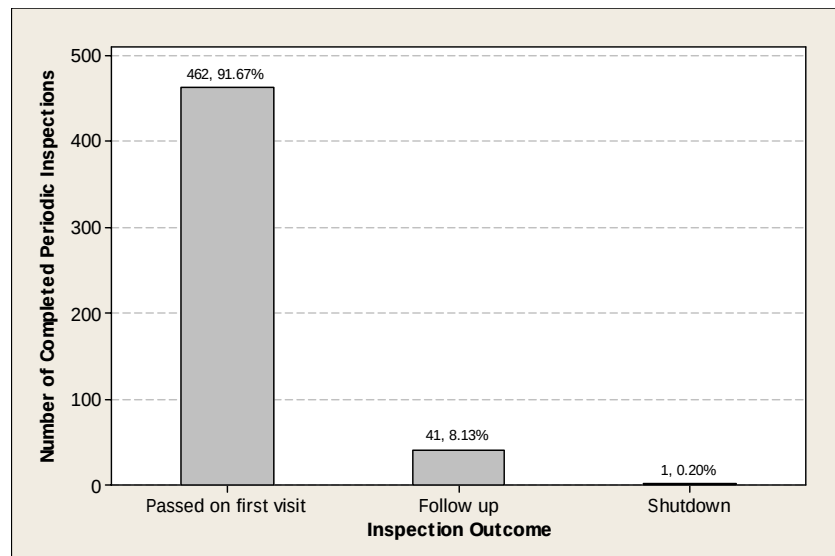
There were 504 periodic inspections conducted in fiscal year 2009/2010. Each of these inspections results in an outcome as determined by a TSSA inspector, shown in Figure BPV-3. Of all periodic inspections completed in



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fiscal year 2009/2010, 91.67% passed on the first visit. Please note that the periodic inspections analyzed in this report only cover visits to facilities falling under TSSA's jurisdiction.

Figure BPV-3: Outcomes from boilers and pressure vessels periodic inspections completed in fiscal year 2009/2010.

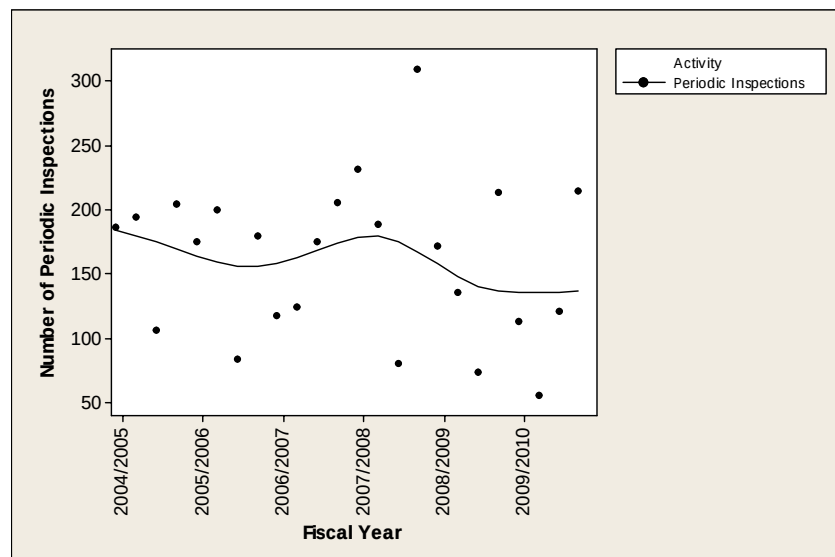


TSSA inspectors issued a total of 30 inspection orders during the course of these periodic inspections. This yields an average number of inspection orders issued per inspection of 0.060.

Compliance Related Trends

Figure BPV-4 charts the number of periodic inspections over the last six fiscal years. A statistical analysis of this data indicates that the number of periodic inspections does not demonstrate a significant trend over the last six fiscal years.

Figure BPV-4: Boilers and pressure vessels periodic inspections completed over the last six fiscal years.





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Figure BPV-5 provides the average number of inspection orders per inspection for the last six fiscal years. A statistical analysis of this data indicates that the average number of inspection orders per inspection does not demonstrate a significant trend over the last six fiscal years.

Figure BPV-5: The average number of inspection orders per boilers and pressure vessels periodic inspection over the last six fiscal years.

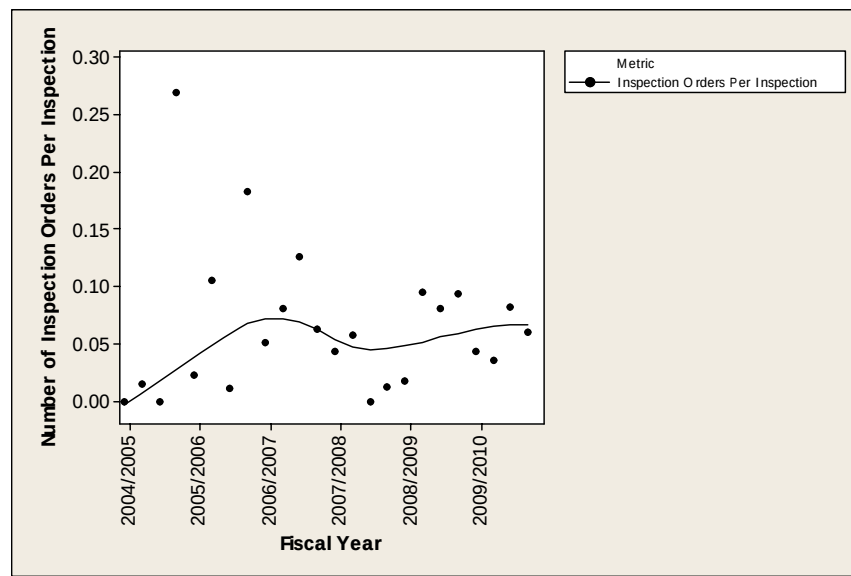
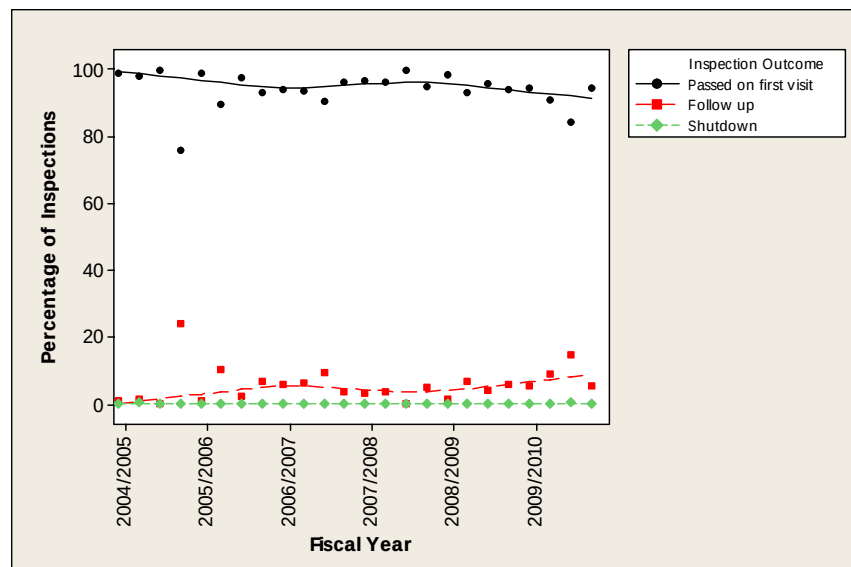


Figure BPV-6 charts the outcomes from the periodic inspections over the last six fiscal years. A statistical analysis of this data indicates that none of the inspection outcomes on first inspection demonstrate significant trends over the last six fiscal years. Since the average number of inspection orders per inspection is low, the level of compliance is expected to be high. The analysis shows that the percentage of passed inspections dominates compared to all other inspection outcomes.

Figure BPV-6: The inspection outcomes of boilers and pressure vessels periodic inspections completed over the last six fiscal years.





Other Safety and Risk Analysis Results

No significant compliance or safety issues were identified through TSSA analysis or other stakeholder sources in the past fiscal year.

Public Safety Decisions

TSSA Actions

Improving Compliance

A new audit process was initiated with two petrochemical companies. Intervening block valves on safety valves are considered under TSSA's variance process; however, for complex facilities such as refineries and petrochemical plants, due to the number of intervening block valves, for practical purposes the review needs to be handled by audit. Working with the Ontario Petrochemical Inspectors Association for many months to determine an appropriate certification statement and audit checklist has resulted in a successful introduction of the audit process. Additional companies are being scheduled for this new process.

Technical training seminars were delivered by TSSA on topics ranging from Ontario *Boilers and Pressure Vessels Regulation* requirements, pressure piping installation requirements, welding qualifications and effective quality control systems.

Managing Safety Issues

Boilers – Internal Inspection

Periodic inspections of low pressure boilers in the *Boilers and Pressure Vessels Act* (before the year 2000) required both internal and external inspection every 24 months. This is no longer required by the current CAD as it does not identify any specifics for internal inspection. This item was discussed at the Boilers and Pressure Vessels Advisory Council meeting in April as part of a safety priority setting initiative. The council identified the frequency of internal inspections as the second of their three top priorities to be addressed over the next three years.

Insurance Data Collection

TSSA is exploring a process for receiving and collecting data electronically from insurers for insured pressure equipment. The benefits would include more effective control over insured pressure equipment inspections for which equipment requires follow-up and a comprehensive consolidated equipment database for the province of Ontario including technical data and location of installation.

Currently, information is received from insurers in hard copy form and requires significant administration time to manage.

In an electronic system, each insurer would enter insurance status information for a site and technical data for inspected equipment at the site including inspection status.

Future steps include finalizing development of a database and web-enabled system to pilot test with participating insurance companies.

Regulatory Improvements

Certificates of Recognition were issued to task force members engaged in the development of the new *Refrigeration Code* section *CSA B52 for Carbon Dioxide* used as a refrigerant. TSSA is a participant of this task force. The newly published supplement to the standard has already been applied to new refrigeration plants in Ontario.



Operating Engineers

Operating Engineers, known as power engineers in the majority of jurisdictions outside Ontario, are certified professional power plant managers and operators who provide energy, climate control, electric power or other utilities for thermal-electric generating stations, industrial processes and facilities. They manage, operate and maintain boilers, steam turbines and engines, gas compression plants, refrigeration plants, and associated mechanical and electrical systems in power generation, industrial processes and environmental system plants.

Depending upon the size of a specific facility, operating engineers may also manage, operate and maintain all physical facility operations. Large power plants have several operating engineers for each shift, designated as shift engineers and assistant shift engineers. In all cases, a chief operating engineer is responsible for the entire plant management, operation and maintenance. The Operating Engineers program area is responsible for registering, inspecting and regulating the safety of approximately 3,000 plants in Ontario. In addition, the program is responsible, under the regulation, for the examination and certification of over 12,000 operating engineers and operators to confirm their qualifications. These activities ensure that all operating engineers and operators in Ontario have the skills and knowledge to safely manage, operate and maintain registered power plants.

Public Safety Analysis

Occurrence Analysis

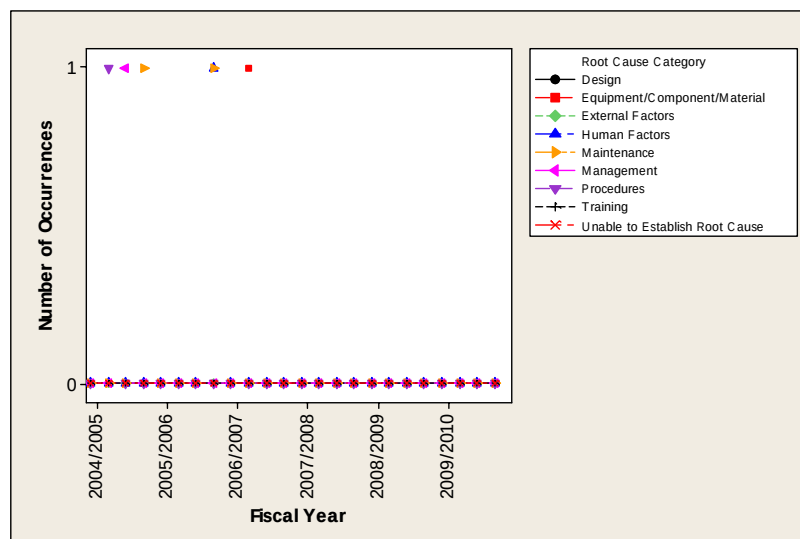
There were no occurrences in the period May 1, 2009 to April 30, 2010.

Occurrence Related Trends

There were no fatalities or serious injuries over the last six fiscal years.

Figure OE-1 illustrates the number of occurrences and their root causes. A statistical analysis of this data indicates that there are no significant trends associated with the occurrences, their consequences or their root causes. Occurrences in this program are relatively rare.

Figure OE-1: Operating engineer occurrences by root cause category.



Compliance Analysis

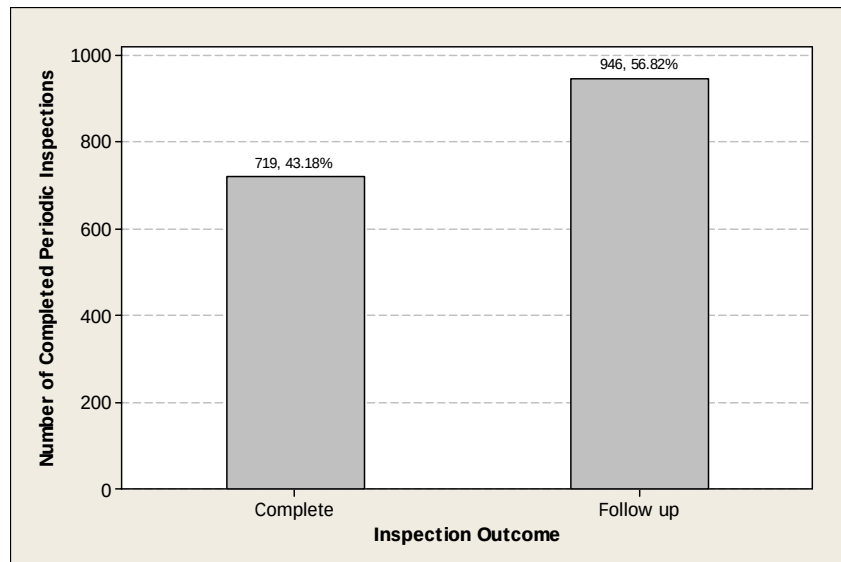
Periodic Inspections

There were 1,665 periodic inspections conducted in fiscal year 2009/2010. Each of these inspections results in an outcome as determined by a TSSA inspector, shown in Figure OE-2. Of all periodic inspections completed in fiscal year 2009/2010, 43.18% passed on the first visit.



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Figure OE-2: Outcomes from operating plant periodic inspections completed in fiscal year 2009/2010.



TSSA inspectors issued a total of 2,935 inspection orders during the course of these periodic inspections. This yields an average number of inspection orders issued per inspection of 1.76.

Compliance Related Trends

Figure OE-3 charts the number of periodic inspections over the last six fiscal years. A statistical analysis of this data indicates that the number of periodic inspections does not demonstrate a significant trend over the last six fiscal years.

Figure OE-3: Operating plant periodic inspections completed over the last six fiscal years.

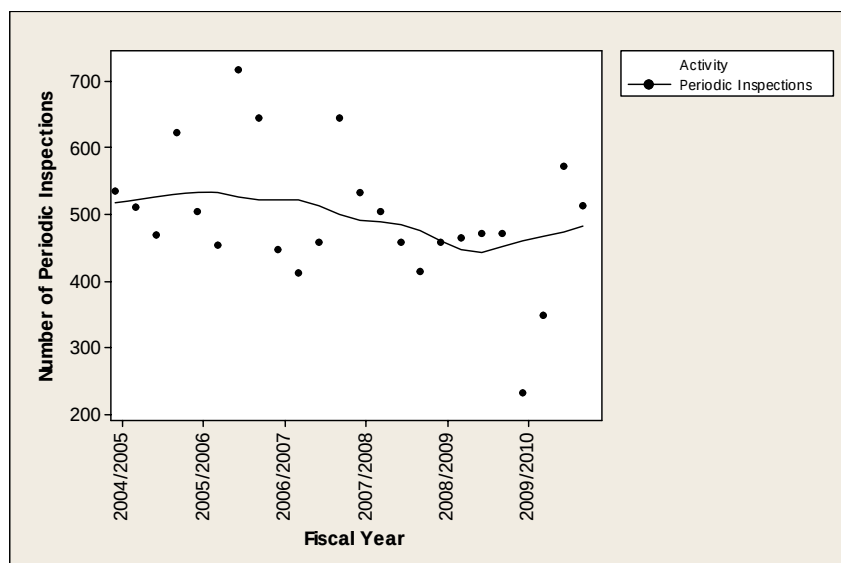


Figure OE-4 provides the average number of inspection orders per inspection for the last six fiscal years. A statistical analysis of this data indicates that the average number of inspection orders per inspection exhibits a downward trend over the last six fiscal years, while the number of periodic inspections has remained relatively constant.



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Figure OE-4: The average number of inspection orders per operating plant periodic inspection over the last six fiscal years.

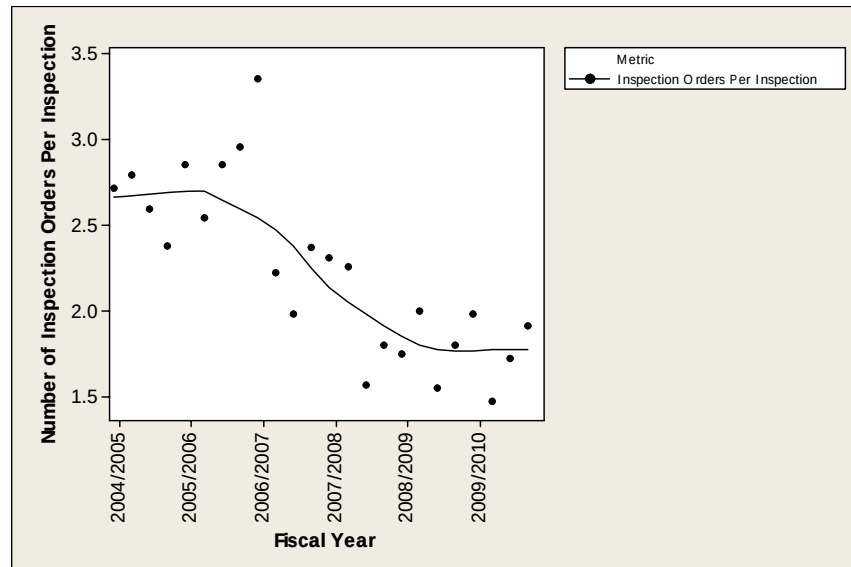
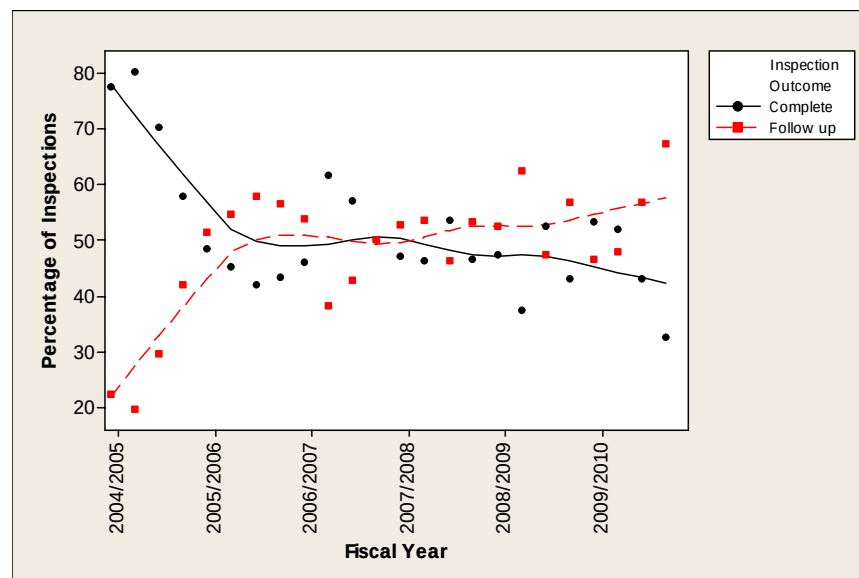


Figure OE-5 charts the outcomes from the periodic inspections over the last six fiscal years. A statistical analysis of this data indicates there is an upward trend in the percentage of inspections with the 'Follow-up' outcome, and a downward trend in the percentage of inspections with the 'Complete' outcome. While the average number of inspection orders per inspection may have a downward trend, the significance of inspection orders is increasing, demonstrated by the upward trend in the percentage of inspections requiring follow-up.

Figure OE-5: The inspection outcomes of operating plant periodic inspections completed over the last six fiscal years.



Other Safety and Risk Analysis Results

No significant compliance or safety issues were identified through TSSA analysis or other stakeholder sources in the past fiscal year.



Public Safety Decisions

TSSA Actions

Improving Compliance

TSSA has been administering a risk-informed inspection process for this program area over the past three years, the results of which are being used by TSSA to generate a risk profile of power plants. This process focuses TSSA inspection activities on those plants that are demonstrating a higher level of non-compliance and ensures that safety inspection resources are applied in the most effective manner.

Managing Safety Issues

Steam Turbine Governors

A study of steam turbine governor systems has been completed. Manufacturers and users of steam turbines are being surveyed to determine if the current regulation requirements are effective relative to the maintenance and testing of governor systems.

Thermal Oil Plants

Currently, Ontario does not regulate the operation of thermal oil plants. This technology has a higher relative potential than other technologies to cause hot oil burns and fires. A study is ongoing in consultation with the Operating Engineers Advisory Council to address the technology. TSSA will review any recommendations from the study and make recommendations to the government of Ontario on regulatory change to ensure the safe operation and maintenance of thermal oil plants.

Power Engineers

A risk reduction group is working to address the anticipated skills shortage in this profession. The risk reduction group is exploring opportunities for additional approved training providers as well as other training models. The risk reduction group is also considering means of raising awareness and investigating how industry can assist with practical operating qualifying time for those candidates receiving training.

Regulatory Improvements

Revisions and amendments to *Ontario Regulation 219/01, Power Engineering* (formerly Operating Engineers), developed in 2006 in consultation with industry have been submitted to MCS for approval.



Elevating Devices and Amusement Devices

Amusement Devices

TSSA regulates over 2,300 amusement devices in Ontario by ensuring all rides conform to the *Technical Standards and Safety Act, 2000* and applicable regulations, codes and standards. TSSA reviews and registers rides, issues permits for each ride in the current operating season, licenses operators, conducts inspections and incident investigations, and delivers public awareness campaigns throughout the province. Amusement devices under TSSA's jurisdiction include roller coasters, Ferris wheels, merry-go-rounds, water and dry slides and go-karts, as well as spinning, whirling, inflated and bungee type rides.

The trend analysis presented in this section should be considered in the context that these devices are predominantly seasonal in nature. The trend analysis confirmed the seasonality and took it into account while establishing historical patterns of safety and compliance performance.

Public Safety Analysis

Occurrence Analysis

Table AD-1 summarizes the amusement devices occurrences reported to TSSA. It presents the number of occurrences that were reported to TSSA in accordance with the reporting guidelines provided to the stakeholders. These occurrences can be categorized as an incident or a near-miss and Table 4 includes their occurrence inspection status at the end of the fiscal year. The number of victims and their injury severity from the occurrences are also included.

Occurrences not requiring formal inspections do not involve a device-related failure. These are attributed to the specific sub-category 'Failure to Follow User Instructions' from the 'Human Factors' category, and have been treated accordingly in the root cause trend analysis.

Table AD-1: Activity breakdown for amusement devices occurrences.

Occurrence Detail	May 1, 2009 – April 30, 2010
Number of Incidents	91
Number of Near-Misses	10
Occurrences Within TSSA Jurisdiction	101
• Completed Causal Analysis	11
• Unable to Establish Root Cause	0
• In Progress	18
• Not Requiring Formal Inspection	72
Total Occurrences	101
Occurrences Outside TSSA Jurisdiction	0
Number of Fatalities	0
Number of Serious Injuries	5
Number of Minor Injuries	87

The 5 serious injuries occurred on the following devices:

- Go-Karts - 2;
- Dry Slide – 1;
- Inflatable - 1; and
- Water Slide – 1.

'Human Factors' is the most dominant causal type of these injuries.



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Occurrence Related Trends

Figure AD-1 shows the number of occurrences to which TSSA has responded over the last three fiscal years. A statistical analysis of this data indicates that the number of occurrences on amusement devices does not demonstrate a significant trend over the last three fiscal years. It should be noted that this graph only includes occurrence inspections that have been concluded.

Figure AD-1: Amusement devices occurrences over the last three fiscal years.

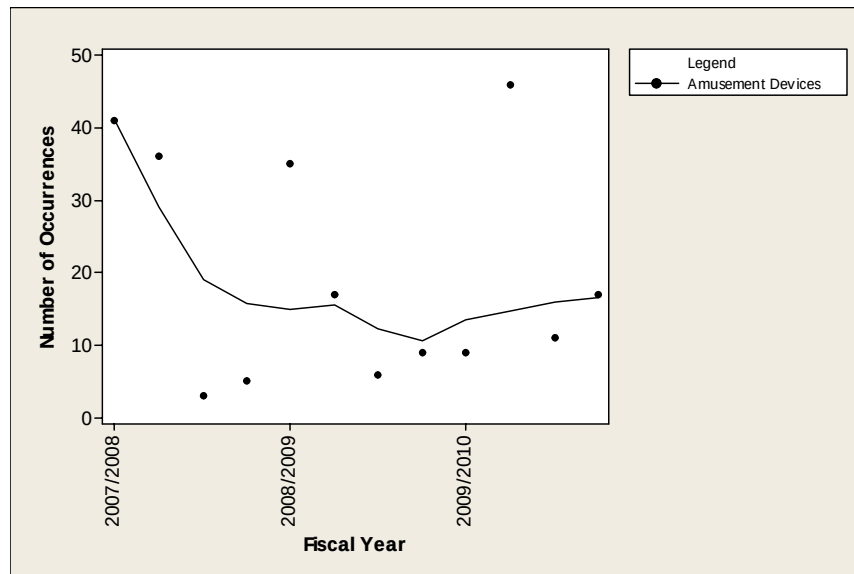
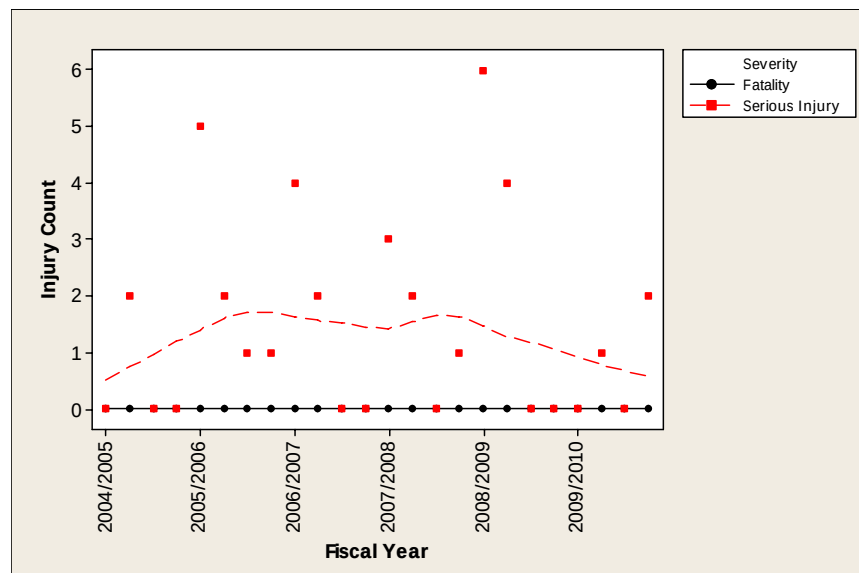


Figure AD-2 charts the number of amusement devices fatalities and serious injuries over the last six fiscal years. As illustrated, there have been no fatalities on amusement devices within TSSA's jurisdiction during this period. A statistical analysis of this data indicates that the number of serious injuries does not demonstrate a significant trend over the last six fiscal years.

Figure AD-2: Amusement devices fatalities and serious injuries over the last six fiscal years (analyzed occurrences).





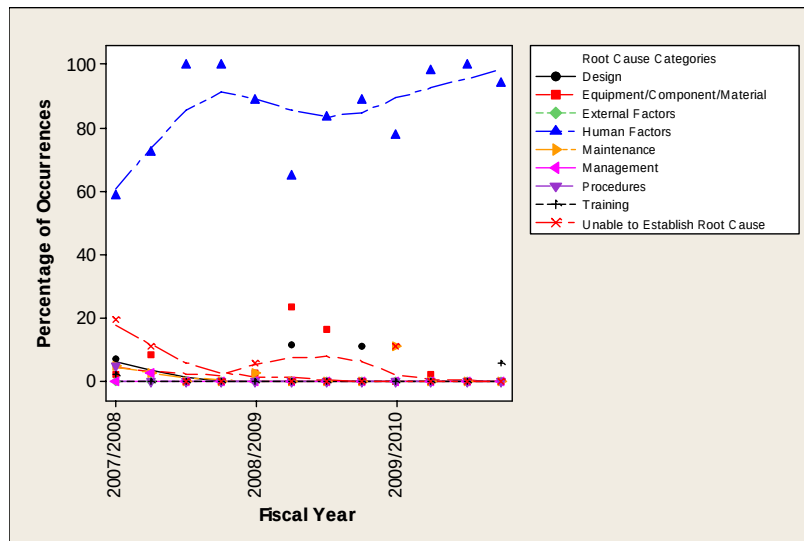
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Figure AD-3 illustrates the distribution of root causes for inspected occurrences (in percentages) over the last three fiscal years. A statistical analysis of the data indicates that all root cause categories do not demonstrate significant trends over the last three fiscal years. 'Human Factors' is the dominant root cause category relative to all the other causal categories.

'Human Factors' include many different sub-categories such as 'Failure to Follow User Instructions', 'Failure to Follow Operating Procedures', 'Deliberate Intent or Sabotage', and 'Inadequate or Unsafe Operating Environment'. Please refer to Appendix B, Root Cause Analysis Categories, for a further definition of 'Human Factors'.

Figure AD-3: The percentage of each root cause category attributed in amusement devices occurrences over the last three fiscal years.

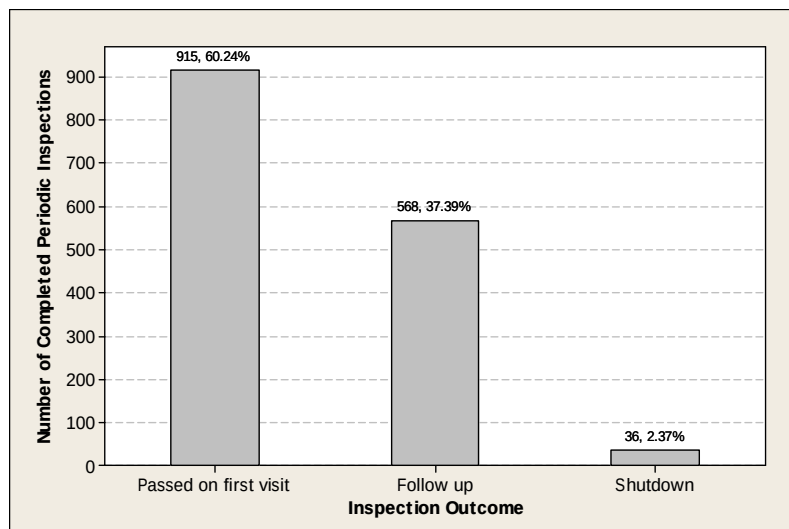


Compliance Analysis

Periodic Inspections

There were 1,519 periodic inspections conducted in fiscal year 2009/2010. Each of these inspections results in an outcome as determined by a TSSA inspector, shown in Figure AD-4. Of all periodic inspections completed in fiscal year 2009/2010, 60.24% passed on the first visit.

Figure AD-4: Outcomes from amusement devices periodic inspections completed in fiscal year 2009/2010.





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TSSA inspectors issued a total of 1,691 inspection orders during the course of these periodic inspections. This yields an average number of inspection orders issued per inspection of 1.11.

Compliance Related Trends

Figure AD-5 charts the number of periodic inspections over the last six fiscal years. A statistical analysis of this data indicates that the number of periodic inspections does not demonstrate a significant trend over the last six fiscal years.

Figure AD-5: Amusement devices periodic inspections completed over the last six fiscal years.

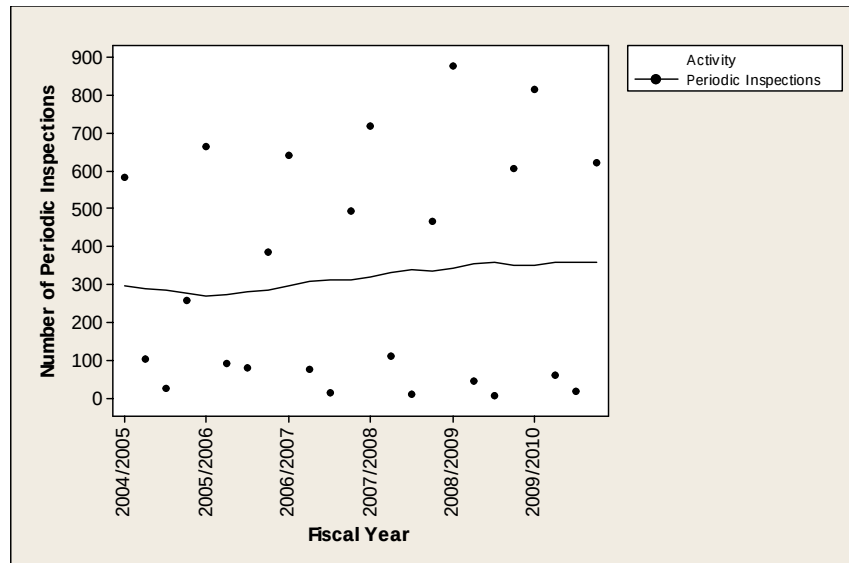
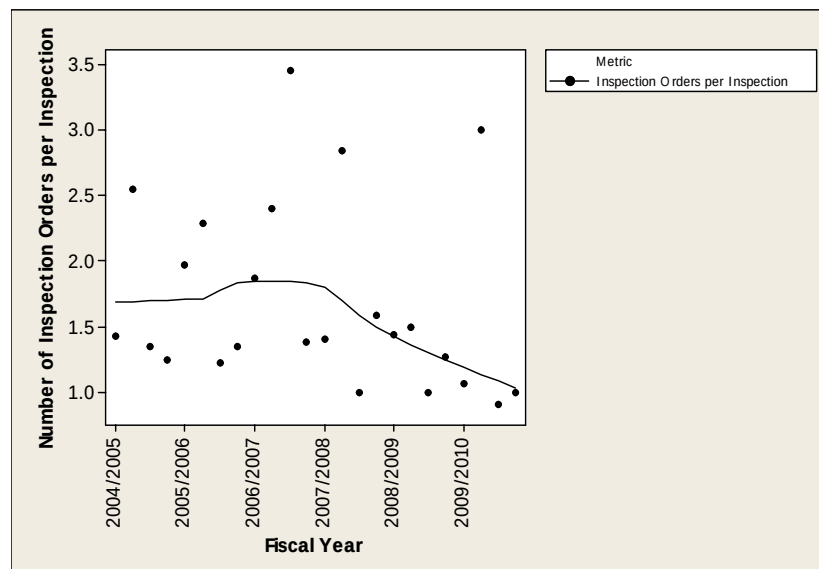


Figure AD-6 provides the average number of inspection orders per inspection for the last six fiscal years. A statistical analysis of this data indicates that the average number of inspection orders per inspection does not demonstrate a significant trend over the last six fiscal years.

Figure AD-6: The average number of inspection orders per amusement devices periodic inspection over the last six fiscal years.

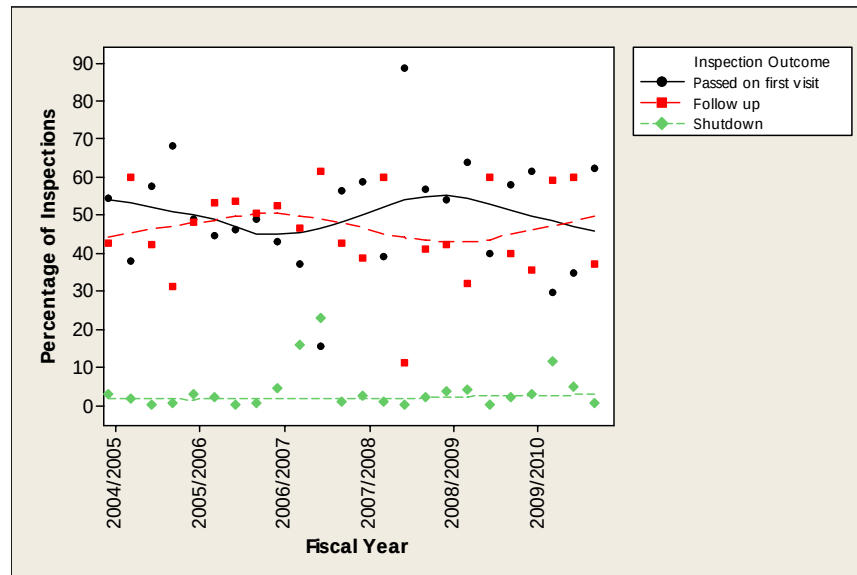




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Figure AD-7 charts the outcomes from the periodic inspections over the last six fiscal years. A statistical analysis of this data indicates that none of the inspection outcomes demonstrate significant trends over the last six fiscal years.

Figure AD-7: The inspection outcomes of amusement devices periodic inspections completed over the last six fiscal years.



Other Safety and Risk Analysis Results

Victim Age Group

A comprehensive analysis has been initiated to determine the age profile associated with occurrences. In particular, the intent is to focus on occurrences whose causes may have been attributed to "failure to follow user instructions". It is expected that the results of this analytical study would enhance TSSA's ability to understand and, if required, manage user behaviour.

One key area of application is related to amusement devices due to the information available on the historic profile of occurrences. Initial results from the analysis indicate that there has been a concentration of children and young people who have experienced occurrences on amusement devices. The median ages collected in victim information forms from prior fiscal years has been compiled in Table AD-3 below, for the fiscal years 2007/2008, 2008/2009, and 2009/2010. The most significant root cause for all of the occurrences involving people of age 16 and under is 'Failure to Follow User Instructions'.

Table AD-3: Activity breakdown for amusement devices occurrences.

Fiscal Year	Median Age of Victims
2007/2008	14.0
2008/2009	15.5
2009/2010	12.0

Further detailed analysis is being carried out and will be used to help inform decision making related to user behavior.



Public Safety Decisions

TSSA Actions

Improving Compliance

TSSA held its annual amusement devices technical training workshop for engineers, inspectors and industry members. By promoting safety requirements to relevant stakeholders, events such as these are expected to result in a positive impact on safety outcomes.

Managing Safety Issues

Analysis has continually identified 'Human Factors' as the primary root and contributing causes of occurrences. In response, TSSA has continued to enhance its public education program. TSSA has delivered successful public education campaigns focused on rider responsibility and raising safety awareness at special events, national fairs and numerous waterslide and go-kart parks around the province.

Regulatory Improvements

TSSA issued *Incident Reporting Guideline 531/09* to provide guidance on the new incident reporting requirements in the amusement devices regulation.

TSSA is actively involved with the Canadian Standards Association and the American Society for Testing and Materials in the harmonization of the amusement device standards. Work continues and completion is anticipated the fall of 2010.

Elevators

TSSA regulates over 48,000 operating elevators in Ontario to ensure all devices conform to the *Technical Standards and Safety Act, 2000* and applicable regulations, codes and standards. TSSA reviews and registers elevating devices, issues licences, conducts inspections and performs incident investigations. These devices include passenger elevators, construction hoists, dumbwaiters, observation elevators, freight elevators, material lifts, man lifts, stage lifts, parking garage lifts and lifts designed for persons with physical disabilities.

Public Safety Analysis

Occurrence Analysis

Table ED-1 summarizes the occurrences on elevators reported to TSSA in accordance with the reporting guidelines provided to the stakeholders. These occurrences can be categorized as an incident or a near-miss and the table includes their occurrence inspection status at the end of the fiscal year. The number of victims and their injury severity from the occurrences are also included.

Occurrences not requiring formal inspection do not involve a device related failure and are attributed to the sub-category 'Failure to Follow User Instructions' from the 'Human Factors' category, and have been treated accordingly in the root cause trend analysis.



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Table ED-1: Activity breakdown for occurrences on elevators.

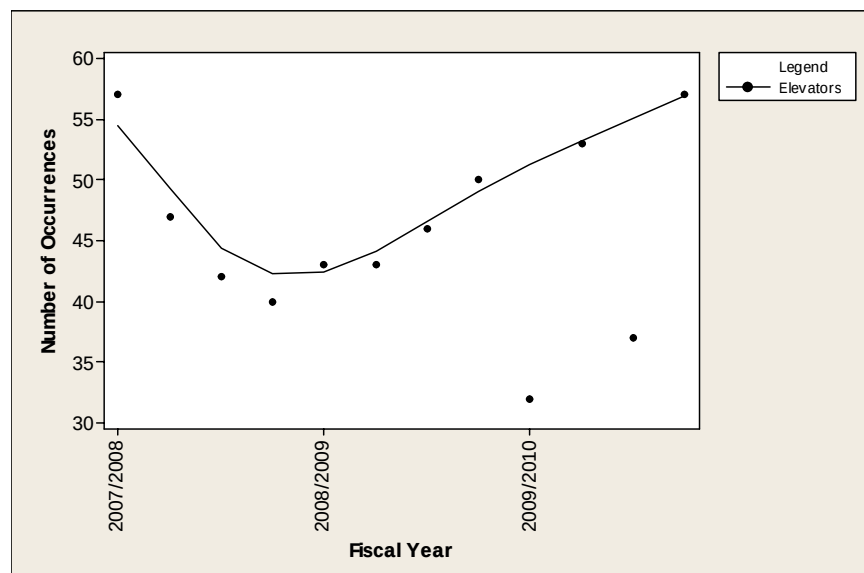
Occurrence Detail	May 1, 2009 – April 30, 2010
Number of Incidents	132
Number of Near-Misses	79
Occurrences Within TSSA Jurisdiction	211
• Completed Causal Analysis	64
• Unable to Establish Root Cause	4
• In Progress	32
• Not Requiring Formal Inspection	111
Total Occurrences	211
Occurrences Outside TSSA Jurisdiction	0
Number of Fatalities	0
Number of Serious Injuries	6
Number of Minor Injuries	112

Two of the serious injuries occurred on workers' rail-guided construction hoists, and the remaining four happened on passenger elevators. Three of the occurrences with serious injuries have completed occurrence inspections. Two of these occurred on passenger elevators and have an attributed root cause of 'Human Factors'. The other completed occurrence inspection was on a workers' rail-guided construction hoist, and had an attributed root cause of 'Design'.

Occurrence Related Trends

Figure ED-1 shows the number of occurrences to which TSSA has responded over the last three fiscal years. A statistical analysis of this data indicates that the number of occurrences on elevators does not demonstrate a significant trend over the last three fiscal years. It should be noted that this graph only includes occurrences with completed inspections.

Figure ED-1: Occurrences involving elevators over the last three fiscal years.





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Figure ED-2 charts the number of fatalities and serious injuries on elevators over the last six fiscal years. As illustrated, there have been no fatalities on elevators within TSSA's jurisdiction during this period. A statistical analysis of this data indicates that the number of serious injuries demonstrates a downward trend over the last six fiscal years.

Figure ED-2: Fatalities and serious injuries involving elevators over the last six fiscal years (analyzed occurrences).

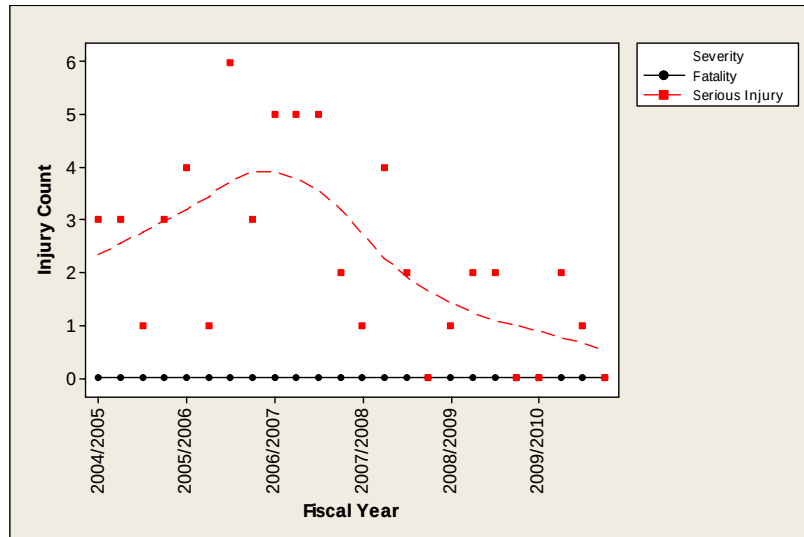
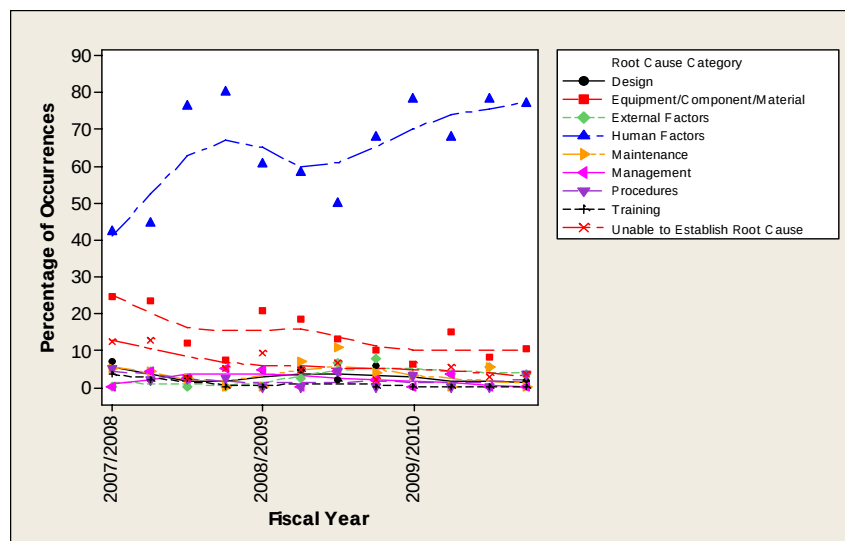


Figure ED-3 illustrates the distribution of root causes for inspected occurrences (in percentages) over the last three fiscal years. A statistical analysis of this data indicates that there are upward trends in the percentage of occurrences with the root causes 'External Factors' and 'Human Factors', and downward trends in the percentage of occurrences with the root causes 'Equipment/Component/Material' and 'Training'. All other root cause categories do not demonstrate significant trends over the last three fiscal years. 'Human Factors' is the dominant root cause category relative to all the other causal categories.

'Human Factors' include many different sub-categories such as 'Failure to Follow User Instructions', 'Failure to Follow Operating Procedures', 'Deliberate Intent or Sabotage', and 'Inadequate or Unsafe Operating Environment'. Please refer to Appendix B, Root Cause Analysis Categories, for a further definition of 'Human Factors'.

Figure ED-3: The percentage of each root cause category attributed in elevator occurrences over the last three fiscal years.





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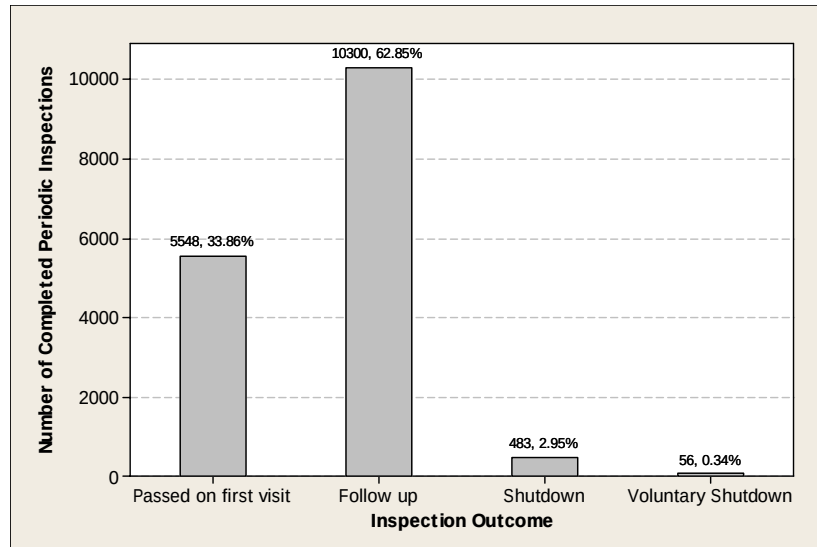
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Compliance Analysis

Periodic Inspections

There were 16,387 periodic inspections conducted in fiscal year 2009/2010. Each of these inspections results in an outcome as determined by a TSSA inspector, shown in Figure ED-4. Of all periodic inspections completed in fiscal year 2009/2010, 33.86% passed on the first visit.

Figure ED-4: Outcomes from elevator periodic inspections completed in fiscal year 2009/2010.

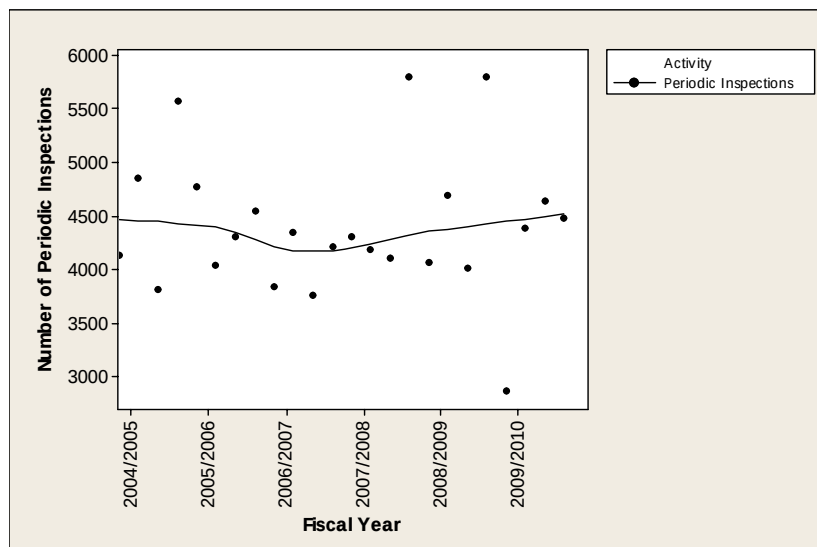


TSSA inspectors issued a total of 33,955 inspection orders during the course of these periodic inspections. This yields an average number of inspection orders issued per inspection of 2.07.

Compliance Related Trends

Figure ED-5 charts the number of periodic inspections over the last six fiscal years. A statistical analysis of this data indicates that the number of periodic inspections does not demonstrate a significant trend over the last six fiscal years.

Figure ED-5: Periodic inspections completed on elevators over the last six fiscal years.





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Figure ED-6 provides the average number of inspection orders per inspection for the last six fiscal years. A statistical analysis of this data indicates that the average number of inspection orders per inspection does not demonstrate a significant trend over the past six fiscal years; however, the period from the first quarter of fiscal year 2004/2005 to the third quarter of fiscal year 2007/2008 exhibits an upward trend. This is followed by a downward trend from the fourth quarter of fiscal year 2007/2008 to the end of fiscal year 2009/2010.

Figure ED-6: The average number of inspection orders per periodic inspection on elevators over the last six fiscal years.

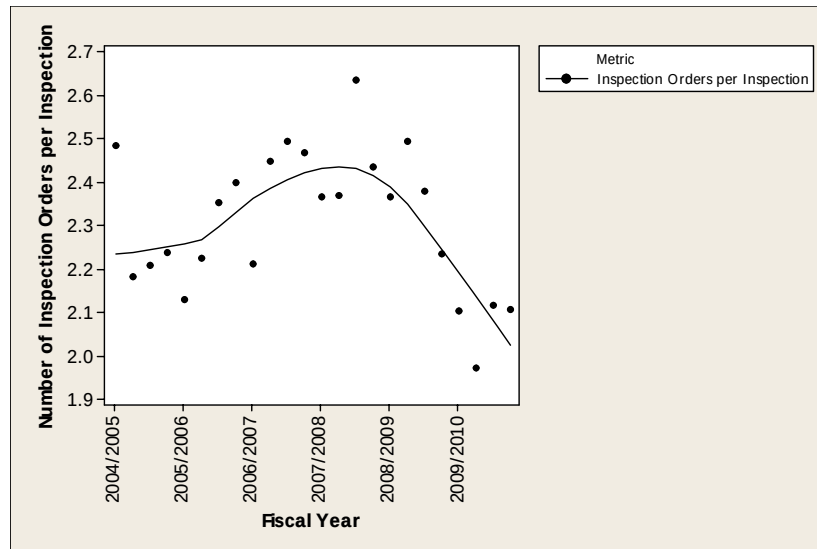
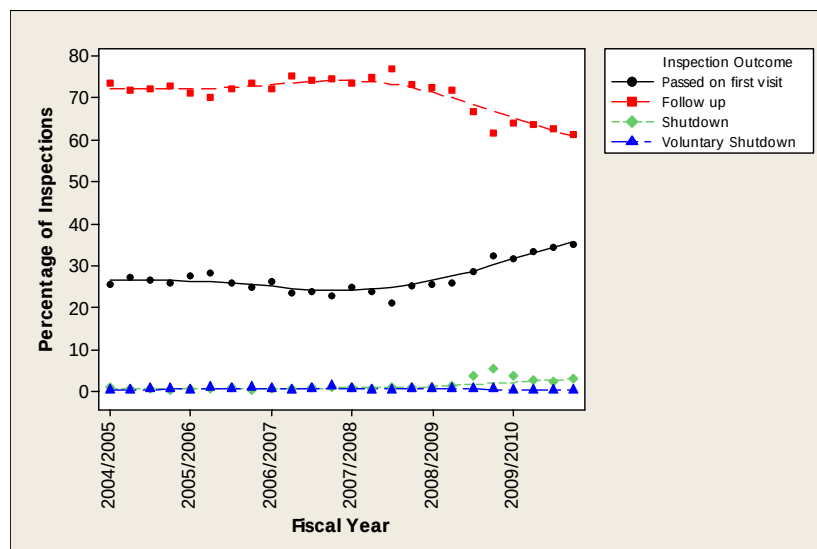


Figure ED-7 charts the outcomes from the periodic inspections over the last six fiscal years. A statistical analysis of this data indicates that there are upward trends in both the percentage of 'Passed' and 'Shutdown' outcomes, and a corresponding downward trend in the percentage of 'Follow-up' inspection outcomes over the last six fiscal years. There is also strong statistical evidence that indicates that the program's efforts to improve compliance as described in the TSSA Actions section are behind the more recent trends in the inspection outcomes and the number of inspection orders per inspection. The percentage of inspections resulting in a 'Voluntary Shutdown' outcome does not demonstrate a significant trend over the last six fiscal years.

Figure ED-7: The inspection outcomes of periodic inspections completed on elevators over the last six fiscal years.





Other Safety and Risk Analysis Results

No significant compliance or safety issues were identified through TSSA analysis or other stakeholder sources in the past fiscal year.

Public Safety Decisions

TSSA Actions

Improving Compliance

For a number of years, TSSA has engaged industry, talked to contractors, and issued orders – but non-compliances requiring follow-up continued to increase. As a result, TSSA enhanced its efforts to achieve greater levels of compliance.

In the past, TSSA offered a tangible incentive: cost-effective voluntary reporting of compliance. Contractors and owners who received and resolved low risk safety directions – within a specified time period – were permitted to voluntarily report compliance, avoiding the cost of a follow-up inspection. There was also an associated deterrent. Should one choose not to resolve directions in the time provided, the owner would be billed at twice the regular rate – with outstanding directives subject to additional follow-ups and associated fees.

In December 2008, TSSA offered three new enforcement actions:

1. shutdown one elevator for any overdue safety tests, and/or annual, two or five-year inspections;
2. shutdown successive elevators for failing to complete outstanding directives with seven days; and
3. mandate a detailed plan from the owner – within 30 days – to ensure ongoing and future compliance.

In 2010, in an effort to further reduce the number of follow-up inspections and improve compliance, TSSA added a new enforcement action: shutdown an elevator where directions found on follow-up inspections have not been completed in the time line given on the periodic inspection report.

Analysis of periodic inspection outcomes over the last three years shows that the number of shutdowns have increased as have the number of periodic inspections passed without a follow-up inspection required. This indicates that the actions listed above are leading to improved industry compliance.

Managing Safety Issues

TSSA issued *Information Bulletin 243/10* which reminds owners of the importance of oil loss monitoring and advises them of upcoming code changes. These code changes will require hydraulic elevators with single bulkhead jacks to be replaced or be equipped with a plunger gripper or car safety. TSSA advises owners that they should be planning for these changes now.

As a member of the National Association of Elevator Safety Authority's Canadian Region, TSSA participated in the annual training workshop for its inspectors and engineers, alongside inspectors from other provinces and industry members. Participation in the workshop provides the necessary credits qualifying TSSA inspectors and engineers to write the annual exam required to renew their qualified elevator inspector certification.

Regulatory Improvements

TSSA issued *Incident Reporting Guideline 230/09* which provides guidance on the new incident reporting requirements in the *Elevating Devices Regulation*.

TSSA issued *CAD Amendment 238/09* which adopts the revised *B355 Code for Lifts for Persons with Physical Disabilities*.



Escalators and Moving Walks

TSSA regulates over 2,050 escalators and moving walks in Ontario to ensure all devices conform to the *Technical Standards and Safety Act, 2000* and applicable regulations, codes and standards. TSSA reviews and registers escalators and moving walks, issues licences, conducts inspections and performs incident investigations.

Public Safety Analysis

Occurrence Analysis

Table EM-1 summarizes the escalator and moving walk occurrences reported to TSSA for fiscal year 2009/2010 in accordance with the reporting guidelines provided to stakeholders. These occurrences can be categorized as an incident or a near-miss. The table includes their occurrence inspection status at the end of the fiscal year. The number of victims and their injury severity from the occurrences are also included. It should be noted that the reason that 487 occurrences did not require formal inspection is due to the fact that the occurrences were not equipment related and in most cases they were slips, trips or falls.

Occurrences not requiring formal inspection do not involve a device related failure and are attributed to the sub-category 'Failure to Follow User Instructions' from the 'Human Factors' category, and have been treated accordingly in the root cause trend analysis.

Table EM-1: Activity breakdown for escalator and moving walk occurrences.

Occurrence Detail	May 1, 2009 – April 30, 2010
Number of Incidents	383
Number of Near-Misses	152
Occurrences Within TSSA Jurisdiction	535
• Completed Causal Analysis	29
• Unable to Establish Root Cause	0
• In Progress	19
• Not Requiring Formal Inspection	487
Total Occurrences	535
Occurrences Outside TSSA Jurisdiction	0
Number of Fatalities	1
Number of Serious Injuries	7
Number of Minor Injuries	362

The fatality occurred on an escalator involving a rider who sat on the rail of the escalator and fell off backwards. This fatality underscores the importance of following user instructions on escalators.

Six of the serious injuries occurred on escalators, the remaining one occurred on a moving walk. The root causes of the six injuries on escalators were as follows (one serious injury per occurrence):

- 'Human Factors' (five occurrences); and
- 'Equipment/Component/Material'.

The root cause of the serious injury occurrence on the moving walk was 'Equipment/Component/Material'.

Occurrence Related Trends

Figure EM-1 shows the number of occurrences to which TSSA has responded over the last three fiscal years. A statistical analysis of the data indicates that the number of occurrences on escalators and moving walks does not



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demonstrate a significant trend over the last three fiscal years. It should be noted that this graph only includes occurrences with completed inspections.

Figure EM-1: Occurrences involving escalators and moving walks over the last three fiscal years.

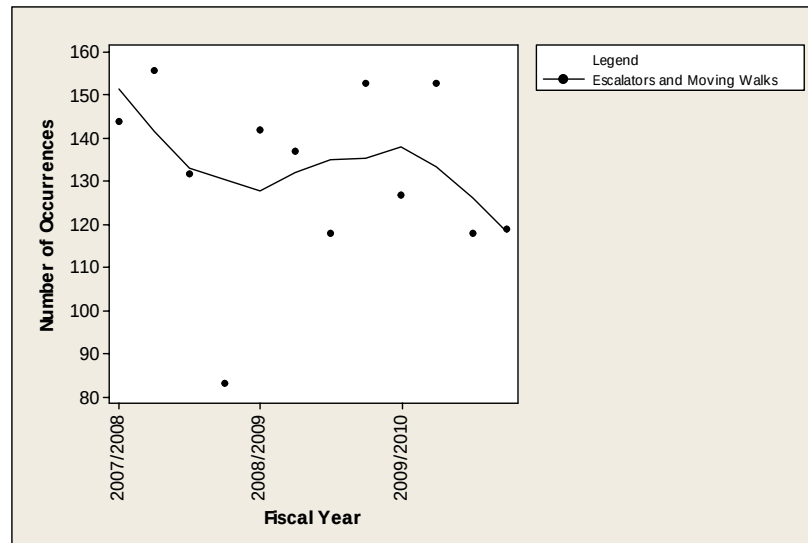


Figure EM-2 charts the number of fatalities and serious injuries on escalators and moving walks over the last six fiscal years. As illustrated, there was one fatality and seven serious injuries within TSSA's jurisdiction during this period. A statistical analysis of this data indicates that the number of fatalities and serious injuries do not demonstrate significant trends over the last six fiscal years.

Figure EM-2: Fatalities and serious injuries on escalators and moving walks over the last six fiscal years (analyzed occurrences).

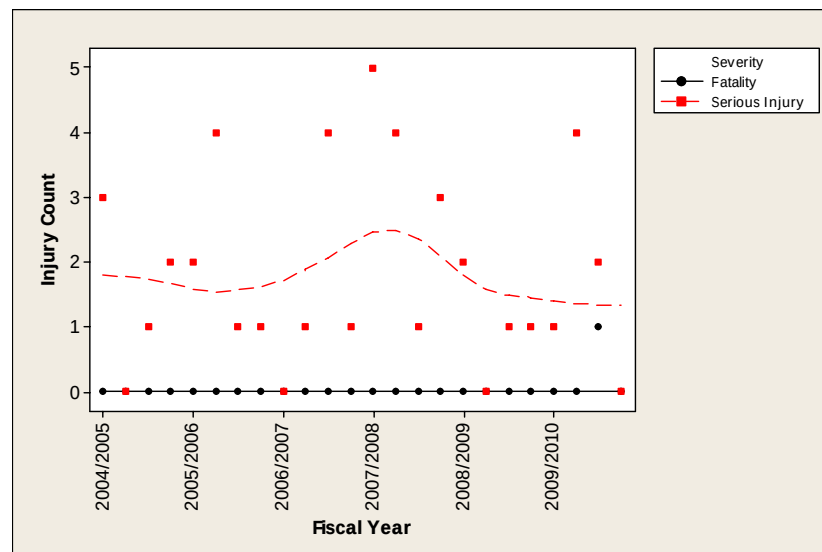


Figure EM-3 illustrates the distribution of root causes for inspected occurrences (in percentages) over the last three fiscal years. A statistical analysis of this data indicates that there is an upward trend in the percentage of occurrences with the root cause 'Human Factors', and downward trends in the percentage of occurrences with the root causes 'Design', 'Equipment/Component/Material' and 'Unable to Establish Root Cause'. All other root cause categories do not demonstrate significant trends over the last three fiscal years. 'Human Factors' is the dominant root cause category



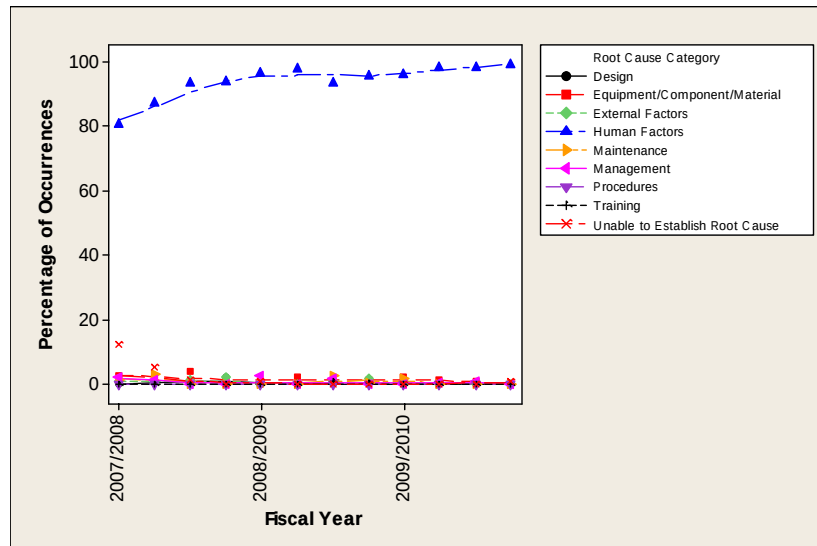
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relative to all the other causal categories. The downward trend in the 'Unable to Establish Root Cause' category demonstrates that TSSA has improved its ability to carry out root cause analysis as a result of ongoing training activities.

'Human Factors' include many different sub-categories such as 'Failure to Follow User Instructions', 'Failure to Follow Operating Procedures', 'Deliberate Intent or Sabotage', and 'Inadequate or Unsafe Operating Environment'. Please refer to Appendix B, Root Cause Analysis Categories, for a further definition of 'Human Factors'.

Figure EM-3: The percentage of each root cause category attributed in escalators and moving walks occurrences over the last three fiscal years.

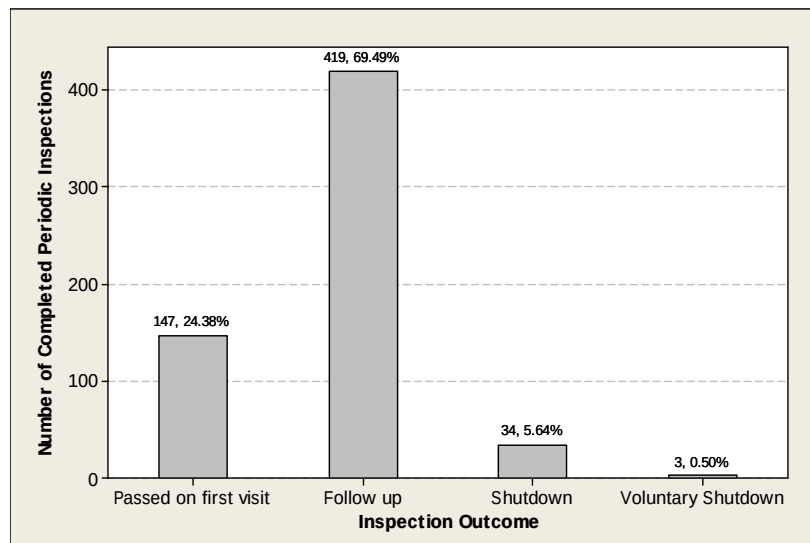


Compliance Analysis

Periodic Inspections

There were 603 periodic inspections conducted in fiscal year 2009/2010. Each of these inspections results in an outcome as determined by a TSSA inspector, shown in Figure EM-4. Of all periodic inspections completed in fiscal year 2009/2010, 24.38% passed on the first visit.

Figure EM-4: Outcomes from periodic inspections completed on escalators and moving walks in fiscal year 2009/2010.





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TSSA inspectors issued a total of 1,438 inspection orders during the course of these periodic inspections. This yields an average number of inspection orders issued per inspection of 2.38.

Compliance Related Trends

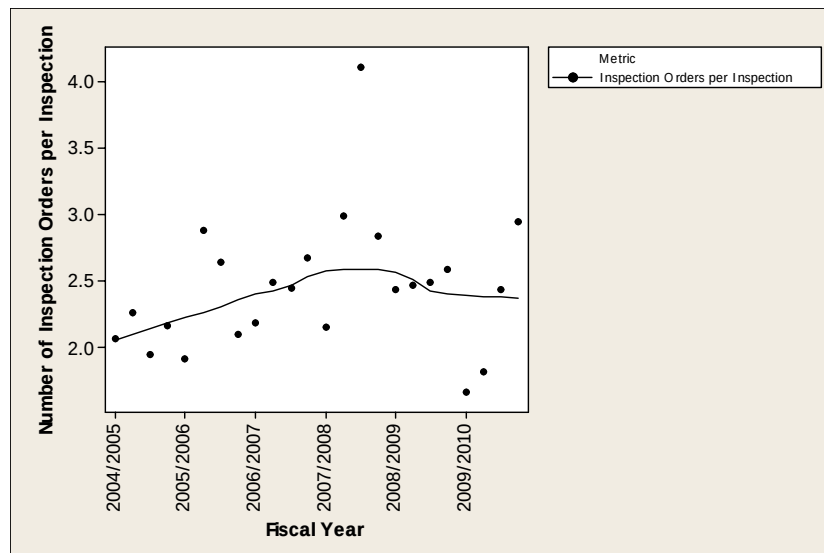
Figure EM-5 charts the number of periodic inspections over the last six fiscal years. A statistical analysis of this data indicates that the number of periodic inspections does not demonstrate a significant trend over the last six fiscal years.

Figure EM-5: Periodic inspections completed on escalators and moving walks over the last six fiscal years.



Figure EM-6 provides the average number of inspection orders per inspection for the last six fiscal years. A statistical analysis of this data indicates that the average number of inspection orders per inspection does not demonstrate a significant trend over the last six fiscal years.

Figure EM-6: The average number of inspection orders per periodic inspection on escalators and moving walks over the last six fiscal years.

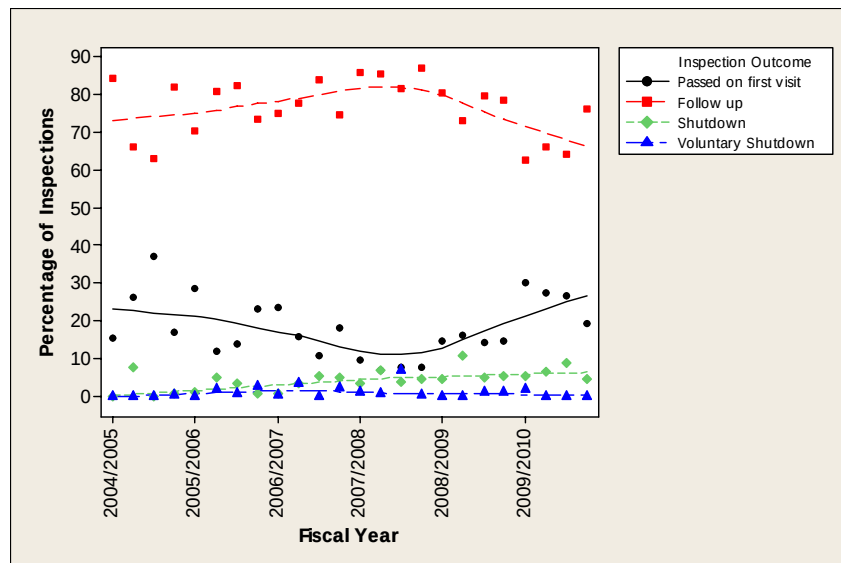




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Figure EM-7 charts the outcomes from the periodic inspections over the last six fiscal years. A statistical analysis of this data indicates that there is an upward trend in the percentage of inspections resulting in a 'Shutdown' outcome. Moreover, in the time period from the first quarter of fiscal year 2004/2005 to the second quarter of fiscal year 2007/2008, the 'Passed' and 'Follow-up' outcome demonstrate a downward and upward trend, respectively; however, from the third quarter of fiscal year 2007/2008 to the end of fiscal year 2009/2010, these outcomes demonstrate the opposite trends. This gives statistical evidence that the program's efforts to improve compliance (described in the TSSA Actions section) are behind the more recent trends in the inspection outcomes. The percentage of inspections with the 'Voluntary Shutdown' outcome does not demonstrate a significant trend over the last six fiscal years.

Figure EM-7: The inspection outcomes of periodic inspections completed on escalators and moving walks over the last six fiscal years.



Other Safety and Risk Analysis Results

Escalator Entrapments

TSSA observed multiple entrapment occurrences indicated by occurrence history. Escalator entrapment occurrences involve a user's hands, clothing and/or footwear becoming caught somewhere in the device. TSSA constituted a risk reduction group involving TSSA experts and industry to determine appropriate actions to address this safety issue. Additionally, TSSA has been engaged in a risk assessment study to quantify risks associated with this safety issue that would facilitate making informed safety decisions.

The analysis indicated that the significance of entrapments as compared to other types of occurrences on escalators has shown an upward trend.

The findings and conclusions from the escalator entrapment risk assessment are summarized as follows:

- the most significant established root cause categories for entrapments are 'Human Factors' and 'Maintenance'; and
- the 'Maintenance' root cause category has increased in relative significance by an order of magnitude in the last two years as compared to the last eight years.

Escalator Brakes

TSSA has received reports of and investigated incidents involving failure of escalator brakes over the past several years. Specifically, three such occurrences have been reported and investigated over the last five years. Additionally, TSSA has observed several non-compliance issues involving the operation and maintenance of escalator brakes across the entire inventory within the province of Ontario. Unlike elevators, no redundancy requirements are currently in place in the adopted codes and standards associated with escalator brakes. TSSA has constituted a risk reduction group



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involving TSSA experts and industry to determine appropriate actions to address this safety issue. Additionally, TSSA has been engaged in a risk assessment study to quantify risks associated with this safety issue that would facilitate making informed safety decisions.

Public Safety Decisions

TSSA Actions

Improving Compliance

TSSA has enhanced its efforts to achieve greater levels of compliance for escalators and moving walk using the same methods as those described above for elevators.

Managing Safety Issues

Based on the recommendations of the escalator entrapment risk reduction group, TSSA issued *Enforcement Procedure 241/10* reminding owners of escalators and moving walks of the importance of the monthly application of a friction reducing agent to escalator skirts on certain older escalators. It also reinforced the escalator and moving walk start up procedure, and has alerted escalator owners of upcoming code changes that will require all existing escalators to comply with the step skirt index requirements. TSSA has advised owners that they should start planning for these changes now.

Regulatory Improvements

TSSA issued *Incident Reporting Guideline 230/09* which provides guidance on the new incident reporting requirements in the *Elevating Devices Regulation*.

Ski Lifts

TSSA regulates chair lifts, bar lifts, outdoor recreational conveyers, rope tows and tube tows, totaling over 270 ski lifts in Ontario, to ensure all devices conform to the *Technical Standards and Safety Act, 2000*, and applicable regulations, codes and standards. TSSA reviews and registers lift designs, conducts inspections and performs incident investigations. It also licenses lift devices, ensuring they conform to Ontario safety standards. TSSA in partnership with the Ontario Snow Resorts Association additionally provides public education throughout the province, promoting safer behaviour to ski lift users.

The trend analysis outlined in this section should be considered in the context that these devices are predominantly seasonal in nature. The trend analysis confirmed the seasonality and took it into account while establishing historical patterns of safety and compliance performance.

Public Safety Analysis

Occurrence Analysis

Table SL-1 summarizes the ski lift occurrences reported to TSSA for the fiscal year 2009/2010 in accordance with the reporting guidelines provided to stakeholders. These occurrences can be categorized as an incident or a near-miss. The table includes their occurrence inspection status at the end of the fiscal year. The number of victims and their injury severity from the occurrences are also included.

Occurrences not requiring formal inspection do not involve a device related failure and are attributed to the sub-category 'Failure to Follow User Instructions' from the 'Human Factors' category, and have been treated accordingly in the root cause trend analysis.



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Table SL-1: Activity breakdown for ski lift occurrences.

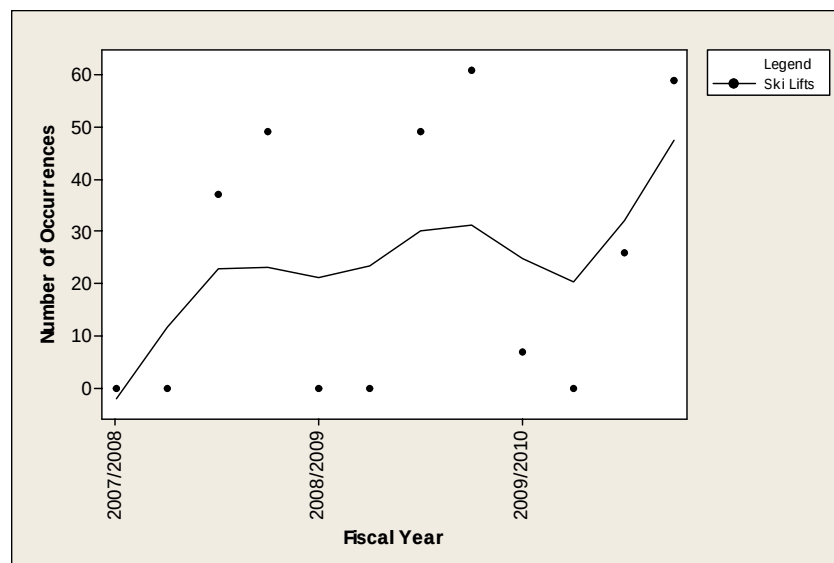
Occurrence Detail	May 1, 2009 – April 30, 2010
Number of Incidents	88
Number of Near-Misses	8
Occurrences Within TSSA Jurisdiction	96
• Completed Causal Analysis	4
• Unable to Establish Root Cause	0
• In Progress	4
• Not Requiring Formal Inspection	88
Total Occurrences	96
Occurrences Outside TSSA Jurisdiction	0
Number of Fatalities	0
Number of Serious Injuries	3
Number of minor Injuries	84

Two of the three serious injuries occurred on wire rope tows. The remaining serious injury occurred on a chairlift. 'Human Factors' was the root cause in all the serious injury occurrences but one, where the root cause was 'Equipment/Component/Material' on a wire rope tow.

Occurrence Related Trends

Figure SL-1 shows the number of occurrences to which TSSA has responded over the last three fiscal years. A statistical analysis of this data indicates that the number of occurrences on ski lifts does not demonstrate a significant trend over the last three fiscal years. It should be noted that this graph only includes occurrences with completed inspections.

Figure SL-1: Occurrences involving ski lifts over the last three fiscal years.





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Figure SL-2 charts the number of fatalities and serious injuries over the last six fiscal years. As illustrated, there have been no fatalities on ski lifts within TSSA's jurisdiction during this period. A statistical analysis of this data indicates that the number of serious injuries does not demonstrate a significant trend over the last six fiscal years.

Figure SL-2: Fatalities and serious injuries on ski lifts over the last six fiscal years (analyzed occurrences).

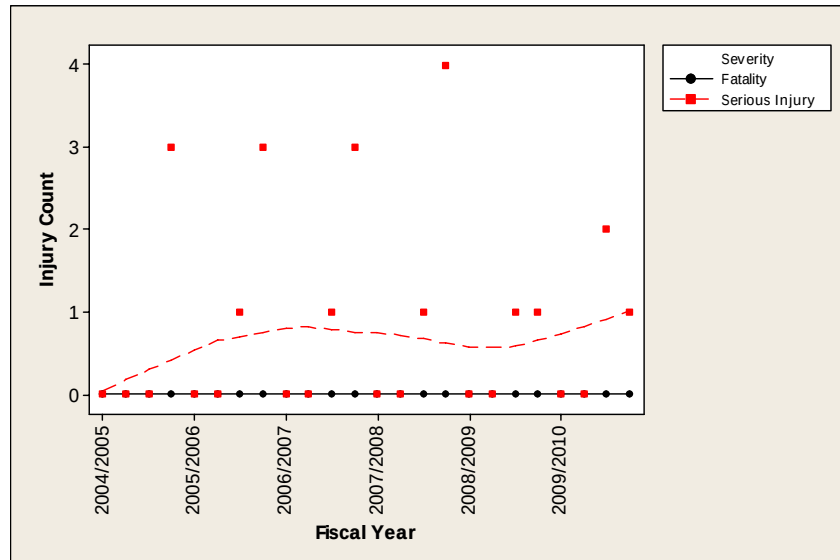
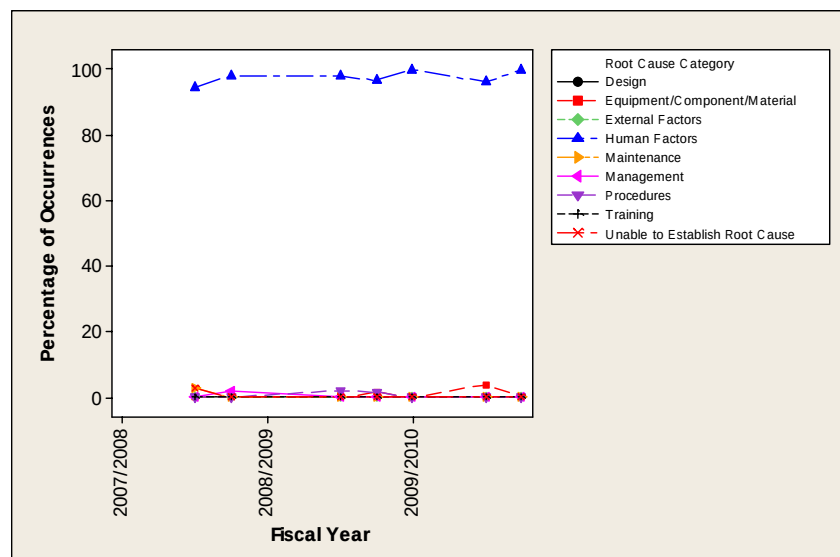


Figure SL-3 illustrates the distribution of root causes for inspected occurrences (in percentages) over the last three fiscal years. A statistical analysis of this data indicates that all root cause categories do not demonstrate significant trends over the last three fiscal years. This distribution shows that 'Human Factors' is the dominant root cause category relative to all the other causal categories.

'Human Factors' include many different sub-categories such as 'Failure to Follow User Instructions', 'Failure to Follow Operating Procedures', 'Deliberate Intent or Sabotage', and 'Inadequate or Unsafe Operating Environment'. Please refer to Appendix B, Root Cause Analysis Categories, for a further definition of 'Human Factors'.

Figure SL-3: The percentage of each root cause category attributed in ski lift occurrences over the last three fiscal years.



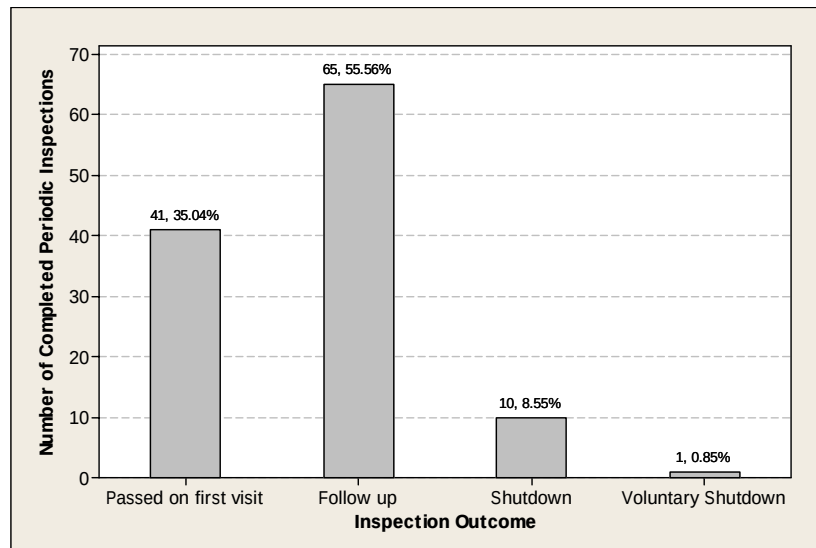


Compliance Analysis

Periodic Inspections

There were 117 periodic inspections conducted in fiscal year 2009/2010. Each of these inspections results in an outcome as determined by a TSSA inspector, shown in Figure SL-4. Of all periodic inspections completed in fiscal year 2009/2010, 35.04% passed on the first visit.

Figure SL-4: Outcomes from periodic inspections completed on ski lifts in fiscal year 2009/2010.

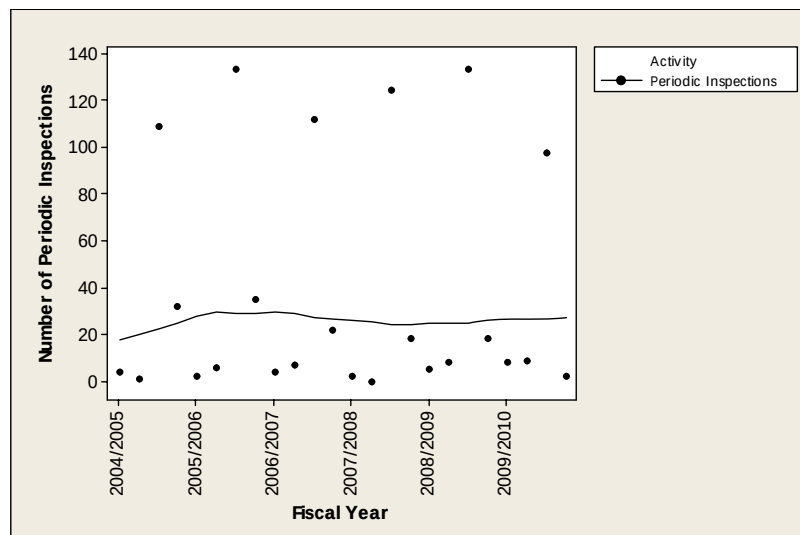


TSSA inspectors issued a total of 172 inspection orders during the course of these periodic inspections. This yields an average number of inspection orders issued per inspection of 1.47.

Compliance Related Trends

Figure SL-5 charts the number of periodic inspections over the last six fiscal years. A statistical analysis of this data indicates that the number of periodic inspections does not demonstrate a significant trend over the last six fiscal years. It should be noted that ski lift operations are seasonal in nature and inspections are carried out accordingly.

Figure SL-5: Periodic inspections completed on ski lifts over the last six fiscal years.





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Figure SL-6 provides the average number of inspection orders per inspection for the last six fiscal years. A statistical analysis of this data indicates that the average number of orders per inspection does not demonstrate a significant trend over the last six fiscal years.

Figure SL-6: The average number of inspection orders per periodic inspection on ski lifts over the last six fiscal years.

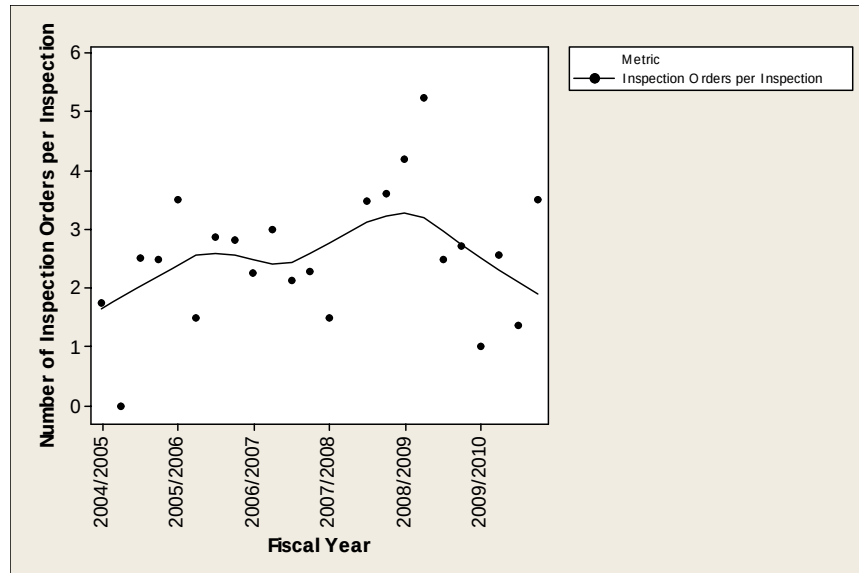
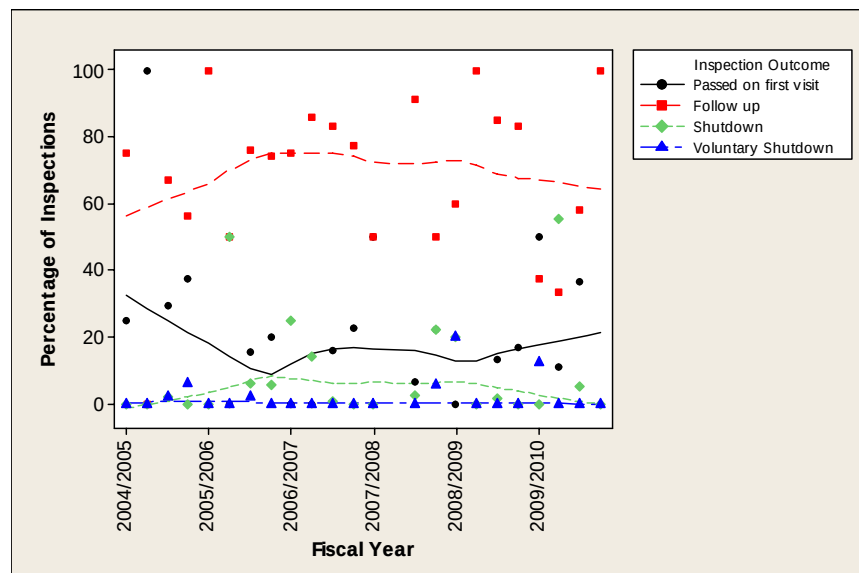


Figure SL-7 charts the outcomes from the periodic inspections over the last six fiscal years. A statistical analysis of this data indicates that none of the inspection outcomes demonstrate significant trends over the last six fiscal years.

Figure SL-7: The percentage outcome in periodic inspections completed on ski lifts over the last five fiscal years.





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Other Safety and Risk Analysis Results

No significant compliance or safety issues were identified through TSSA analysis or other stakeholder sources in the past fiscal year.

Public Safety Decisions

TSSA Actions

Improving Compliance

TSSA continues to use its risk-based inspection program to prioritize and direct its resources in inspecting ski lifts in Ontario. Based on the results of the inspections, there are presently no significant compliance issues requiring TSSA response.

Managing Safety Issues

Through *Director's Order 240/09*, TSSA continued to collect data on the chair location when the safety bar is lifted by riders prior to unloading.

'Human Factors' continue to be the dominant root cause category relative to all the other causal categories of occurrence. TSSA continues to partner with industry to deliver the *Look, Load & Lower* campaign, raising rider responsibility and safety awareness.

Regulatory Improvements

TSSA issued *Incident Reporting Guideline 214/09* which provides guidance on the new incident reporting requirements for passenger ropeways in the *Elevating Devices Regulation*.



Fuels

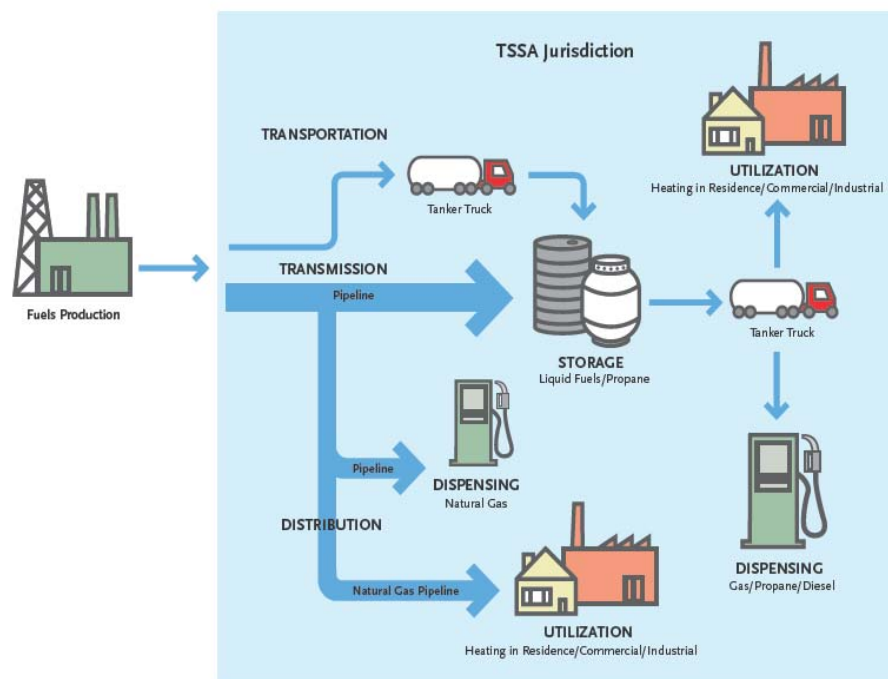
TSSA regulates the transportation, storage, handling and use of fuels as defined in the regulations. These fuels include natural gas, propane, butane, hydrogen, digester gas, landfill gas, fuel oil, gasoline and diesel. TSSA licenses fuel facilities, registers contractors and certifies tradespersons who install and service equipment.

Additionally, TSSA reviews and approves facility plans for sites licensed by TSSA, and performs custom equipment approvals and inspection services to ensure fuel is handled and used safely.

The three stages of the fuels life cycle that fall under TSSA's jurisdiction as illustrated in Figure F-1 are:

- transmission, distribution and transportation;
- storage and dispensing; and
- utilization (burning).

Figure F-1: The fuels life cycle.



Public Safety Analysis

Occurrence Analysis

TSSA's occurrence information tracking database, the Incident Management Information System (IMIS), categorizes each type of occurrence reported to TSSA. Table F-1 provides a summary of the occurrences by type reported to the TSSA during fiscal year 2009/2010. These occurrences include those that are currently in progress and those with resolved root cause analysis. The health impact associated with each occurrence type is also included in the table below.



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Table F-1: Fuels occurrence types and health impacts for fiscal year 2009/2010.

Occurrence Type	Number of Occurrences	Number of Fatalities	Number of Serious Injuries
Carbon Monoxide Release	204	1	2
Discovery of a Petroleum Product	130	0	0
Explosion	45	0	9
Fire	141	0	3
Leak	297	0	0
Liquid Petroleum Spill	88	0	0
Other	42	0	0
Pipeline Strike	2,349	0	0
Unknown	3	0	0
Vapour Release	372	0	0
Total Occurrences	3,671	1	14

Due to the distinct nature of pipeline strike occurrences, their status and fuel type summary are presented separately from the other types of occurrences. Table F-2 presents the number of pipeline strike occurrences that were reported to TSSA in accordance with the reporting guidelines provided to stakeholders. Each occurrence is categorized as an incident or a near-miss. The table includes their occurrence inspection status at the end of the fiscal year. Finally, the number of occurrences reported to the TSSA but which are outside of its jurisdiction is also included; these occurrences are not included in any of the analysis or trending.

Table F-2: Activity breakdown for pipeline strike occurrences.

Occurrence Detail	May 1, 2009 – April 30, 2010
Number of Incidents	2,337
Number of Near-Misses	12
Occurrences Within TSSA Jurisdiction	2,349
• Completed Causal Analysis	1,674
• Unable to Establish Root Cause	0
• In Progress	627
• Not Requiring Formal Inspection	48
Total Occurrences	2,349
Occurrences Outside TSSA Jurisdiction	225
Number of Fatalities	0
Number of Serious Injuries	0
Number of Minor Injuries	0

Table F-3 breaks down the pipeline strike occurrences into their involved fuel type. Nearly all of the strikes involve natural gas.

Table F-3: Activity breakdown for pipeline strike occurrences.

Fuel Type	Number of Occurrences
Natural Gas	2,164
Other Hydrocarbon Fuel	1
Not Confirmed: Occurrences Pending Inspection	184



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Table F-4 summarizes the non-pipeline strike fuels occurrences reported to TSSA. It presents the number of occurrences that were reported to TSSA in accordance with the reporting guidelines provided to stakeholders. These occurrences can be categorized as an incident or a near-miss. The table includes their occurrence inspection status at the end of the fiscal year. Finally, the number of occurrences reported to the TSSA but which are outside of its jurisdiction is also included; these occurrences are not included in any of the analysis or trending.

Table F-4: Activity breakdown for non-pipeline strike occurrences.

Occurrence Detail	May 1, 2009 – April 30, 2010
Number of Incidents	1,281
Number of Near-Misses	41
Occurrences Within TSSA Jurisdiction	1,322
Completed Causal Analysis	948
Unable to Establish Root Cause	3
In Progress	368
Not Requiring Formal Inspection	3
Total Occurrences	1,322
Occurrences Outside TSSA Jurisdiction	456
Number of Fatalities	1
Number of Serious Injuries	14
Number of Minor Injuries	23

Table F-5 shows the fuel types involved in non-pipeline strike occurrences.

Table F-5: Activity breakdown for non-pipeline strike occurrences.

Fuel Type	Number of Occurrences
Butane	3
Diesel	15
Fuel oil	253
Gasoline	33
Natural gas	497
Other hydrocarbon fuel	2
Propane	37
Used oil	1
Not confirmed: completed inspections	179
Not confirmed: occurrences pending inspection	299
Not confirmed: inspection not required	3

Occurrence Related Trends

Figure F-2 shows the number of occurrences to which TSSA has responded over the last three and a half fiscal years by occurrence type. A statistical analysis indicates that there is a downward trend in the number of 'Liquid Petroleum Spill' and an upward trend in the number of 'Discovery of Petroleum Product' occurrences. The remaining occurrence types demonstrate no significant trends over the last three and a half fiscal years. It should be noted that this graph only includes occurrence inspections that have been concluded.



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For the purposes of appropriate decision making, TSSA looks at both the frequency of occurrences and their health impacts. Specifically, in the next fiscal year, the trends shown below will be looked at in combination with fatality and serious injury trends to prioritize safety management issues.

Figure F-2: Occurrences by occurrence type over the last three and a half fiscal years.

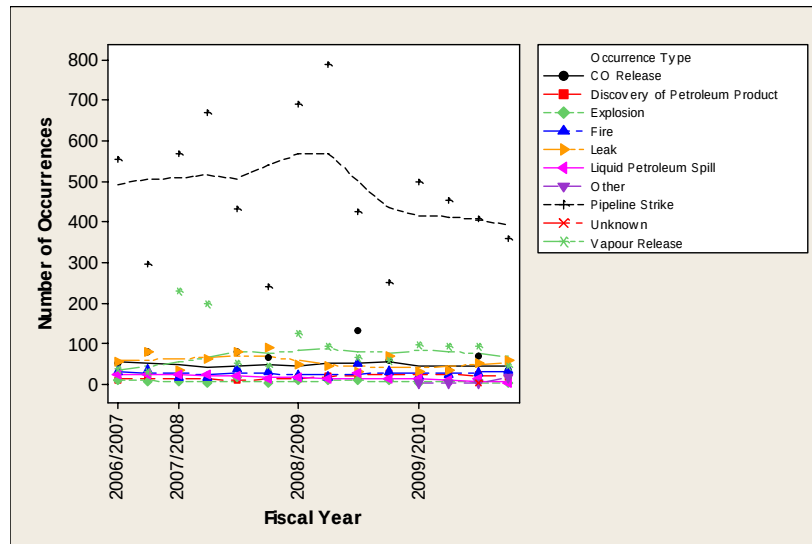
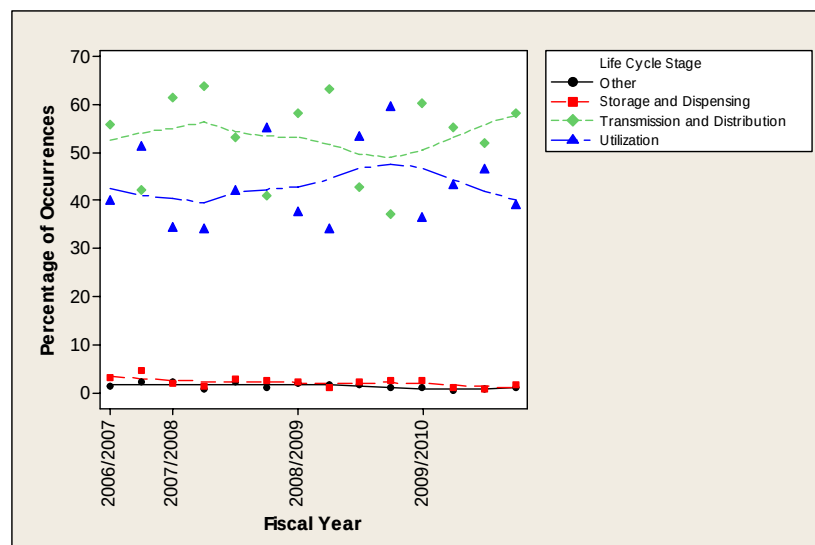


Figure F-3 shows the percentage distribution of occurrences across the fuels life cycle over the last three and a half fiscal years. A statistical analysis of this data indicates that there are downward trends in the percentage of occurrences in the 'Storage and Dispensing' and 'Other' life cycle stages. The primary factor (68%) of the occurrences in the 'Storage and Dispensing' life cycle is made up of events at retail fuel stations. This factor has demonstrated a strong decreasing trend, which accounts for the associated decrease in this life cycle. The dominant life cycle stages have been (and continue to be) 'Transmission', 'Distribution and Transportation', and 'Utilization'.

The primary contributor to the 'Utilization' stage has been occurrences at private dwellings. The occurrences most often seen with private dwellings have been pipeline strikes, carbon monoxide releases, and leaks. There are increasing trends in the number of occurrences at private dwellings that involve the discovery of petroleum products and vapour releases, and a downward trend in the number of liquid petroleum spills.

Figure F-3: The percentage of occurrences by life-cycle stage over the last three and a half fiscal years.





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Figure F-4 charts the number of fatalities and serious injuries over the last six fiscal years. A statistical analysis of this data indicates that the number of fatalities and serious injuries do not demonstrate significant trends over the last six fiscal years. It is important to note that this trend does not take into account the effect of those occurrences that have multiple serious injuries.

Since fiscal year 2006/2007, injuries incurred during occurrences at private dwellings have consistently been a major contributor to the overall number of injuries. The type of occurrences typically generating injuries at private dwellings have been carbon monoxide releases and explosions.

Figure F-4: Fuels fatalities and serious injuries over the last six fiscal years (analyzed occurrences).

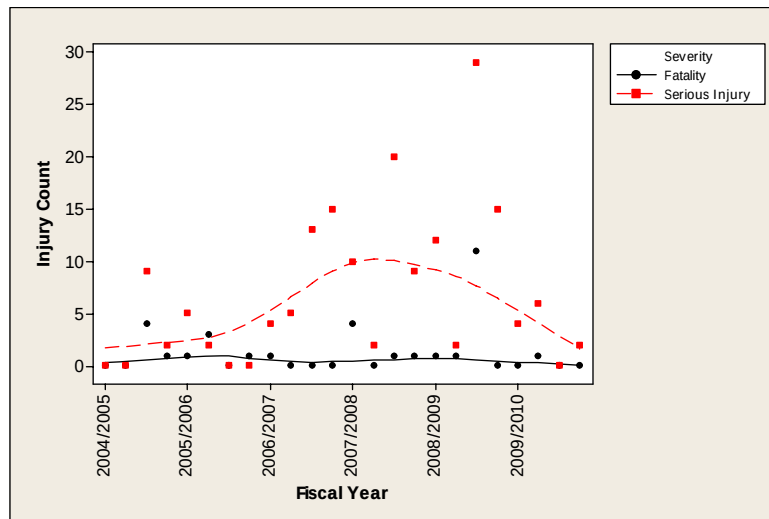
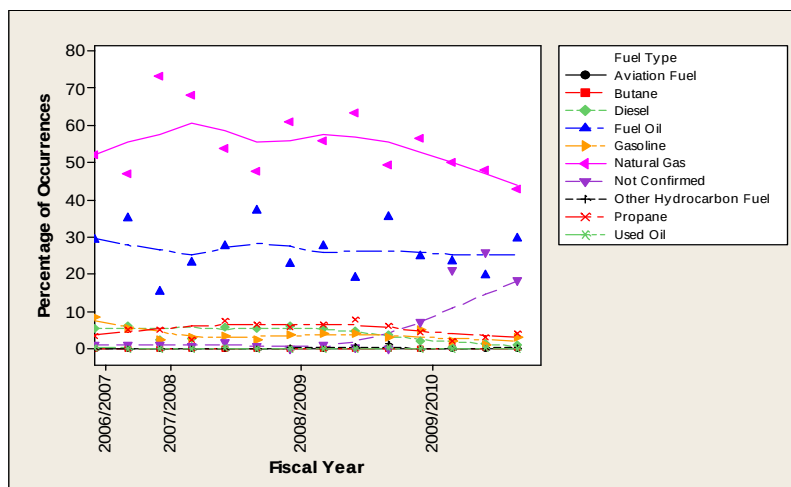


Figure F-5 shows the percentage distribution of occurrences, excluding pipeline strike occurrences, across the different fuel types over the last three and a half fiscal years. A statistical analysis of this data indicates that there are upward trends in the percentage of occurrences involving butane, and gasoline fuel types, and a downward trend in the percentage of occurrences involving diesel. All other fuel types demonstrate no significant trends over the last three and a half fiscal years. The dominant fuel types are natural gas and fuel oil.

The fuel types involved with occurrences at private dwellings have been primarily natural gas and fuel oil. A statistical analysis of this data indicates that the fuel types involved at private dwellings demonstrate no significant trends over the last six fiscal years.

Figure F-5: The percentage of occurrences by fuel type, excluding pipeline strikes over the last three and a half fiscal years.



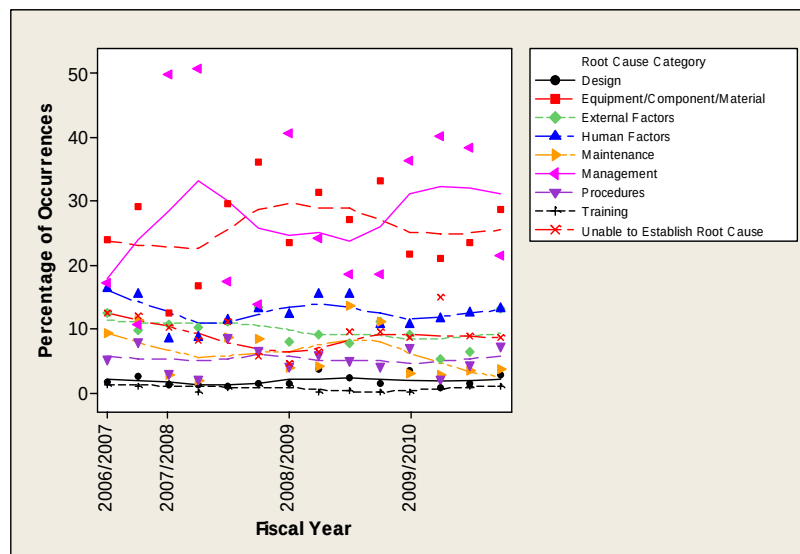


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Figure F-6 illustrates the distribution of root causes for inspected occurrences (in percentages) over the last three and a half fiscal years, excluding pipeline strike occurrences. A statistical analysis of this data indicates that none of the root cause categories demonstrate significant trends over the last three and a half fiscal years. 'Management' and 'Equipment/Component/Material' factors are the dominant root cause categories relative to all the other causal categories.

Further analysis into occurrences at private dwellings (due to its prominence in the overall percentage of occurrences) has revealed that 'Management', 'Equipment/Component/Material', and 'Human Factors' are the most dominant root cause categories. There has been an observed statistical upward trend in the number of occurrences at private dwellings that involve the 'Management' root cause, and a downward trend in the number of occurrence that involve 'External Factors'.

Figure F-6: The percentage of occurrences by root cause category, excluding pipeline strikes over the last three and a half fiscal years.



Pipeline strike occurrences involving the transmission and distribution of natural gas tend to be the dominant occurrence type and in most cases do not lead to significant health consequences. Due to their specific nature with respect to frequency and effects, the following trends address pipeline strike occurrences separately from other types of occurrences.

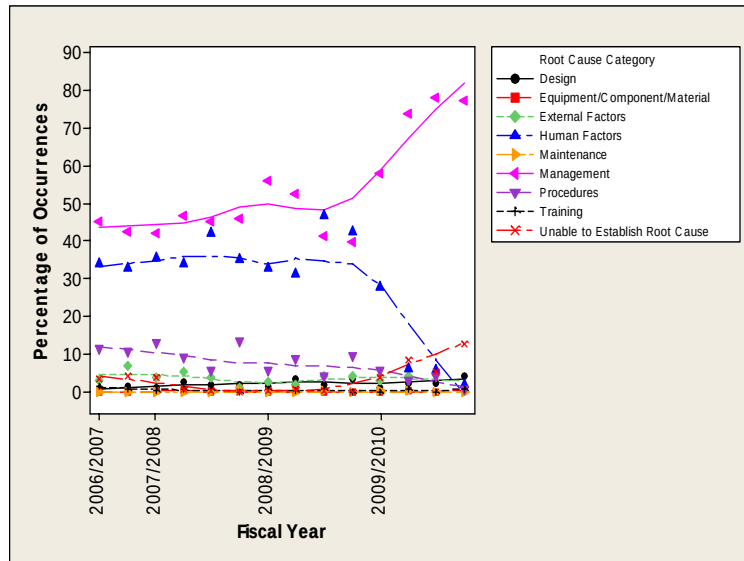
Figure F-7 illustrates the distribution of root causes for inspected occurrences (in percentages) over the last three and a half fiscal years for pipeline strike occurrences. A statistical analysis of this data indicates that there are upward trends in the percentage of pipeline strike occurrences with the root cause 'Design' and 'Management', and downward trends in the percentage of pipeline strike occurrences with the root cause 'Human Factors' and 'Procedures'. None of the root cause categories demonstrate significant trends over the last three and a half fiscal years. The dominant root cause categories relative to all other causal categories are 'Management' and 'Human Factors'.



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Figure F-7: The percentage of pipeline strike occurrences by root cause category over the last three and a half fiscal years.

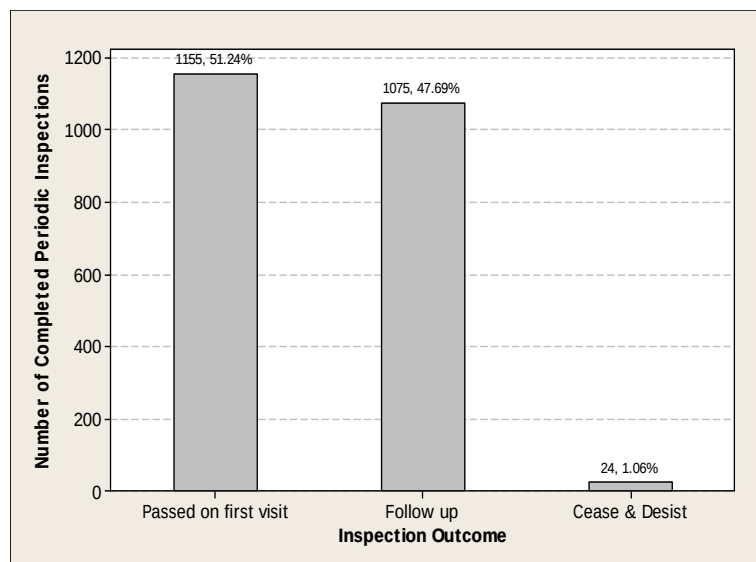


Compliance Analysis

Periodic Inspections

There were 2,254 periodic inspections conducted in fiscal year 2009/2010. Each of these inspections results in an outcome as determined by a TSSA inspector, shown in Figure F-8. Of all periodic inspections completed in fiscal year 2009/2010, 51.24% passed on the first visit.

Figure F-8: Outcomes from fuels periodic inspections completed in fiscal year 2009/2010.



TSSA inspectors issued a total of 3,649 inspection orders during the course of these periodic inspections. This yields an average number of inspection orders issued per inspection of 1.62.



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Compliance Related Trends

Figure F-9 charts the number of periodic inspections over the last six fiscal years. A statistical analysis of this data indicates that the number of periodic inspections does not demonstrate a significant trend over the last six fiscal years; however, there is a demonstrated downward trend from the first quarter of fiscal year 2004/2005 to the last quarter of fiscal year 2007/2008. This phenomenon highlights the difference between trending over an entire period and trending over subsections of that period; although there is a subsection with a defined trend, the overall behaviour does not statistically indicate movement in one direction or the other.

Figure F-9: Fuels periodic inspections completed over the last six fiscal years.

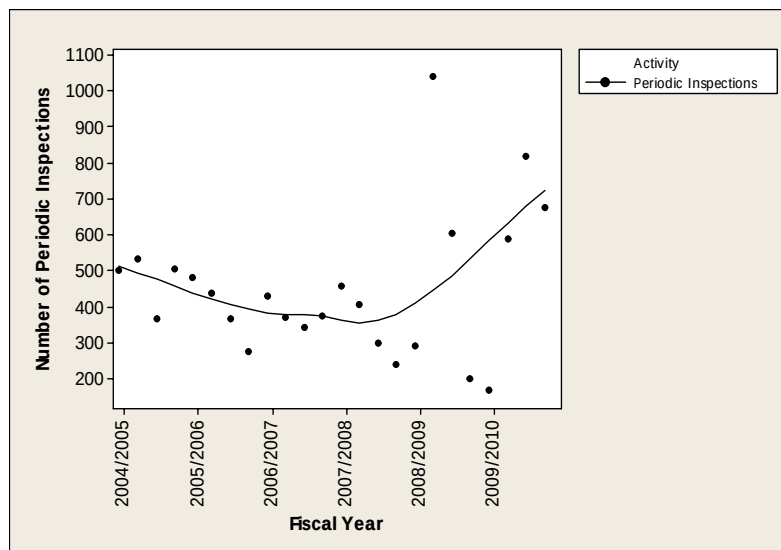
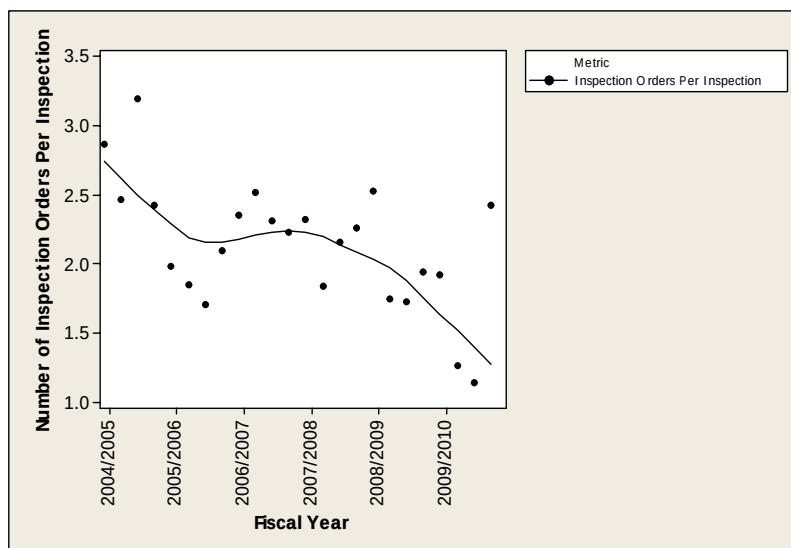


Figure F-10 provides the average number of inspection orders per inspection for the last six fiscal years. A statistical analysis of this data indicates that the average number of inspection orders per inspection exhibits a downward trend over the last six fiscal years.

Figure F-10: The number of inspection orders per fuels periodic inspection over the last six fiscal years.

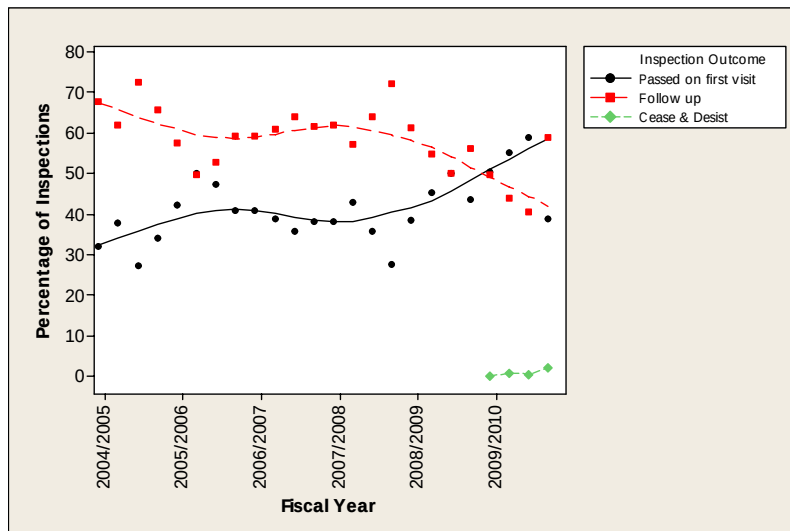




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Figure F-11 charts the outcomes from fuels periodic inspections completed over the last six fiscal years. A statistical analysis of this data indicates that there is an upward trend in the percentage of 'Passed on First Visit' inspection outcomes, and a downward trend in the percentage of 'Follow-up' inspection outcomes. The 'Cease and Desist' inspection outcome has only been available since the end of the first quarter of fiscal year 2009/2010 thus it does not have enough data points to conduct a proper statistical trend test. It will be monitored over the next two fiscal years.

Figure F-11: Fuels periodic inspection outcomes by percentage over the last six fiscal years.

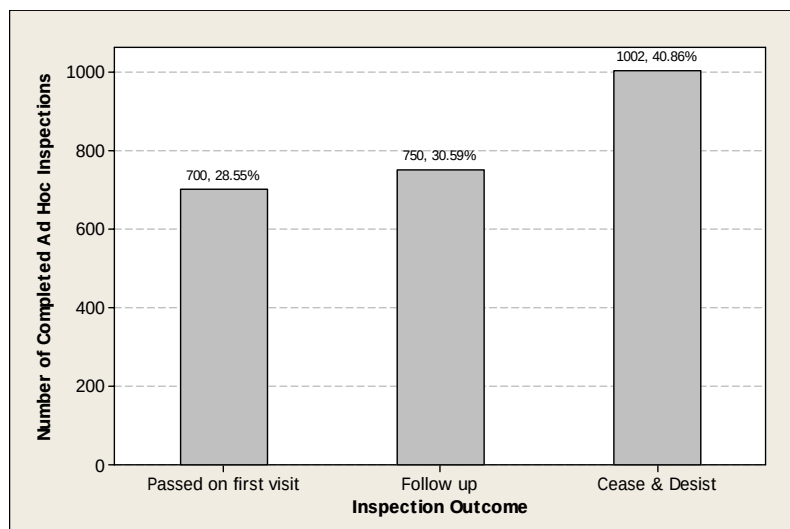


Ad Hoc Inspections

Due to the broad scope of TSSA's authority with respect to the fuels sector, Fuels inspectors conduct many inspections at sites and on persons who have not been authorized by TSSA. Examples would include construction sites, residences, campsites, and private petroleum sites, etc. The inspection work conducted at these entities is categorized as ad hoc inspections.

There were 2,452 ad hoc inspections conducted in fiscal year 2009/2010. Each of these inspections results in an outcome as determined by a TSSA inspector, shown in Figure F-12. Of all ad hoc inspections completed in fiscal year 2009/2010, 28.55% passed on the first visit.

Figure F-12: Outcomes from fuels ad hoc inspections completed in fiscal year 2009/2010.





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TSSA inspectors issued a total of 5,307 inspection orders during the course of these periodic inspections. This yields an average number of inspection orders issued per inspection of 2.16.

Compliance Related Trends

Figure F-13 charts the number of ad hoc inspections over the last six fiscal years. A statistical analysis of this data indicates that the number of ad hoc inspections exhibits a downward trend over the last six fiscal years.

Figure F-13: Fuels ad hoc inspections completed over the last six fiscal years.

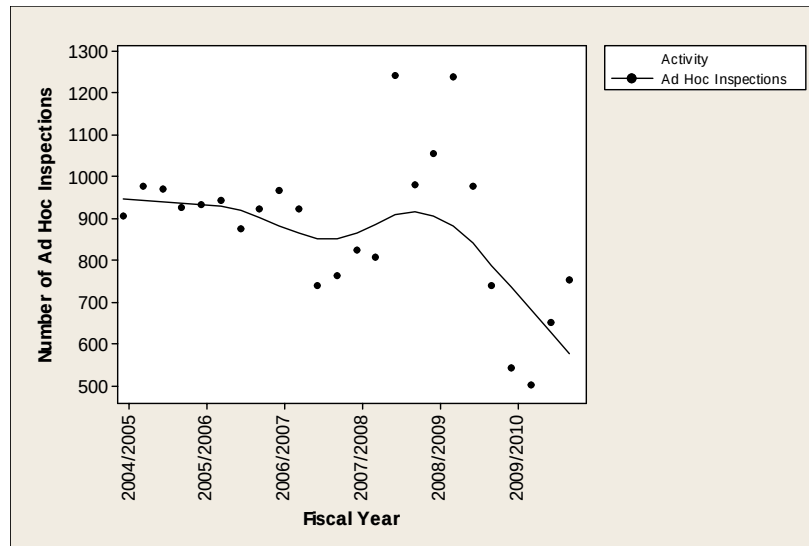
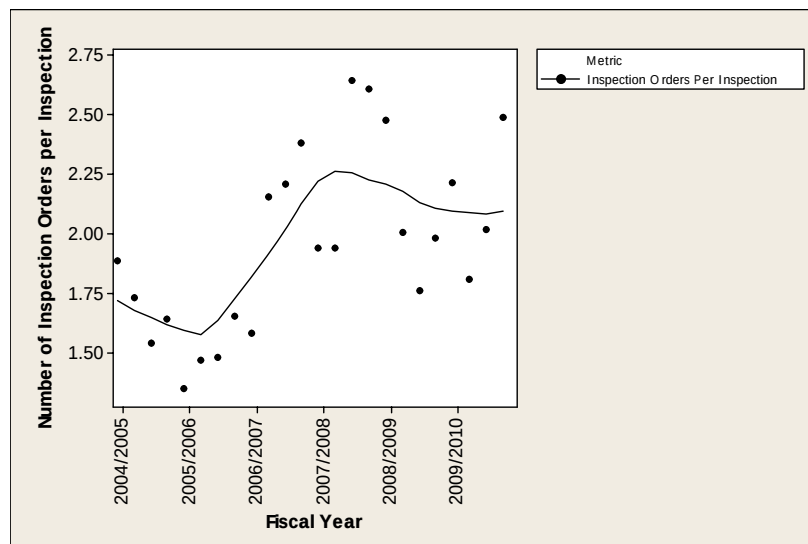


Figure F-14 provides the average number of inspection orders per inspection for the last six fiscal years. A statistical analysis of this data indicates that the average number of inspection orders per inspection does not demonstrate a significant trend over the last six fiscal years; however, the period from the first quarter of fiscal year 2005/2006 to the last quarter of the fiscal year 2007/2008 exhibits an upward trend. This phenomenon highlights the difference between trending over an entire period and trending over subsections of that period. Although there is a subsection with a defined trend, the overall behaviour does not statistically indicate movement in one direction or the other.

Figure F-14: The number of inspection orders per fuels ad hoc inspection over the last six fiscal years.



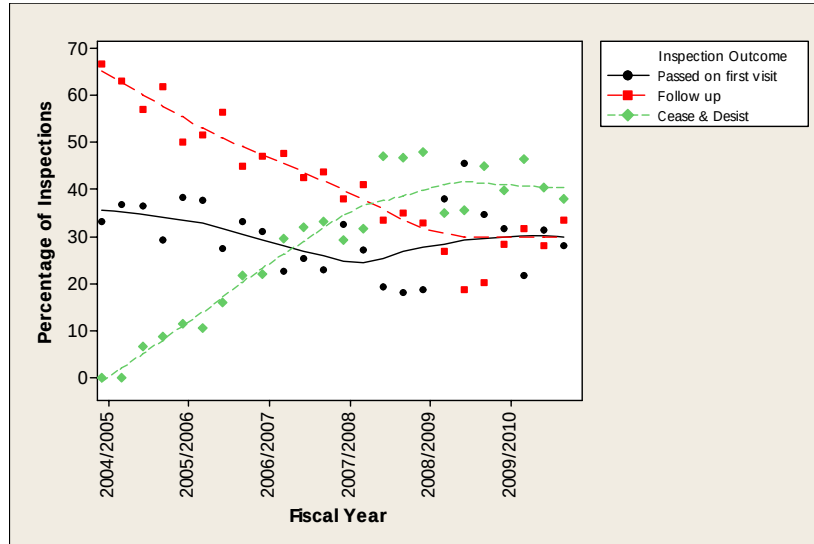


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Figure F-15 charts the outcomes from fuels ad hoc inspections completed over the last six fiscal years. A statistical analysis of this data indicates that there is an upward trend in the percentage of 'Cease and Desist' inspection outcomes, and a downward trend in the percentage of 'Follow-up' inspection outcomes. The 'Passed on First Visit' inspection outcome does not demonstrate a significant trend over the last six fiscal years.

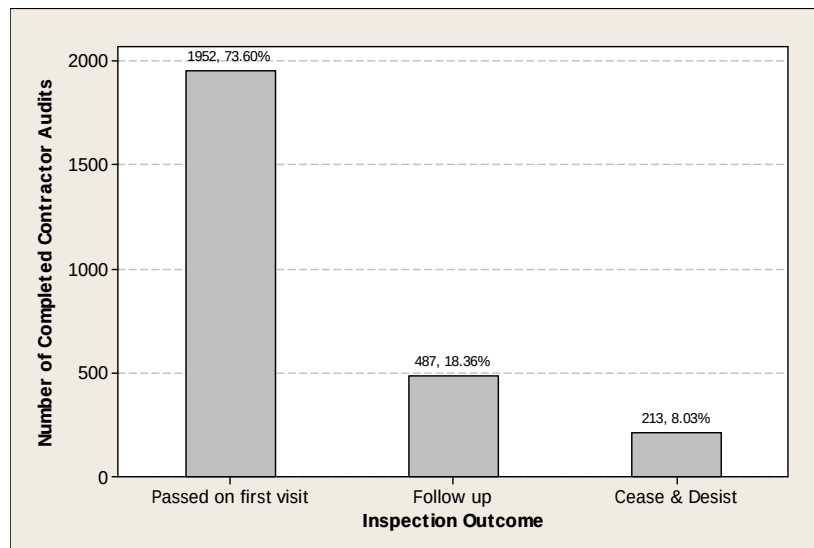
Figure F-15: Fuels ad hoc inspection outcomes by percentage over the last six fiscal years.



Contractor Audits

There were 2,652 contractor audits conducted in fiscal year 2009/2010. Each of these inspections results in an outcome as determined by a TSSA inspector, shown in Figure F-16. Of all contractor audits completed in fiscal year 2009/2010, 73.60% passed on the first visit.

Figure F-16: Outcomes from fuels contractor audits completed in fiscal year 2009/2010.



TSSA inspectors issued a total of 3,122 inspection orders during the course of these periodic inspections. This yields an average number of inspection orders issued per inspection of 1.18.



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Compliance Related Trends

Figure F-17 charts the number of contractor audits over the last six fiscal years. A statistical analysis of this data indicates that the number of contractor audits exhibits an upward trend over the last six fiscal years.

Figure F-17: Fuels contractor audits completed over the last six fiscal years.

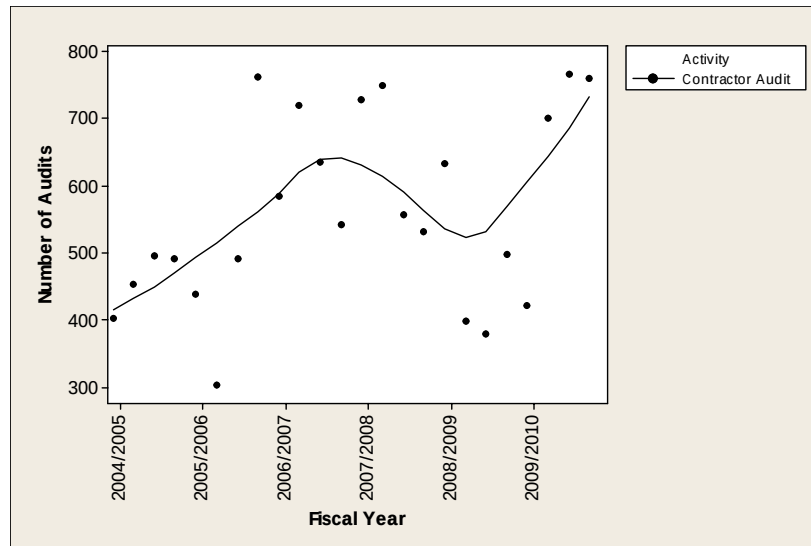
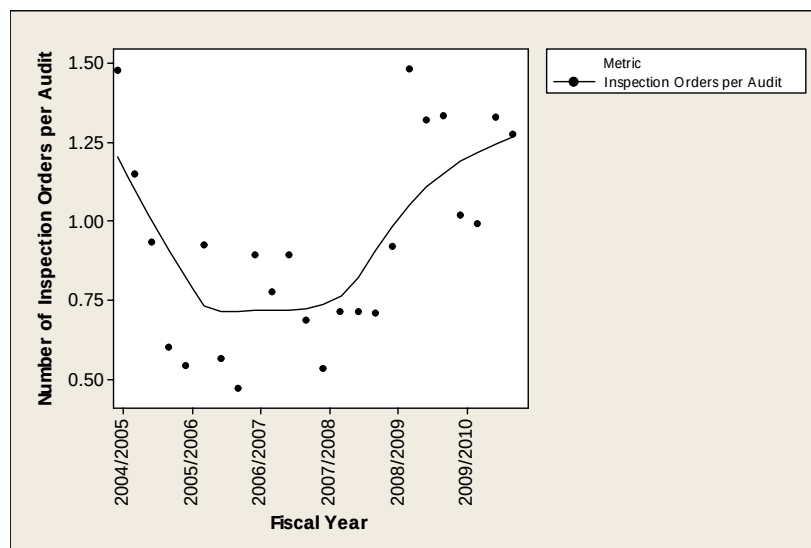


Figure F-18 provides the average number of inspection orders per audit for the last six fiscal years. A statistical analysis of this data indicates that the average number of inspection orders per audit does not demonstrate a significant trend over the last six fiscal years; however, the period from the first quarter of fiscal year 2004/2005 to the second quarter of fiscal year 2006/2007 exhibits a downward trend, and the period from the first quarter of fiscal year 2007/2008 to the last quarter of the fiscal year 2009/2010 exhibits an upward trend. This phenomenon highlights the difference between trending over an entire period and trending over subsections of that period. Although there is a subsection with a defined trend, the overall behaviour does not statistically indicate movement in one direction or the other.

Figure F-18: The number of inspection orders per fuels contractor audit over the last six fiscal years.

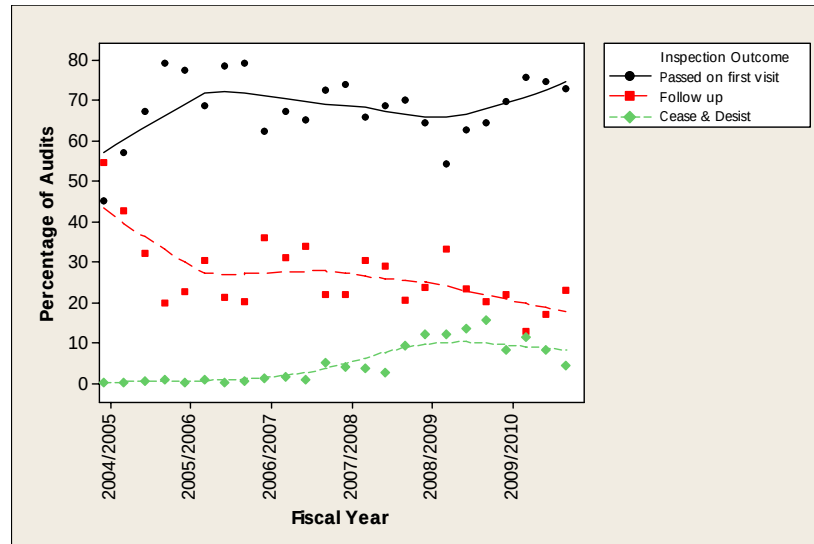




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Figure F-19 charts the outcomes from fuels contractor audits completed over the last six fiscal years. A statistical analysis of this data indicates that there is an upward trend in the percentage of 'Cease and Desist' inspection outcomes, and a downward trend in the percentage of 'Follow-up' inspection outcomes. The 'Passed on First Visit' inspection outcome does not demonstrate a significant trend over the last six fiscal years.

Figure F-19: Fuels contractor audit outcomes by percentage over the last six fiscal years.



Other Safety and Risk Analysis Results

TSSA is currently undertaking risk assessment studies in the following areas:

- **fuel oil storage tanks:** to examine and determine areas that may require additional attention;
- **propane storage and dispensing facilities:** to continue to evaluate results of inspections; and
- **age-induced failure of plastic vents:** to determine if the aging of vents contributes to failure and what step should be taken.

Status updates (and results, if completed) of these studies will be provided in next year's report.

Public Safety Decisions

TSSA Actions

Improving Compliance

A risk based contractor audit model has been in place for a year at TSSA. This model allows the Fuels Safety Program to focus its audits on contractors with higher rates of non-compliance. The results of the compliance analysis will continue to be monitored to evaluate the effectiveness of the model and to consider options to improve compliance across the stakeholder group. The contractor audit program was enhanced this year with the addition of a new requirement for a pre-registration inspection. This program should also assist in addressing issues arising at private dwellings as identified in the analysis.

TSSA will be evaluating the results of ad hoc inspections conducted at various locations across the province and will determine if any focused and targeted inspections are required at those sites where non-compliances of significance have been found. Specifically, targeted inspections at construction sites and private fuel outlets have been carried out in the past and will be considered in the future as well.



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Managing Safety Issues

Residential Natural Draft Boilers

Five years ago TSSA constituted a risk reduction group to address safety issues associated with natural draft residential boilers. This group, combining TSSA and industry experts, determined appropriate actions on an annual basis to address the problem of carbon monoxide release from these boilers. This process is used to achieve a decision approach that is comprehensive, logically sound, practical, open to evaluation, and conducive to learning that can be used for evaluating possible short-term and long-term controls to manage the residential boiler safety issue. As a result of efforts of the risk reduction group, TSSA issued a Director's Order requiring carbon monoxide safety testing for these appliances whenever a technician is on site performing any work.

TSSA also collected data over three heating seasons which was used in conjunction technical literature and theoretical predictions to develop a comprehensive risk assessment of these appliances and their susceptibility to house depressurization and the production of carbon monoxide. Prior to the 2009/2010 heating season, the risk assessment was presented to and discussed with the risk reduction group. In a cooperative effort, TSSA issued a revised Director's Orders which increased the mitigation controls for existing boilers and introduced mitigation controls for new installations. For existing boilers, in addition to the carbon monoxide safety test, more detailed visual examination is required as is the installation of carbon monoxide alarms in sleeping areas. For new installations, the appliance shall only be installed in a room isolated from occupied areas and carbon monoxide alarms installed in sleeping areas.

Coleman Green Key 1 lb Disposable Propane Cylinder

Coleman introduced a new disposable 1 lb propane cylinder to the market. TSSA was contacted as the manufacturer was directing users (public) to release un-used propane to atmosphere using a provided plastic key and then dispose of the cylinder into the recycling system. TSSA struck a risk reduction group to discuss the issue which was composed of the manufacturer, municipalities, industry stakeholders and fire officials. The concerns were twofold: the release of propane to the atmosphere by the general public and disposal of a hazardous waste into the recycling system. The manufacturer removed the product from the Canadian market.

Propane Re-Audit

As a result of a propane explosion in August 2008, the provincial government introduced new regulatory requirements including the requirement for annual inspections of propane facilities where the transfer of propane takes place. TSSA now conducts annual inspections of all propane facilities in Ontario.

The findings are generally consistent with the results from TSSA's previous cyclical three year audit process. The vast majority of non-compliances continue to be focused on low risk items generally considered as routine site maintenance.

Regulatory Improvements

As part of its continuous improvement efforts to achieve positive safety outcomes, TSSA has issued the following Director's Orders or advisories:

- safety tests for existing natural draft residential boilers;
- installation requirements for natural draft residential boilers;
- clarification on how to properly isolate natural draft residential boilers from occupied areas;
- common interpretations for the *National Propane Installation and Handling Code*;
- general requirements for the re-use of out of service fuel tanks;
- environmental test requirements for the re-use of out of service tanks;
- vent terminations above a common walkway between two dwellings;
- person's certification requirements for fuel oil distributor inspections;
- ballasting of fuel oil tanks;
- definition of approved equipment for fuel oil installations;
- pressure testing of underground fuel oil systems;
- registration process for underground fuel oil tanks;
- licensing process for filling cylinders from tank trucks;
- regulatory requirements pertaining to private natural gas wells;



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- abandonment of underground piping at liquid fuels facilities;
- checklist for inspections of diesel engines with day or elevated tanks; and
- low pressure hoses on propane conversion vehicles.

When deficiencies are found for equipment in the field that is not installation specific but of a systemic nature, TSSA investigates and issues safety orders/advisories when warranted to either not allow their use or only allow their use in a modified form. TSSA issued safety orders and advisories with respect to the existing and new installations of natural draft residential natural draft boilers (previously described), non-compliant gaseous fireplace installations and the use of existing chimneys, and barbeque propane cylinders not having their valves properly closed upon refilling.

As of December 11, 2008 *Ontario Regulation 440/08* and *Ontario Regulation 441/08* were filed by the province of Ontario amending *Ontario Regulation 211/01, Propane Storage and Handling*, and changes were made to the regulations under the *Planning Act* requiring information notifications from TSSA. TSSA initiated a risk reduction group composed of impacted stakeholders (industry, fire services, municipalities and the Ontario government) to set guidelines for the implementation of the new regulatory requirements. Those meetings concluded in July 2009 and TSSA issued implementation advisories and guidelines to facilitate understanding and implementation of the new regulatory requirements. Those documents were communicated to impacted licence holders through a number of channels, and TSSA is obtaining the necessary resources to address the anticipated extra work load.



Upholstered and Stuffed Articles

The role of the Upholstered and Stuffed Articles Safety Program is to protect the public from potential hazards associated with the use of unclean or unsafe filling materials in upholstered and stuffed articles in Ontario. In addition to promoting safety, TSSA's aim is to protect consumers against fraud, misrepresentation of filling materials in upholstered and stuffed articles, and to provide a level playing field for the industry. Under *Ontario Regulation 218/01, Upholstered and Stuffed Articles*, the mandate of the program is to ensure that only new and clean filling materials are used in upholstered and stuffed articles, and that all articles are correctly labeled. Such articles include toys, sporting goods, pet items, furniture, mattresses, down-filled apparel, bedding items, handbags, luggage and seasonal ornaments. The requirements for new and clean filling materials are enforced through inspections at point-of-sale and the manufacturing level.

Trends on safety outcomes will be presented after a minimum of two years of inspection data has been collected.

Public Safety Analysis

Inspection Analysis

The number of inspections completed for the fiscal year 2009/2010 is presented in Table USA-1 and Table USA-2. Table USA-1 separates the inspections by the activities conducted in May and June 2009. The introduction of the new information system is designed to allow the collection of safety outcomes that enables trend analysis. Table USA-2 illustrates this difference in design by detailing the inspection types documented in the new information system covering the period from July 2009 to the end of April 2010. Each table also includes the total number of inspection orders issued in those inspections.

Table USA-1: Activity measures for upholstered and stuffed articles inspections in May and June 2009.

Activity	Number of Inspections
Annual Inspection	259
Complaints by Competitor Investigation	3
Complaints by Public Investigations	1
Follow-up Inspections	137
Initial Inspections	18
Initial Inspections Unregistered Entities Found by Inspector	19
Trade/Craft Show Inspections	0
Seasonal Inspections	0
Total Number of Inspections Conducted	437
Total Number of Inspection Orders Issued	663



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Table USA-2: Activity measures for upholstered and stuffed articles inspections from July 2009 to April 2010.

Activity	Number of Inspections ¹	Number of Follow-ups	Number of Inspection Orders	Number of Inspection Orders Per Inspection
Home Hobby/Craft Operator Ad hoc Inspection	16	0	4	0.25
Importer/Distributor Ad hoc Inspection	135	12	387	2.87
Major Retailer Ad hoc Inspection	148	138	4,086	27.61
Manufacturer Ad hoc Inspection	129	20	139	1.08
Renovator Ad hoc Inspection	173	13	71	0.41
Retailer Ad hoc Inspection	407	178	4,295	10.55
Supplier Ad hoc Inspection	7	0	1	0.14
Trade Show Ad hoc Inspection	75	1	4	0.05
Manufacturer Periodic Inspection	1	0	1	1.00
Retailer Periodic Inspection	2	0	0	0.00
Total	1,093	362	8,988	8.22

Table USA-3 breaks down the top infraction types by volume. This level of analysis is another enhancement introduced at the time of the new information system, and thus is only available for the period of July 2009 to April 2010.

Table USA-3: Number of Inspection Orders by Infraction from inspections conducted July 2009 to April 2010.

Infraction Type	Number of Inspection Orders	Number of Inspection Orders Per Inspection
Manufacturer Not Registered in Ontario	2396	2.19
No Provincial Label	1871	1.71
No Contents Declared	839	0.77
Unclean/unsafe Filling Material	542	0.50
Non-approved Label Format	300	0.27
Incorrect Content Declaration	291	0.27
Expired Registration	169	0.15
Country of Origin Conflicts with Registration Address	51	0.05
Other	2,529	2.31
Total Number of Inspection Orders Issued	8,988	8.22

Public Safety Decisions

TSSA Actions

Highlights from fiscal year 2009/2010 include:

- examples of inspection orders with the 'Other' infractions include the following:
 - 'Affix a second label on returned article/s',

¹ The number of inspections as counted in the new information system includes multiple visits to the same site. Thus, the number of inspections may seem artificially lower than previous years.



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- o 'Email/fax inspector label for corrective action/release',
 - o 'Affix label in a conspicuous area',
 - o 'Remove all filling materials from floor, and
 - o 'Do not mix new filling materials with used';
- confiscated domestically recycled mattresses that were contaminated with bedbugs to prevent their further use, and to reduce potential public safety impacts on mattresses being sold;
- ensured that the public was aware of second-hand mattresses being sold at the involved location;
- identified and confiscated various products containing used materials that were imported from foreign manufacturers;
- continued to work with Canada Customs to ensure that used furniture and mattresses are not being imported for sale in Ontario;
- continued to identify and address an increase in unregistered manufacturers and materials with incorrect content/s (as indicated in table USA-3); and
- continued to use a strategy of continuous communication and inspections to ensure that no company utilizes used materials in manufacturing or creating products without obtaining a valid registration.



Statistical Methods Used in Trend Analysis

The trend analysis of a time series of the data includes:

- graphical data analysis; and
- trend tests.

Time series plots are used to present the data graphically. These plots provide insight into the data for the analysts and readership. Time series plots are two-dimensional scatterplots and illustrate the relationship between a random response variable of interest and time. The human eye is an excellent judge of the range of data on a scatter plot, but has a difficult time accurately judging the pattern of how a variable varies over time. Furthermore, in the presence of a large number of data points, a scatterplot would have merely shown a cluster of data points.

To aid in the trending judgment, a smooth local curve is superimposed on the data in the report. There are various smoothing methods that fit the center line to the data whose direction and slope varies locally in response to the data itself. The analysis uses a method known as Locally Weighted Scatterplot Smoothing (LOWESS) for fitting lines to data. The method is more robust to outliers than the method of ordinary least squares regression and does not require the assumptions of normality and constant variance of residuals to be satisfied. Unlike the regression method, the shape of a smooth is not specified *a priori* but is determined solely by the data. Adding a smooth line through the middle of the data aids judgment of whether the pattern is linear and indicates where breaks in slope occur. To aid in the graphical data analysis, the smoothers are superimposed on the data using Minitab 15[®].

Hypotheses testing regarding trends has two advantages over graphical data analysis:

- it ensures that every analyst of a data set using the same methods will arrive at the same result; and
- it presents a measure of the strength of the evidence (the p-value).

The current study uses the Mann-Kendall test in the determination of whether the probability distribution from which response values arise has changed over time. The Mann-Kendall test is a non-parametric test and does not require the assumption of normality for the data. This test is robust to outliers and allows missing data in the data analysis. To better discern the trend in the response variable, efforts are made to remove the effects of other exogenous variables in this report.

There are many instances where seasonality is the source of variation in the response variable. This report uses Kruskal-Wallis statistics for testing seasonality in the time series. These statistical tests on the data are done using the Minitab 15[®] software. If the evidence is found for seasonality then the Seasonal Mann-Kendall trend test is used instead of the Mann-Kendall test. The decisions based on the outcomes of these tests are made at the confidence level of 95%.



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Appendix B

Root Cause Analysis Categories

Category	Definition	Sub-Categories
Design	Factors related to the engineering outline and physical make-up of a device for its intended purpose.	- Defective or inadequate design. - Defective/inadequate safety features, or devices. - Inappropriate equipment or material selection. - Inappropriate drawing, specification or data.
Equipment/Material/Component	Factors related to a device (machinery), the physical constituents of a device (material used or make-up) or a specific unit of an overall device of machinery.	- Defective, failed, or malfunctioning equipment. - Defective or failed component including safety devices. - Defective or failed material. - Defective assembly. - Electrical or instrument noise or malfunction. - Contamination of material, component or equipment.
External Factors	Factors representing occurrences beyond human control or TSSA regulatory control.	- Weather or other environment conditions. - Utilities disruption or failure. - External incidents. - Sabotage, terrorism, vandalism or theft. - Non-compliance with non-TSSA regulations.
Human Factors	Factors related to actions or inactions of humans in the execution of activities in the operation of equipment or in the general work environment.	- Inadequate or unsafe operating environment. - Special conditions. - Failure to follow maintenance procedures. - Failure to follow operating procedures. - Failure to follow installation procedures. - Failure to follow user instructions. - Inappropriate plant operator attendance. - Deliberate intent or sabotage. - Incomplete or inadequate internal communication. - Incomplete or inadequate external communication.
Maintenance Procedures	Factors related to repair and upkeep activities required for the preservation of a device during its useful lifecycle.	- Defective or inadequate maintenance procedures. - Lack of maintenance procedures.
Management	Factors related to the levels of responsibility that are accountable for specific activities, programs and systems of operation.	- Inadequate or defective management systems. - Lack of management systems. - Improper or negligent work practices. - Gaps in the regulatory management system.
Operating Procedures	Factors related to guidelines that outline how specific activities should be executed.	- Defective or inadequate operating procedures. - Lack of operating procedures. - Lack of or inadequate safety procedures. - Defective or inadequate installation procedures. - Lack of installation procedures.
Training	Factors related to documented programs that prepare employees for the proper execution of specific work activities as required.	- Lack of training programs. - Defective or inadequate training programs.



Updated Inspection Outcomes

The available inspection outcomes as documented by the Oracle business system are different than those in the previous system. These changes are designed to fall in line with all program policies. The tables below provide the mapping from the previous outcomes to the new. Please refer to the glossary (Appendix D) for definitions of both the previous and new inspection outcomes.

Table D-1: Boilers and Pressure Vessels, and Operating Engineers Inspection Outcomes

Activity	Updated Outcome	Historical Outcome
Boilers and Pressure Vessels Periodic Inspections	Passed on First Visit	Passed Inspection
	Follow-up	Partly Inspected: Follow-up Required
		Directives Issued: Follow-up
Operating Engineers Periodic Inspections	Complete	Passed
		Passed & Seal/Unseal Equipment
	Follow-up	Directives Issued: Re-inspect

Table D-2: Elevators, Escalators and Moving Walks, Amusement Devices, and Ski Lifts inspection outcomes

Activity	Updated Outcome	Historical Outcome
Elevators, Escalators, Moving Walks, Amusement Devices, and Ski Lift Periodic Inspections	Passed on First Visit	Passed Inspection: No Follow-up Needed
	Follow-up	Conditional Pass with Voluntary Compliance
		Conditional Pass: Needs Follow-up
	Shutdown	Failed Inspection: Shutdown - Follow-up Needed
		Failed Inspection: Amusement Device Shutdown
	Voluntary shutdown	Voluntary Shutdown: No Follow-up Required

Table D-3: Fuels Inspection Outcomes

Activity	Updated Outcome	Historical Outcome
Periodic Inspections	Passed on First Visit	Inspection Complete
	Follow-up	Minor Deficiencies: Voluntary Compliance
		Minor Deficiencies: Must Re-inspect
		Failed Inspection: Major Deficiencies
	Cease and Desist	N/A – This is a new inspection outcome available for periodic inspections at licenced sites.
Contractor Audits	Passed on First Visit	Inspection Complete
	Follow-up	Minor Deficiencies: Voluntary Compliance
		Minor Deficiencies: Must Re-inspect
		Major Deficiency: Voluntary Compliance
		Major Deficiency: Must Re-inspect
	Cease and Desist	Cease & Desist



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Appendix C

Activity	Updated Outcome	Historical Outcome
Ad Hoc Inspections	Passed on First Visit	Inspection Complete
	Follow-up	Minor Deficiencies: Voluntary Compliance
		Minor Deficiencies: Must Re-inspect
		Major Deficiency: Voluntary Compliance
		Major Deficiency: Must Re-inspect
	Cease and Desist	Cease & Desist



Glossary of Terms

Cease and Desist	Applies to an activity or a person and is an order to cease an activity that is in non-compliance or could create an unsafe condition.
Complete	An inspection that has been executed with no outstanding non-compliances (hazards) found.
Conditional Pass	A device is allowed to remain in operation with low hazards or minor non-compliances identified from inspection: • Conditional Pass with Voluntary Compliance: From the inspector's judgment, low enough risk based on likelihood and consequence to allow for voluntary reporting of compliance. • Conditional Pass: Needs Follow-up: Similar to above, but requires follow up inspection to ensure corrective action and does not qualify for voluntary reporting of compliance based on the inspector's judgment (used in periodic inspections).
Deficiency	Instances of inappropriate actions, performance by personnel or condition or deterioration of equipment related to violations of acceptable standards and regulations (please refer to Section 21 of the <i>Technical Standards and Safety Act, 2000</i>).
Directives Issued: Re-inspect	An inspection with this outcome has revealed non-compliances that must be corrected and verified by an inspector.
Failed Inspection: Shutdown – Follow-up Needed	Cannot operate device until non-compliance has been rectified and verified by an inspector (refer to TSSA document ED0028 – <i>Enforcement Procedure Bulletin for Inspections and Follow-Ups to Periodic Inspection on Elevating Devices</i>).
Failed Inspection: Amusement Device is Shutdown	Cannot operate device until non-compliance has been rectified and verified by an inspector.
Follow-up	An inspection with this outcome has revealed non-compliances that must be corrected and verified by an inspector.
Hazard Rank	The assignment of the likelihood of a failure and its associated consequence(s) as judged by the inspector when a non-compliance is found, using a pre-determined hazard ranking tool.
Incident Management Information System (IMIS)	A public safety decision-support information tool that enables TSSA to document the receipt, dispatch, investigation and analysis of reported occurrences and forms a component of the Incident Management System (IMS).
Incident Management System	A structured framework that translates the legislated regulatory responsibilities of TSSA, specifically as it pertains to incident investigations into a management system. This management system contains policies, procedures, roles and responsibilities and associated processes that enable the receipt, investigation and analysis of reported occurrences.
Incident Occurrence	An occurrence involving a system/device/component under TSSA's jurisdiction, whereby a hazard is exposed resulting in a consequence to people or property.
Inspection	An official examination of a device, system or procedure aimed at forming a safety assessment of the device, system or procedure.
Inspection Complete	An inspection that has been executed with no non-compliances (no hazards) found.



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Appendix D

Major Deficiency	Non- compliances and/or conditions posing non-immediate hazards are identified as major deficiencies: • Major Deficiency: Must Re-inspect: A major deficiency for which an inspector based on judgment determines that a follow up is required. • Major Deficiency: Voluntary Compliance: A major deficiency for which an inspector based on judgment determines a voluntary compliance is required.
Minor Deficiency	Non- compliances and/or conditions posing non-immediate hazards are identified as minor deficiencies: • Minor Deficiency: Must Re-inspect: A minor deficiency for which an inspector based on judgment determines that a follow up is required. • Minor Deficiency: Voluntary Compliance: A minor deficiency for which an inspector based on judgment determines a voluntary compliance is required.
Minor Injury	The consequence of an incident occurrence wherein there was an observed health impact that was estimated to be minor based on the nature of the injury and its associated severity using a methodology developed by the World Health Organization (WHO).
Near-Miss Occurrence	An occurrence involving a system/device/component under TSSA's jurisdiction, whereby a hazard is exposed demonstrating an instance of elevated exposure to risk, while in this particular instance resulting in no consequence to people or property.
Occurrence Inspection	A detailed inquiry into an occurrence, including the gathering of information, which is undertaken officially to ascertain the cause(s) and consequence(s) of the occurrence.
Outcome	The output or the end result of an activity or event. The documented end result of actions or the execution of a process.
Partly Inspected: Follow-up	The outcome from an inspection that was incomplete due to various reasons, such as missing data, time factors involved in making equipment ready to be inspected, and owner or their staff unavailability. Any outstanding items will be inspected in a follow-up.
Passed	An inspection that has been executed with no outstanding non-compliances (hazards) found.
Passed on First Visit	An inspection that has been executed with no outstanding non-compliances (hazards) found on first visit.
Passed Inspection: No Follow-up Needed	Compliant device or non-compliances that are deemed not sufficiently significant to warrant a voluntary compliance or a follow-up.
Serious Injury	The consequence of an incident occurrence wherein there was observed health impact that was estimated to be serious based on the nature of the injury and its associated severity using a methodology developed by the WHO.
Shutdown	Inspections that identify non-compliances that must be rectified and verified by an inspector before the device can be operated.
Voluntary Compliance	An allowance provided by the inspector for a person to comply with Legal Orders at a point in the future and self declare the compliance in writing without the need for a follow up inspection by an inspector to verify the compliance.
Voluntary Shutdown	Non-compliances were found which would have warranted a failed inspection, a shut down or conditional pass but the owner has voluntarily decided to shut the device down.
Voluntary Shutdown: No Follow-up Required	Non-compliances were found which would have warranted a failed inspection, a shut down or conditional pass but the owner has voluntarily decided to shut the device down.



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