



Annual Public Safety Performance Report

For the Period January 1, 2008 to April 30, 2009





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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* replaces the previously published *State of Public Safety Report* and contains enhanced reporting, information on historic trends and TSSA actions taken to continually improve compliance and manage public safety issues.

As the *Annual Public Safety Performance Report* tracks information on a fiscal year basis and the *State of Public Safety Report* for 2007 catalogued information on a calendar year basis, this report documents information for the additional first four months of the calendar year 2008 to ensure completeness in the transition to the new format of reporting.

The *Annual Public Safety Performance Report* is structured consistently across all the different 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 January 1, 2008 to April 30, 2009 specific to inspecting occurrences, and conducting 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 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.

It is important for the readers to note that, while in general, analysis on trends has been provided over a five 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.

Three years ago, TSSA embarked on a risk-informed decision-making (RIDM) framework utilizing 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 all TSSA actions that have been implemented or are being planned in response to the results from the public safety analysis carried out from January 1, 2008 to April 30, 2009 and based on 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 and Sources of Uncertainty

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



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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. Where the number of quarters considered was insufficient to run the statistical tests, monthly data points were used. 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 to coincide 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. Further details on the methodology and approach to trend analysis are included in Appendix A to this report.

It is important to note that 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 licence 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.

In producing this report, TSSA makes every effort to ensure a high level of data integrity and continuously works toward 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 will be noted and, in the event of a material restatement, a thorough explanation will be provided.



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Appendix A - Statistical Methods Used in Trend Analysis

Appendix B – Root Cause Analysis Categories

Appendix C – Glossary of Terms



Executive Summary of Public Safety Analysis

Boilers and Pressure Vessels, and Operating Engineers Safety Program

Boilers and Pressure Vessels

Incident/Near-Miss Occurrence Inspections

- There were no occurrences in the period January 1, 2008 to April 30, 2009.
- There are no statistically significant trends in the occurrences or their health impacts over the last five fiscal years.

Periodic Inspections

- There were 1,381 periodic inspections conducted in fiscal year 2008/2009.
- 97.97% of these periodic inspections passed on the first visit.
- The average number of deficiencies per inspection has not significantly varied over the last five fiscal years.
- There are no statistically significant trends in inspection outcomes.

Operating Engineers

Incident/Near-Miss Occurrence Inspections

- There were no occurrences in the period January 1, 2008 to April 30, 2009.
- There are no statistically significant trends in the occurrences or their health impacts over the last five fiscal years.

Periodic Inspections

- There were 1,866 periodic inspections conducted in fiscal year 2008/2009.
- 44.43% of these periodic inspections passed on the first visit.
- The average number of deficiencies per inspection has a downward trend over the last five fiscal years.
- Over the last five fiscal years there is an increasing trend in the percentage of inspections requiring a follow-up and a decreasing trend in the percentage of inspections passing on the first visit.

Elevating Devices and Amusement Devices Safety Program

Amusement Devices

Incident/Near-Miss Occurrence Inspections

- There were 74 occurrences reported to TSSA in fiscal year 2008/2009, with a health impact of 13 serious and 65 minor injuries.
- There are no statistically significant trends in the health impacts of occurrences over the last five fiscal years.
- There is a downward trend in the percentage of occurrences unable to have their root cause established over the last two fiscal years.

Periodic Inspections

- There were 1,539 periodic inspections conducted in fiscal year 2008/2009.
- 55.95% of these periodic inspections passed on the first visit.
- The average number of deficiencies per inspection has not significantly varied over the last five fiscal years.
- There is a downward trend in the percentage of inspections requiring a follow-up over the last five fiscal years.

Elevators

Incident/Near-Miss Occurrence Inspections

- There were 192 occurrences reported to TSSA in fiscal year 2008/2009, with a health impact of five serious and 120 minor injuries.
- There is a downward trend in the number of serious injuries on elevators over the last five fiscal years.



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- There is a downward trend in the percentage of occurrences with a root cause of 'Operating Procedures' over the last two fiscal years.

Periodic Inspections

- There were 18,586 periodic inspections conducted in fiscal year 2008/2009.
- 28.49% of these periodic inspections passed on the first visit.
- The average number of deficiencies per inspection has an upward trend over the last five fiscal years.
- Over the last five fiscal years there are increasing trends in the percentage of inspections with conditional passes requiring follow-ups and failures requiring shutdown, and decreasing trends in the percentage of inspections with voluntary compliance and passing on first visit.
- The percentage of inspections passing on first visit has increased during the last two fiscal years as a result of Director's Order 218/07.

Escalators and Moving Walks

Incident/Near-Miss Occurrence Inspections

- There were 552 occurrences reported to TSSA in fiscal year 2008/2009, with a health impact of four serious and 398 minor injuries.
- There are no statistically significant trends in the health impacts of occurrences over the last five fiscal years.
- Over the last two fiscal years there are upward trends in the percentage of occurrences with root causes of 'Human Factors' and 'Training', and a downward trend in the percentage of occurrences 'Unable to Establish Root Cause'.

Periodic Inspections

- There were 783 periodic inspections conducted in fiscal year 2008/2009.
- 15.07% of these periodic inspections passed on the first visit.
- The average number of deficiencies per inspection has an upward trend over the last five fiscal years.
- Over the last five fiscal years there are increasing trends in the percentage of inspections with conditional passes requiring follow-ups and failures requiring shutdown, and decreasing trends in the percentage of inspections with voluntary compliance and passing on first visit.

Ski Lifts

Incident/Near-Miss Occurrence Inspections

- There were 110 occurrences reported to TSSA in fiscal year 2008/2009, with a health impact of two serious and 93 minor injuries.
- There are no statistically significant trends in the health impacts of occurrences over the last five fiscal years.
- There are no statistically significant trends in the root causes of occurrences over the last two fiscal years.

Periodic Inspections

- There were 165 periodic inspections conducted in fiscal year 2008/2009.
- 12.73% of these periodic inspections passed on the first visit.
- The average number of deficiencies per inspection has an upward trend over the last five fiscal years.
- There are no statistically significant inspection outcome trends.

Fuels Safety Program

Incident/Near-Miss Occurrence Inspections

- There were 2,233 pipeline strike occurrences reported to TSSA in fiscal year 2008/2009, with no health impacts.
- Over the last two and a half fiscal years for pipeline strike occurrences, there is an upward trend in the percentage of occurrences with the 'Design' root cause, and downward trends in the percentage of occurrences with a root cause of 'Operating Procedures' and those occurrences that are 'Unable to Establish Root Cause'.
- There were 1,288 other types of occurrences reported to TSSA in fiscal year 2008/2009, with a health impact of 13 fatalities, 61 serious injuries and 31 minor injuries.



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- There is no statistically significant trend in the number of fatalities for the last five fiscal years.
- There is an upward trend in the number of fuels-related serious injuries over the last five fiscal years primarily as a result of carbon monoxide exposures during the utilization of natural gas, propane and fuel oil.
- There are no statistically significant trends in the root causes of occurrences over the last two and a half fiscal years.

Licensed Site Periodic Inspections

- There were 2,141 periodic inspections conducted in fiscal year 2008/2009.
- 45.54% of these periodic inspections passed on the first visit.
- The average number of deficiencies per inspection has a downward trend over the last five fiscal years.
- Over the last five fiscal years there is an increasing trend in the percentage of inspections with minor deficiencies requiring re-inspection and a decreasing trend in the percentage of inspections allowing voluntary compliance as a result of a TSSA policy decision to re-inspect upon observing non-compliance.

Ad Hoc Inspections

- There were 4,014 ad hoc inspections conducted in fiscal year 2008/2009 at places such as construction sites, residences, campsites, private petroleum sites, etc.
- 34.28% of these ad hoc inspections passed on the first visit.
- The average number of deficiencies per inspection has an upward trend over the last five fiscal years.
- Over the last five fiscal years there are increasing trends in the percentage of inspections with minor deficiencies requiring follow-up, major deficiencies requiring follow-up and cease and desist results, and decreasing trends in the percentage of inspections with minor deficiencies allowing voluntary compliance and major deficiencies allowing voluntary compliance.

Contractor Audits

- There were 1,911 contractor audits conducted in fiscal year 2008/2009.
- 62.01% of these audits passed on the first visit.
- The average number of deficiencies per audit has not significantly varied over the last five fiscal years.
- Over the last five fiscal years there is an increasing trend in the percentage of audits with cease and desist results, and a decreasing trend in the percentage of audits with major deficiencies allowing voluntary compliance.

Upholstered and Stuffed Articles

Inspections

- There were 3,724 inspections conducted in fiscal year 2008/2009.
- 8,446 deficiencies were found in these inspections.



Executive Summary of Public Safety Decisions

Boilers and Pressure Vessels, and Operating Engineers Safety Program

Boilers and Pressure Vessels

Improving Compliance

- TSSA is engaging stakeholders representing insurance companies to enhance the reporting of boilers and pressure vessels periodic inspection records and improve TSSA's ability to report comprehensively on the overall state of compliance.

Managing Safety Issues

- TSSA is engaging stakeholders to improve reporting that will allow for a better understanding of safety issues if they exist.

Regulatory Improvements

- The Code Adoption Document was updated to include the *Boiler, Pressure Vessel and Pressure Piping Code, CSA B51-03, 2004 Update and 2005 Supplement*.
- The procedures for inspecting steam traction boilers have been revised and updated, and a focused team of inspectors has received training to carry out these inspections.

Operating Engineers

Improving Compliance

- TSSA continues to administer a risk-informed inspection process allowing TSSA to focus on plants with demonstrated non-compliance.

Managing Safety Issues

- In response to a risk assessment study of overspeed protection of steam turbines, TSSA is considering to proactively allow the use of electronic overspeed detection systems and exploring the possibility of enhancing regulatory requirements for the maintenance of mechanical stop valves with this technology.

Regulatory Improvements

- Revisions and amendments to Ontario Regulation 219/01, *Power Engineering*, (formerly *Operating Engineers*), previously developed in consultation with industry, are being considered by the Ministry of Small Business and Consumer Services (MSBCS)¹.

Elevating Devices and Amusement Devices Safety Program

Amusement Devices

Improving Compliance

- While no significant trends with non-compliance have been identified, TSSA continues to communicate to and educate stakeholders on regulatory requirements through annual technical training workshops.

Managing Safety Issues

- In response to the dominance of 'Human Factors' as the primary root cause of occurrences, TSSA has enhanced its public education program and delivered successful public education campaigns focused on rider responsibility and safety awareness at special events and numerous waterslide and go-kart parks across Ontario.

¹ Effective June 24, 2009 the Ministry of Consumer Services assumed responsibility for oversight of TSSA from the Ministry of Small Business and Consumer Services (MSBCS).



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Regulatory Improvements

- TSSA has issued a Code Adoption Document introducing new regulatory requirements for the design and operation of zip lines in Ontario.
- TSSA recommended to MSBCS updates to Ontario Regulation 221/01, *Amusement Devices*, with changes being effective January 1, 2009.

Elevators

Improving Compliance

- In response to an upward trend in non-compliance with specific deficiencies such as annual examinations and tests, TSSA issued an enforcement procedure bulletin to bring greater safety compliance and has begun seeing positive results in compliance trends.
- TSSA has developed requirements for the regulation of parking garage lifts as well as advised industry of the rules of compliance through an enforcement procedure bulletin.

Managing Safety Issues

- In order to address risks associated with hydraulic elevators, TSSA has engaged in a focused inspection study to determine the state of compliance with the current Director's Order on oil loss monitoring for known hydraulic elevators equipped with single flat bottom cylinders.
- TSSA is reviewing its current risk-based inspection model to establish an enhanced version that is based on a predictive approach and incorporates factors such as equipment modernization.

Regulatory Improvements

- TSSA recommended to MSBCS updates to Ontario Regulation 209/01, *Elevating Devices*, with changes being effective January 1, 2009.
- As a result of recommendations from a coroner's jury held in September 2007, TSSA implemented continuing education requirements for elevator mechanics which are effective for renewal of certificates that expire after January 1, 2011.

Escalators and Moving Walks

Improving Compliance

- TSSA is analyzing major deficiencies identified during periodic inspections in response to the increasing trend in the rate of deficiencies per inspection.
- TSSA continues to use its risk-based inspection program to prioritize and direct its resources in inspecting escalators and moving walks in Ontario.

Managing Safety Issues

- TSSA has formed a risk reduction group in response to the trends in occurrences involving escalator entrapments and brake failures, and will evaluate options to reduce these occurrences.

Regulatory Improvements

- TSSA recommended to MSBCS updates to Ontario Regulation 209/01, *Elevating Devices*, with changes being effective January 1, 2009.

Ski Lifts

Improving Compliance

- No specific TSSA actions were taken this fiscal year.



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Managing Safety Issues

- TSSA formed a risk reduction group in response to the number of occurrences involving riders falling out of chairlifts, which determined that public education and signage are appropriate measures to reduce this type of occurrence.
- TSSA continues to partner with industry to raise rider responsibility and safety awareness.

Regulatory Improvements

- In response to the risk reduction group's recommendations, new requirements have been introduced for signage, along with increased enforcement on the part of operators to reduce the number of falls from chairs.

Fuels Safety Program

Improving Compliance

- TSSA continues to use its risk-based inspection program to prioritize and direct its resources in auditing fuels contractors operating in Ontario.
- TSSA is utilizing the results of ad hoc inspections to evaluate whether more focused and targeted inspections at locations such as construction sites and private fuel outlets are required to reduce the number of significant non-compliances.

Managing Safety Issues

- TSSA continues to utilize the risk reduction group for residential boilers to evaluate safety hazards and has issued a Director's Order mandating the maintenance for this type of equipment whenever a technician enters a home with a natural draft boiler.
- The residential boiler risk reduction group had also determined that additional controls should be considered for these boilers based on safety information gathered during the heating season from a large service company which are being incorporated into a new Director's Order.
- TSSA has utilized the risk assessment of portable camp heaters and will be initiating a risk reduction group to enhance public safety.
- TSSA continues to raise awareness of the safety risks associated with pipeline strikes and conducts education programs to ensure that stakeholders know safety-related requirements.
- TSSA has initiated a risk assessment process to evaluate the number of fuel oil occurrences with 'Equipment/Component/Material' root causes.
- TSSA initiated and completed a propane re-audit program for all Ontario facilities where there are transfers of propane to assess the level of compliance.

Regulatory Improvements

- TSSA released several Director's Orders and advisories, including clarifications of requirements and procedures.
- TSSA issued safety orders with respect to residential natural draft boilers to require maintenance.
- Ontario Regulation 215/01 *Fuel Industry Certificates*, and Ontario Regulation 216/01 *Certification of Petroleum Mechanics*, were revised to clarify the qualification requirements and include work conducted by natural gas distributors.
- As of December 11, 2008 Ontario Regulation 440/08 and Ontario Regulation 441/08 were filed by MSBCS amending Ontario Regulation 211/01, *Propane Storage and Handling*, and Ontario Regulation 215/01, *Fuel Industry Certificates*, respectively. These amendments include requirements for annual inspections and the implementation of a risk and safety management plan by licence holders of propane facilities. TSSA has initiated a risk reduction group to set guidelines for the phase-in of these changes.

Upholstered and Stuffed Articles

- Ontario Regulation 218/01, *Upholstered and Stuffed Articles*, was amended by MSBCS to exempt manufacturers of padded undergarments, shoulder pads, and trimmings on articles of clothing.
- TSSA worked with Canada Customs to stop the import of used furniture and mattresses for sale in Ontario.
- TSSA continues to use a strategy of continuous communication and inspections to ensure compliance with the regulation.



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 worker and public safety. TSSA's activities help ensure that safeguards are in place for the life cycle of equipment in this sector.

Public Safety Analysis

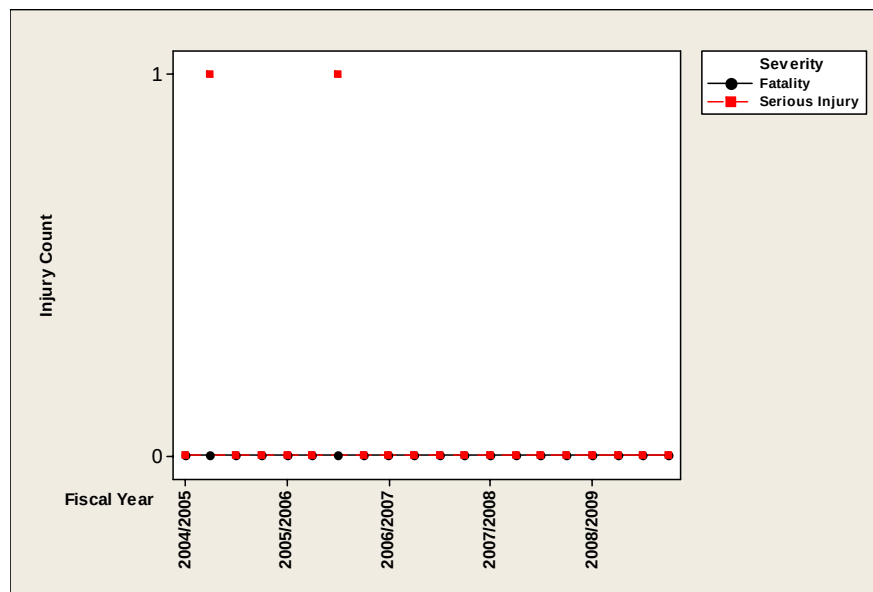
Occurrence Analysis

There were no occurrences in the period January 1, 2008 to April 30, 2009.

Occurrence Related Trends

Figure 1 charts the number of boilers and pressure vessels fatalities and serious injuries over the last five fiscal years. As illustrated, there have been no fatalities involving boilers and pressure vessels within TSSA's jurisdiction during this period. A statistical analysis of this data indicates that the number of serious injuries do not demonstrate any significant trends over the last five fiscal years.

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



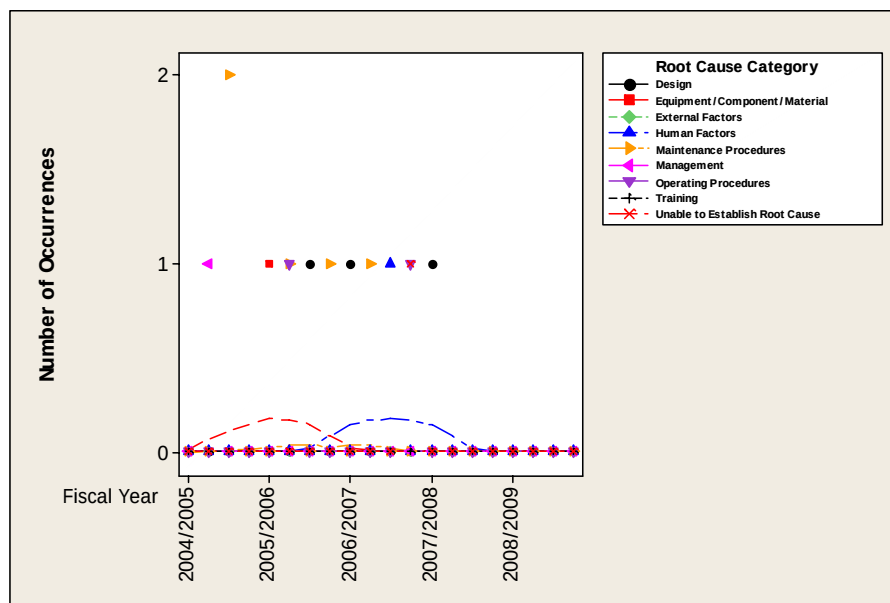


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Figure 2 illustrates the distribution of root causes for inspected occurrences (in percentages) over the last five fiscal years. A statistical analysis reveals that there are no significant trends over the measured period. The occurrences in this program are relatively rare.

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



Compliance Analysis

Periodic Inspections

The number of periodic inspections completed since January 1, 2008 are presented in Table 1. The total number of deficiencies in these periodic inspections are also included.

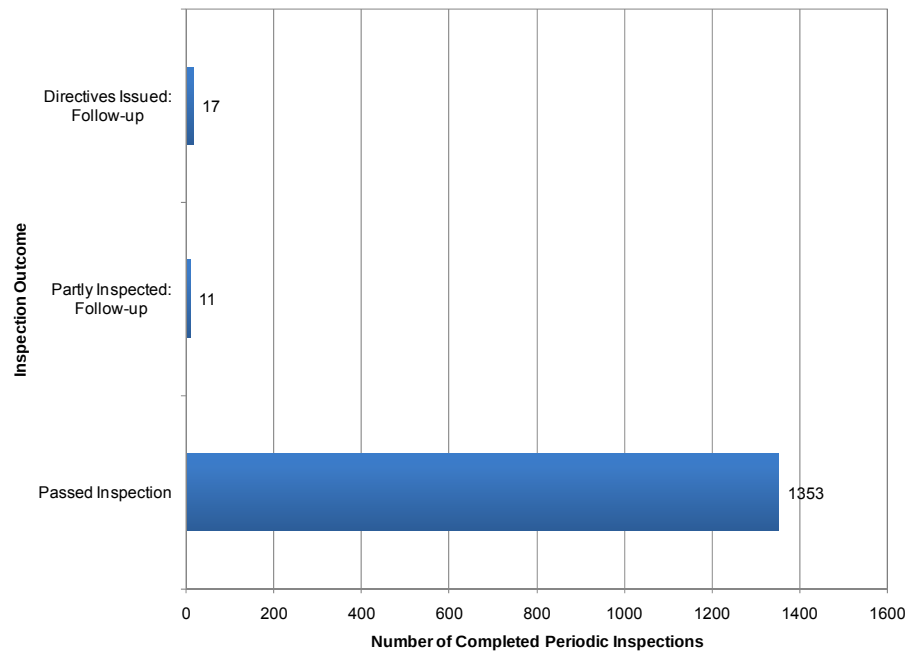
Table 1: Activity measures for boilers and pressure vessels periodic inspections.

Period	Number of Periodic Inspections	Number of Deficiencies
January 1, 2008 – April 30, 2008	591	4
May 1, 2008 – April 30, 2009 Fiscal Year 2008/2009	1,381	43
Total Inspections January 1, 2008 – April 30, 2009	1,972	47

Each of these inspections results in an outcome as determined by a TSSA inspector, shown in Figure 3. Of all periodic inspections completed in fiscal year 2008/2009, 97.97% passed on the first visit.



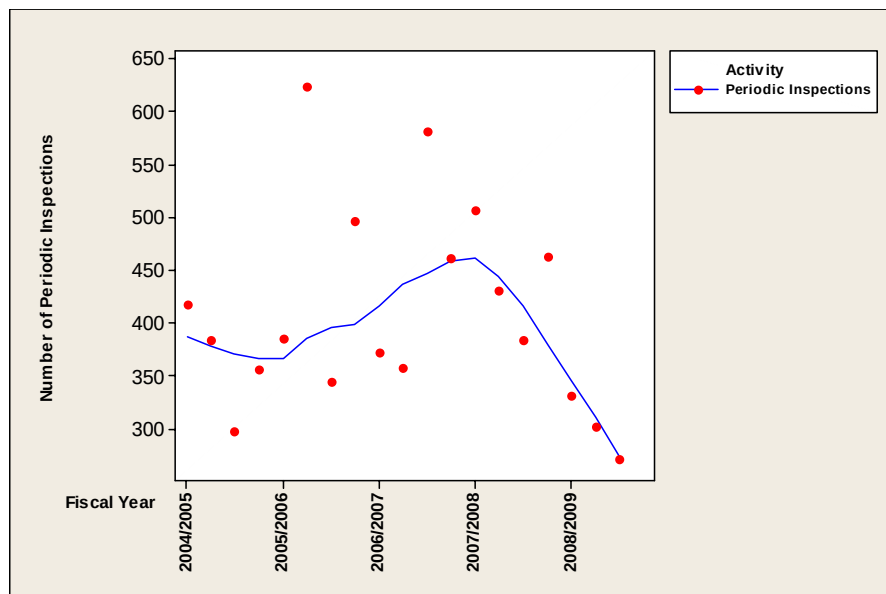
Figure 3: Outcomes from boilers and pressure vessels periodic inspections completed in fiscal year 2008/2009.



Compliance Related Trends

Figure 4 charts the number of periodic inspections over the last five fiscal years. A statistical analysis of this data indicates that the number of periodic inspections has not significantly varied over the last five fiscal years.

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





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Figure 5 provides the average number of deficiencies per inspection for the last five fiscal years. A statistical analysis of this data indicates that the average number of deficiencies per inspection has not significantly varied over the last five fiscal years.

Figure 5: The average number of deficiencies per boilers and pressure vessels periodic inspection over the last five fiscal years.

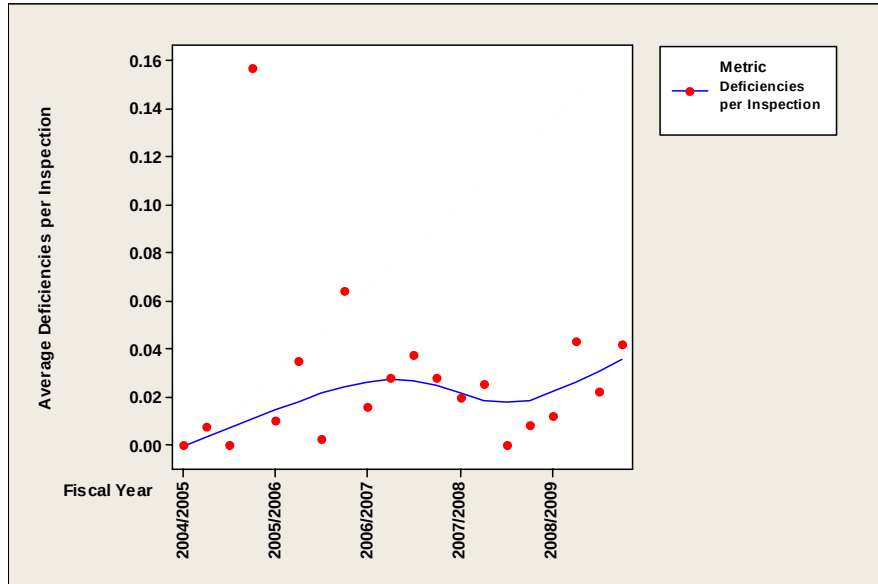
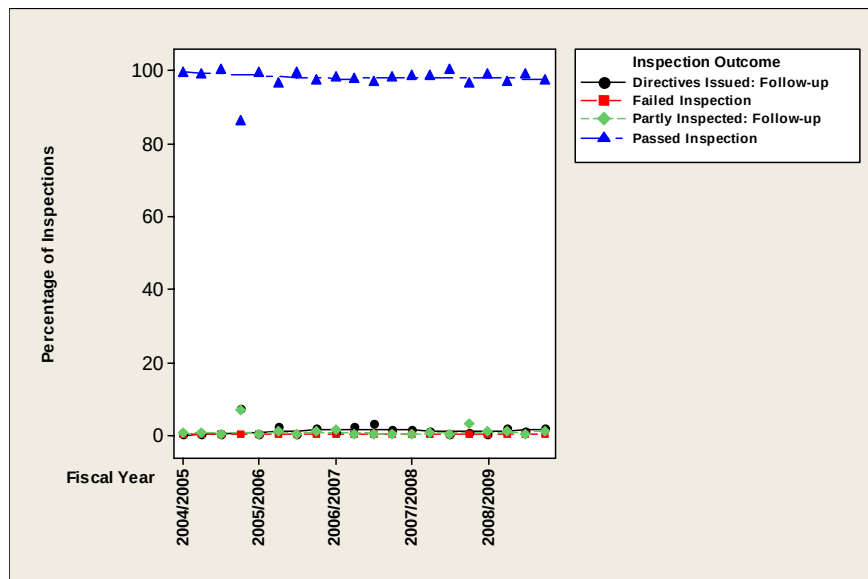


Figure 6 charts the outcomes from the periodic inspections over the last five fiscal years. A statistical analysis of this data indicates that outcomes from the periodic inspections have not significantly varied over the last five fiscal years. Since the average number of deficiencies per inspection 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 outcomes.

Figure 6: The percentage outcomes of boilers and pressure vessels periodic inspections completed 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

The compliance analysis section above represents TSSA's oversight of boilers and pressure vessels in Ontario that are currently identified to be uninsured. These represent approximately 5% of the total number of the registered equipment in the province. All insured vessels are required to be inspected by insurance companies on a periodic basis according to Ontario Regulation 220/01, *Boilers and Pressure Vessels*, making insurance company inspectors carry the largest portion of the effort to enforce the regulation with respect to boilers and pressure vessels periodic inspections. There are approximately 25 insurers in Ontario, each of which is required to provide TSSA with a record of their boilers and pressure vessels inspections. These documents are not standardized, resulting in reports which are inconsistent in format and content. This makes the tracking of equipment quite difficult. For TSSA to be informed that equipment is being periodically inspected, tracking the status is essential.

A plan is being developed to track and verify the status of uninsured devices and will require a phased approach. Short and long term strategies to determine the appropriate access to periodic inspection data is to be established with the assistance of the Boilers and Pressure Vessels Advisory Council and insurers.

Managing Safety Issues

The occurrence analysis shows that the number of reported occurrences in this sector is low. While this may represent a true reflection of the state of safety, TSSA believes that there may be a reporting gap with respect to near-misses and equipment failures. This could be a result of a lack of understanding of the reporting requirements or non-compliance with the regulation.

TSSA recently published a guideline to provide further clarification on incident reporting. In addition to defining types of occurrences, such as a rupture or an accidental vapour release, owners can add alternative methods of notification, deemed acceptable to TSSA, such as contacting the Ministry of the Environment's Spills Action Centre.

Reporting Criteria

The following are the criteria or circumstances under which an occurrence involving equipment covered under Ontario Regulation 220/01, *Boilers and Pressure Vessels*, shall be reported by the owner of a boiler and/or pressure vessel to TSSA by means, and within timeframes, as specified in the regulation:

- injury or death; and/or
- serious property damage when it meets reporting criteria associated with the occurrence type presented in Table 2.



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Table 2: Boilers and pressure vessels occurrence reporting criteria.

Occurrence Type	Reporting Criteria
Explosion or Rupture	Explosions or ruptures to equipment including boiler tubes, pipes, valves or other fittings – but excluding rupture discs.
Fire	Fire that may have adversely impacted regulated equipment.
Accidental Vapour Release	Unexpected or uncontrolled release of vapour, not involving release through safety relief valves, and/or accidental release of hazardous substances related to a regulated pressure boundary such as ammonia.
Pressure Boundary Failure of Vessels or Piping	Equipment failure, including deformation, implosions, welding failure, mechanical damage, control equipment failure that causes overheating of a boiler or fired vessel, corroded and wasted area under required minimum thickness of the vessel, etc. <i>or</i> Failure due to vacuum operation or other sources of external pressure that require repairs to be inspected by authorized inspectors (TSSA or qualified insurance inspectors). <i>or</i> Any other occurrence, such as a near-miss event, involving equipment covered under Ontario Regulation 220/01, <i>Boilers and Pressure Vessels</i>, that is not covered under either criteria above, and is determined by the owner as a reportable occurrence under the regulation shall be reported accordingly.

Regulatory Improvements

A Directors' Order was issued to amend the Code Adoption Document to include the *Boiler, Pressure Vessel and Pressure Piping Code, CSA B51-03, 2004 Update and 2005 Supplement*.

The procedures for inspecting steam traction boilers have been revised and updated. Steam traction boilers form a distinct class of equipment that warrants a specially trained group of inspectors to effectively perform periodic and repair inspections. A team of inspectors has received specific training for carrying out these inspections.

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, TSSA examines and certifies 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.



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Public Safety Analysis

Occurrence Analysis

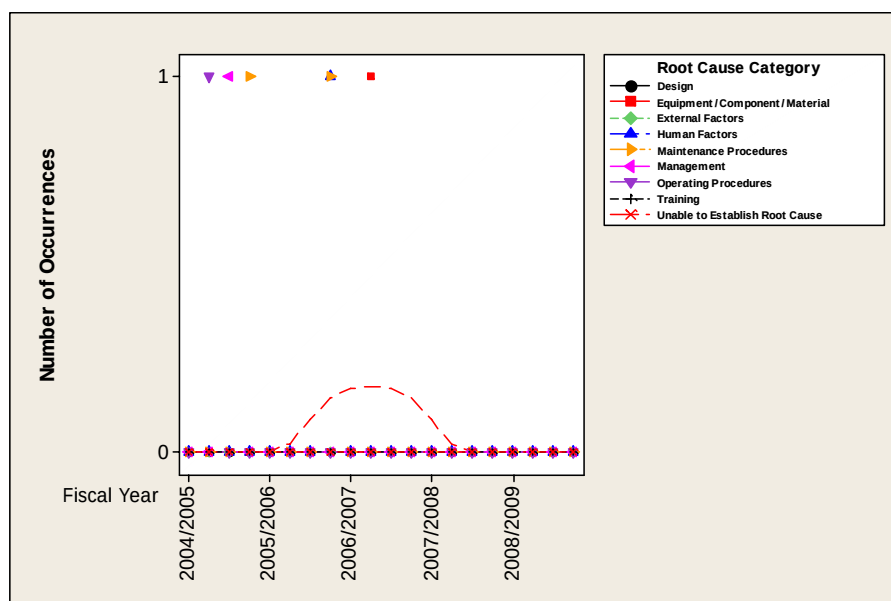
There were no occurrences in the period January 1, 2008 to April 30, 2009.

Occurrence Related Trends

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

Figure 7 illustrates the number of occurrences and their root causes. A statistical analysis of the data reveals that there appears to be no statistically significant trends associated with the occurrences, their consequences and their root causes. The occurrences in this program are relatively rare.

Figure 7: Operating engineers occurrences by root cause category.



Compliance Analysis

Periodic Inspections

The number of periodic inspections completed since January 1, 2008 are presented in Table 3. The total number of deficiencies in these periodic inspections are also included.

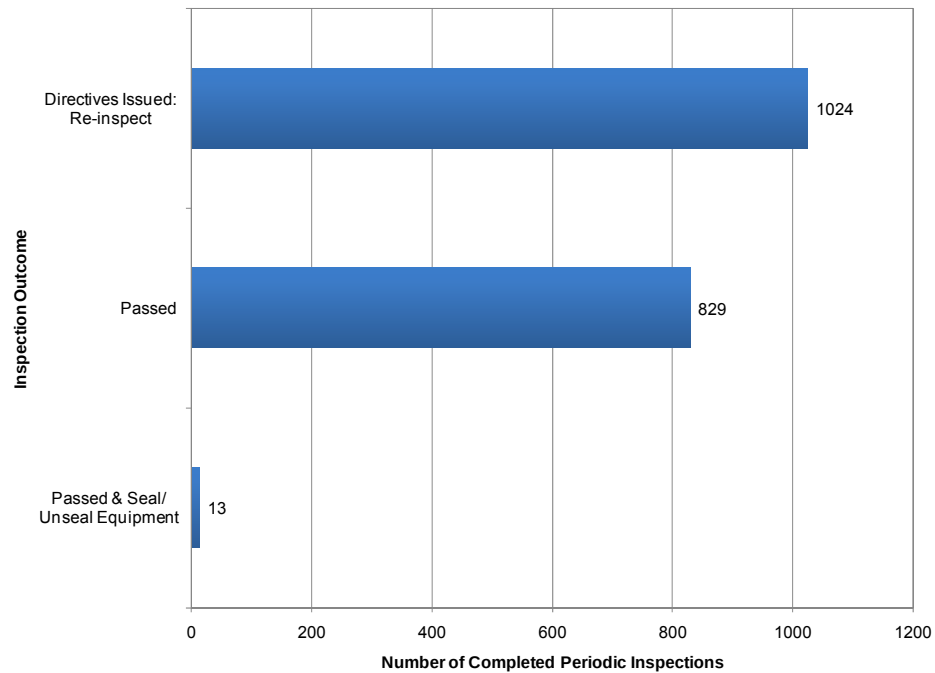
Table 3: Activity measures for operating engineers periodic inspections.

Period	Number of Periodic Inspections	Number of Deficiencies
January 1, 2008 – April 30, 2008	540	932
May 1, 2008 – April 30, 2009 Fiscal Year 2008/2009	1,866	3,310
Total Inspections January 1, 2008 – April 30, 2009	2,406	4,242

Each of these inspections results in an outcome as determined by a TSSA inspector, shown in Figure 8. Of all periodic inspections completed in fiscal year 2008/2009, 44.43% passed on the first visit.



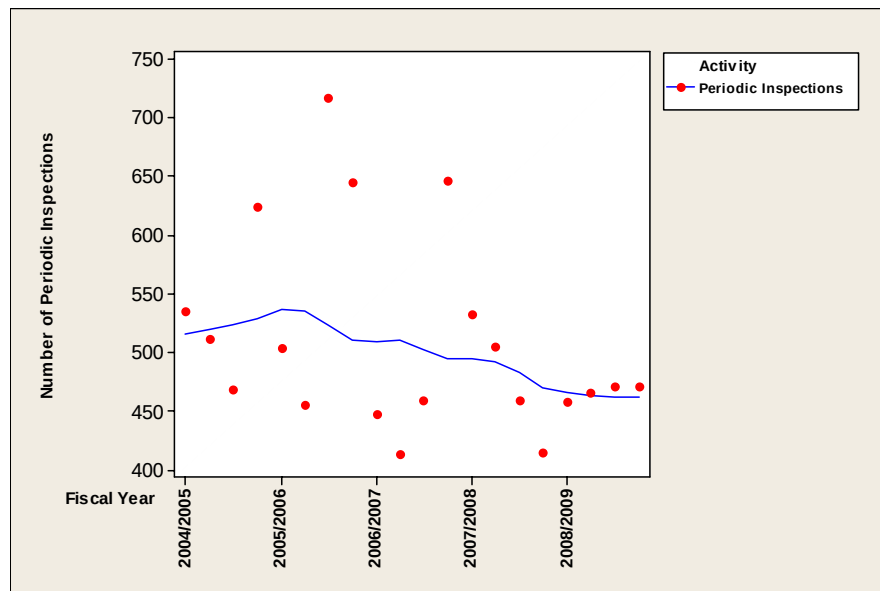
Figure 8: Outcomes from operating engineers periodic inspections completed in fiscal year 2008/2009.



Compliance Related Trends

Figure 9 charts the number of periodic inspections over the last five fiscal years. A statistical analysis of this data indicates that the number of periodic inspections has not significantly varied over the last five fiscal years.

Figure 9: Operating engineers periodic inspections completed over the last five fiscal years.





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Figure 10 provides the average number of deficiencies per inspection for the last five fiscal years. A statistical analysis of this data indicates that the average number of deficiencies per inspection has a downward trend over the last five fiscal years, while the number of periodic inspections has remained relatively constant.

Figure 10: The average number of deficiencies per operating engineers periodic inspection over the last five fiscal years.

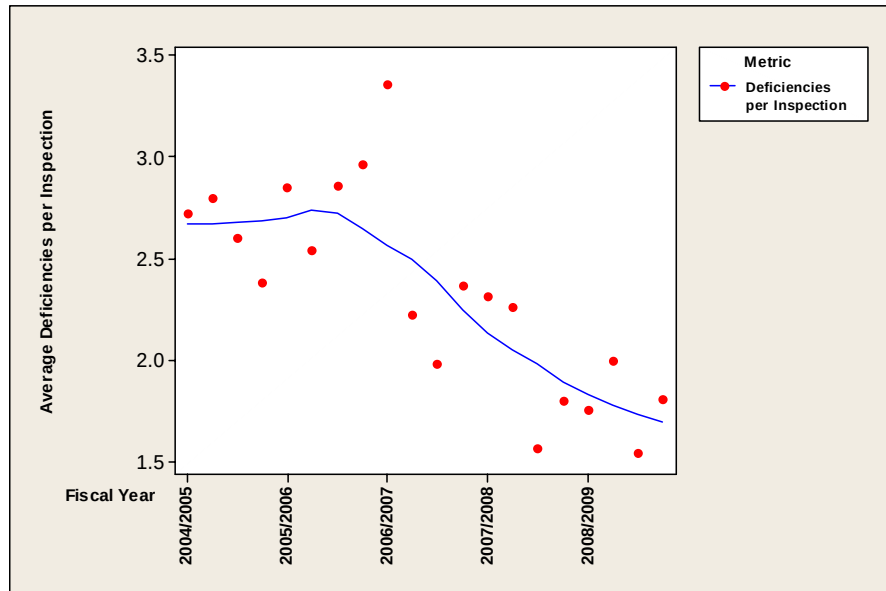
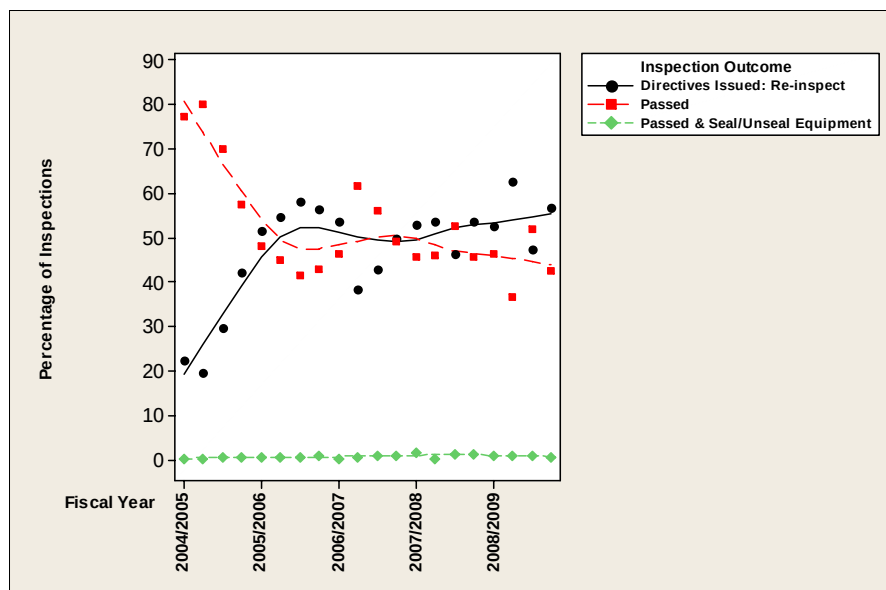


Figure 11 charts the outcomes from the periodic inspections over the last five fiscal years. A statistical analysis of this data indicates that while the average number of deficiencies per inspection may have a downward trend, the significance of deficiencies is increasing, demonstrated by the upward trend in the percentage of inspections requiring follow-up. This analysis also shows that the percentage of passed inspections has a downward trend over the last five fiscal years.

Figure 11: The percentage outcomes of operating engineers periodic inspections completed over the last five fiscal years.





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Other Safety and Risk Analysis Results

TSSA was requested by the Operating Engineers Advisory Council to conduct an assessment of the reliability of electronic overspeed protection systems for steam turbines. Overspeed protection systems include detection and shutdown components. This request was made in response to the increasing availability of more reliable electronic detection systems in the marketplace.

TSSA conducted a risk assessment to determine the limitations of the current mechanical systems and the perceived improvements of the modern electronic detection systems. The risk assessment included a review of the failures and associated causes of overspeed protection systems in North America.

The study concluded that electronic systems provide improved reliability and better safety performance; therefore, such systems could be allowed in Ontario. It additionally demonstrated a detailed review of the causes of failures involving stop valves, a part of the shutdown system, as a next step.

Public Safety Decisions

TSSA Actions

Improving Compliance

TSSA has been administering a risk-informed inspection process for this program area over the last two years, the results of which are being used by TSSA to generate a risk profile of power plants. This focuses TSSA inspection activities on those plants that are demonstrating a higher level of non-compliance and may be contributing to the downward trend in the percentage of inspections that pass on first visit.

Managing Safety Issues

Steam Turbine Governors

In response to the risk assessment study of overspeed protection systems for steam turbines, TSSA is consulting with stakeholders in the industry to proactively accommodate the use of electronic detection systems. During the next fiscal year TSSA will work with stakeholders in evaluating and addressing the reliability of mechanical stop valves and exploring the possibility of enhancing current regulatory requirements of the maintenance of such valves.

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 give hot oil burns and cause fires. A study is being performed in consultation with the Operating Engineers Advisory Council to address the technology. TSSA will review any recommendations from the study and advise the government of Ontario on regulatory change to ensure the safe operation and maintenance of thermal oil plants.

Power Engineers

A risk reduction group was formed to address the anticipated skills shortage in this profession. The risk reduction group will explore opportunities for additional approved training providers as well as other training models. The risk reduction group will also consider means of raising awareness and investigate 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*), previously developed in consultation with industry, are being considered by MSBCS.



Elevating Devices and Amusement Devices

Amusement Devices

TSSA regulates the safety of over 1,600 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, waterslides 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 4 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 4: Activity breakdown for amusement devices occurrences.

Occurrence Detail	Period		
	January 1, 2008 – April 30, 2008	May 1, 2008 – April 30, 2009 Fiscal Year 2008/2009	Total Occurrences January 1, 2008 – April 30, 2009
Number of Incidents	6	70	76
Number of Near-Misses	1	4	5
Completed Causal Analysis	4	34	38
Unable to Establish Root Cause	0	1	1
In Progress	2	7	9
Not Requiring Formal Inspection	1	32	33
Total Occurrences	7	74	81
Number of Fatalities	0	0	0
Number of Serious Injuries	3	13	16
Number of Minor Injuries	4	65	69



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The 16 serious injuries occurred on the following devices:

- adult go-karts – 2;
- fun house – 1;
- horizontally revolving ride – 1;
- inflated rides – 1;
- others – 3; and
- waterslides – 8.

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

Occurrence Related Trends

Figure 12 shows the number of occurrences to which TSSA has responded over the last two fiscal years. A statistical analysis of this data indicates that the number of occurrences has not significantly varied over the last two fiscal years. It should be noted that this graph does not account for occurrence inspections that are in progress; however, the impact on the analysis outcome would be insignificant.

**Figure 12: Amusement devices occurrences
over the last two fiscal years.**

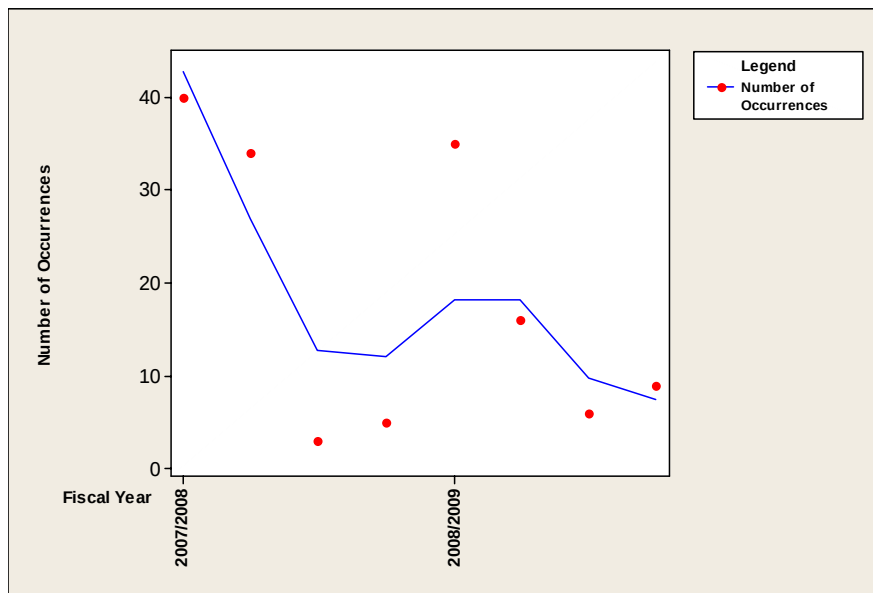


Figure 13 charts the number of amusement devices fatalities and serious injuries over the last five fiscal years. As illustrated, there have been no fatalities on amusement devices within TSSA's jurisdiction during this period. A statistical analysis of this data indicates that the number of serious injuries has experienced no significant variation over the last five fiscal years.



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Figure 13: Amusement devices fatalities and serious injuries over the last five fiscal years (analyzed occurrences).

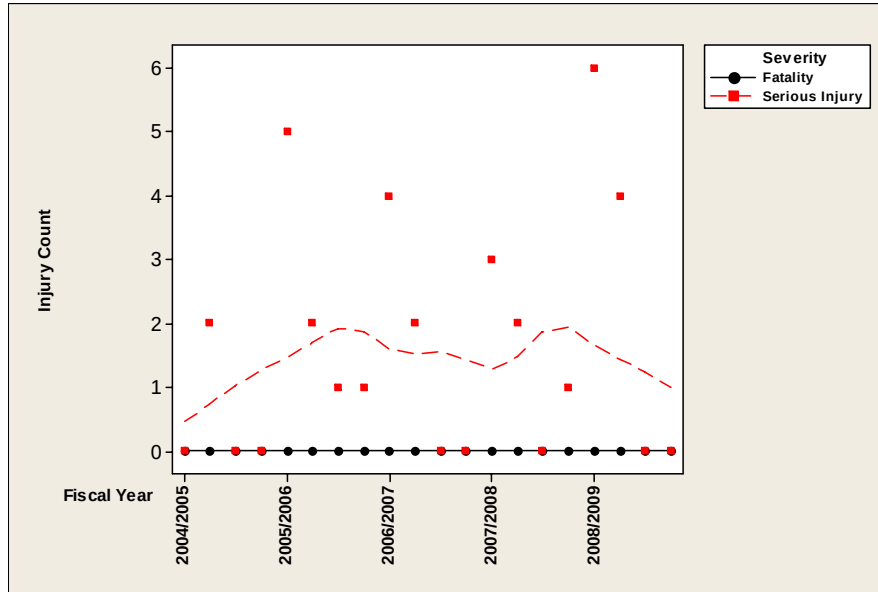
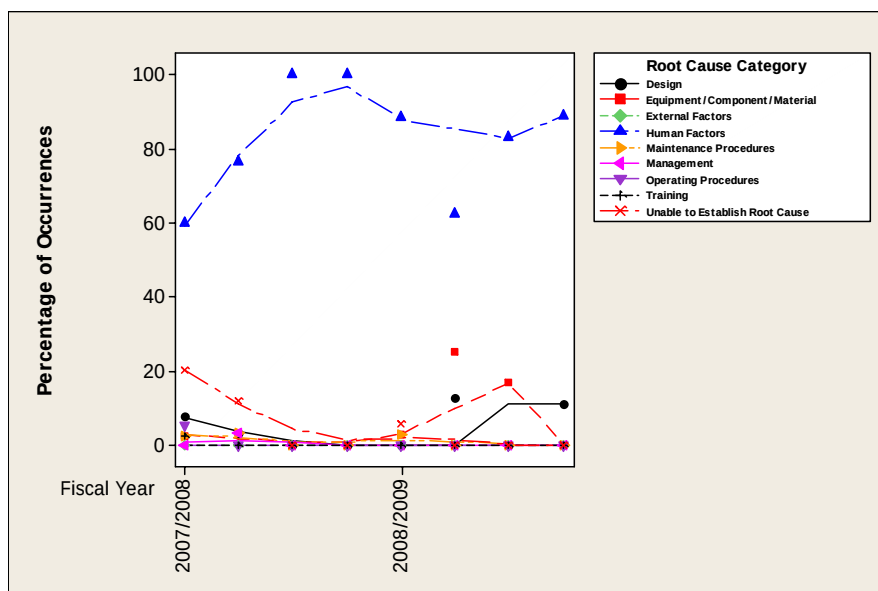


Figure 14 illustrates the distribution of root causes for inspected occurrences (in percentages) over the last two fiscal years. A statistical analysis of the data indicates that the percentage of occurrences with the root cause 'Unable to Establish Root Cause' had experienced a downward trend over the last two fiscal years. The downward trend in this category demonstrates that TSSA has improved its ability to carry out root cause analysis as a result of ongoing training activities. All the other root cause categories do not significantly vary over the last two fiscal years, with 'Human Factors' being 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 14: The percentage of each root cause category attributed in amusement devices occurrences over the last two fiscal years.





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Compliance Analysis

Periodic Inspections

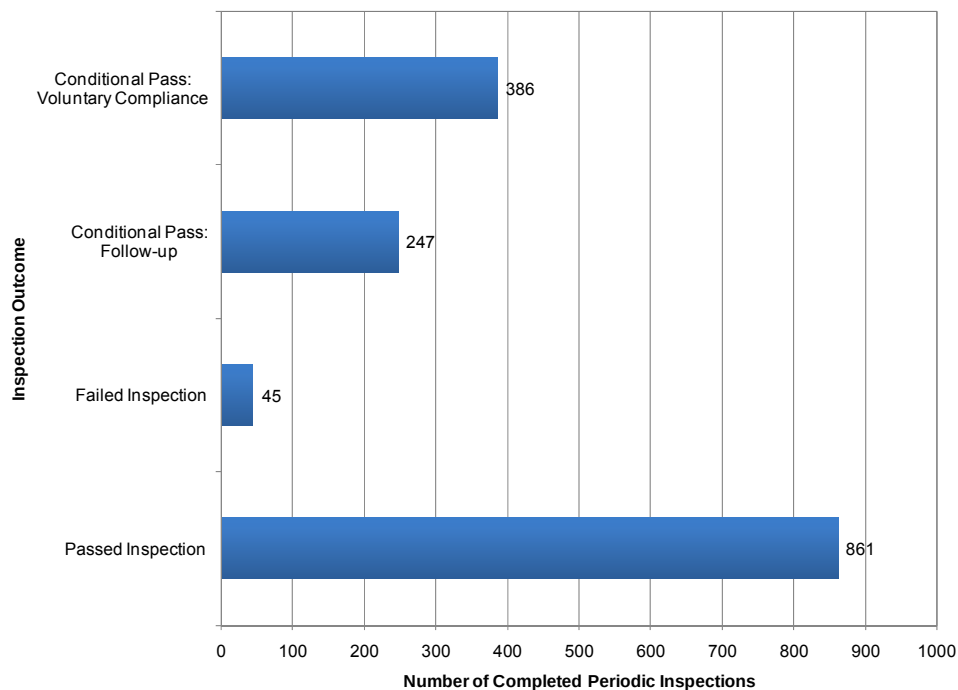
The number of periodic inspections completed since January 1, 2008 are presented in Table 5. The total number of deficiencies in these periodic inspections are also included in the table.

Table 5: Activity measures for amusement devices periodic inspections.

Period	Number of Periodic Inspections	Number of Deficiencies
January 1, 2008 – April 30, 2008	473	747
May 1, 2008 – April 30, 2009 Fiscal Year 2008/2009	1,539	2,111
Total Inspections January 1, 2008 – April 30, 2009	2,012	2,858

Each of these inspections results in an outcome as determined by a TSSA inspector, shown in Figure 15. Of all periodic inspections completed in fiscal year 2008/2009, 55.95% passed on the first visit.

Figure 15: Outcomes from amusement devices periodic inspections completed in fiscal year 2008/2009.





Compliance Related Trends

Figure 16 charts the number of periodic inspections over the last five fiscal years. A statistical analysis of this data indicates that the number of periodic inspections has not significantly varied over the last five fiscal years.

Figure 16: Amusement devices periodic inspections completed over the last five fiscal years.

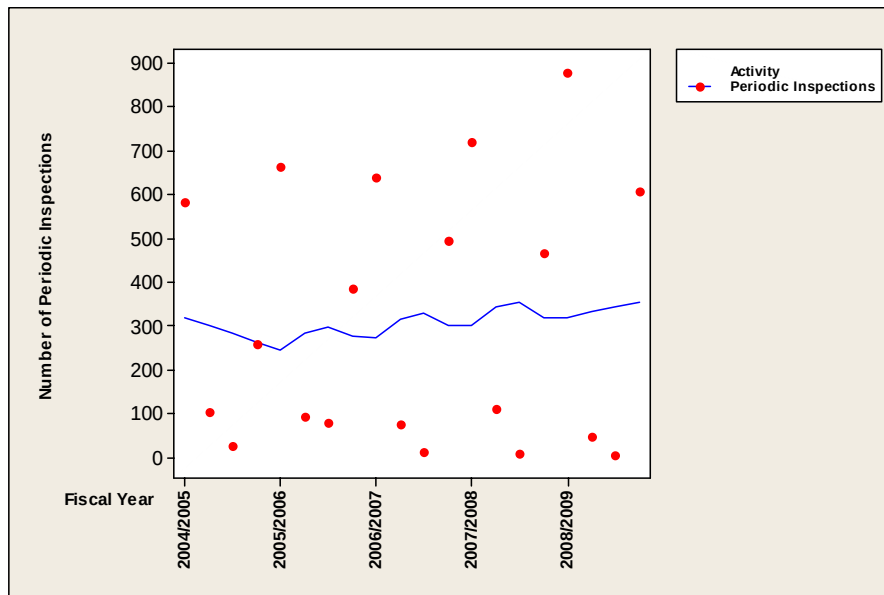
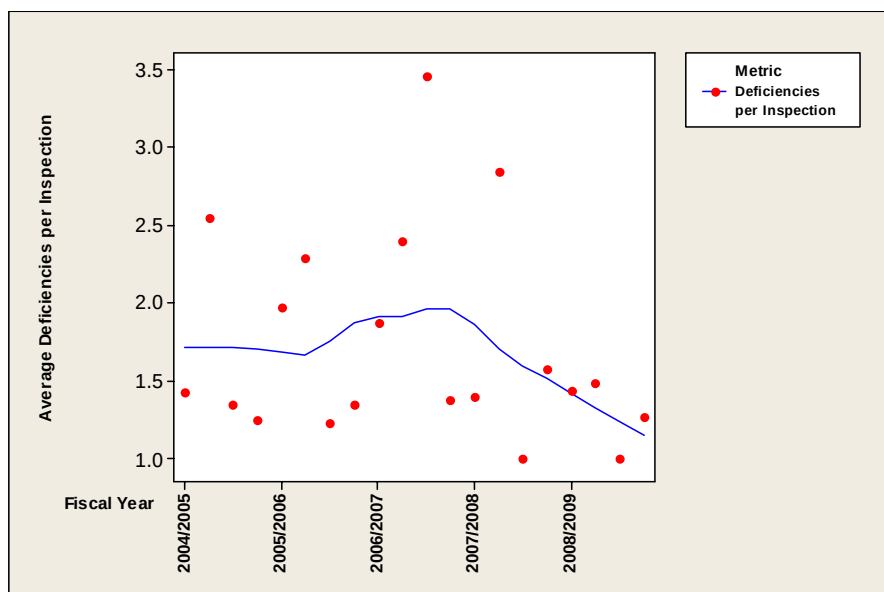


Figure 17 provides the average number of deficiencies per inspection for the last five fiscal years. A statistical analysis of this data indicates that the average number of deficiencies per inspection has not significantly varied over the last five fiscal years.

Figure 17: The average number of deficiencies per amusement devices periodic inspection over the last five fiscal years.

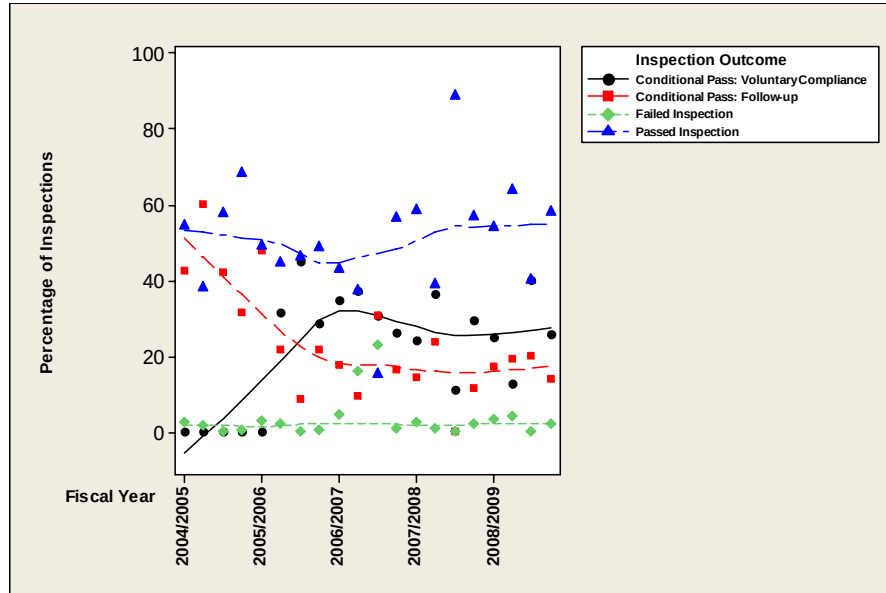




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Figure 18 charts the outcomes from the periodic inspections over the last five fiscal years. A statistical analysis of this data indicates that the percentage of inspections resulting in the need for a follow-up has exhibited a downward trend over the last five fiscal years. All other outcomes have not significantly varied over the last five fiscal years.

Figure 18: The percentage outcomes of amusement devices periodic inspections completed over the last five 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 held its annual amusement devices technical training workshop for engineers, inspectors and industry members.

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

With the increasing popularity of zip lines, TSSA recently issued a Code Adoption Document Amendment, AD-530/09, introducing new regulatory requirements for the design, installation and operation of zip lines in Ontario. These new requirements have not only filled a void in Ontario, but are being considered by other North American jurisdictions.

TSSA recommended to MSBCS updates to Ontario Regulation 221/01, *Amusement Devices*, with changes being effective January 1, 2009:

- amendment regarding the scope of reference where an amusement device, defined by device rather than locale, falls under the regulation and necessary public safety laws regardless of public accessibility;
- liability insurance increased to \$2 million as consistent with minimum insurance requirements under other Canadian jurisdictions;



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- new incident reporting criteria, conveying owner/licence holder requirements;
- new permit placement requiring the number plate to be affixed to device;
- new allowance for contract mechanics, recognizing industry practice;
- definitions to include zip lines, exempt under certain limitations;
- permit requirements for a lapse of five years, where the applicant provides documentation verifying device alterations that comply with up-to-date design specifications;
- amendment of device type certification, where once a device type is certified, similar type designs are exempt from design review if meeting current code requirements; and
- new operator training log requirement to ensure skills and safety knowledge are kept up-to-date and current.

Elevators

TSSA regulates the safety of over 46,500 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 and lifts designed for persons with physical disabilities.

Public Safety Analysis

Occurrence Analysis

Table 6 summarizes the occurrences on elevators 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 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.

Table 6: Activity breakdown for occurrences on elevators.

Occurrence Detail	Period		
	January 1, 2008 – April 30, 2008	May 1, 2008 – April 30, 2009 Fiscal Year 2008/2009	Total Occurrences January 1, 2008 – April 30, 2009
Number of Incidents	35	111	146
Number of Near-Misses	27	81	108
Completed Causal Analysis	26	90	116
Unable to Establish Root Cause	2	6	8
In Progress	1	10	11
Not Requiring Formal Inspection	31	86	117
Total Occurrences	62	192	254
Number of Fatalities	0	0	0
Number of Serious Injuries	1	5	6
Number of Minor Injuries	33	87	120



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Each serious injury occurred on a passenger elevator. The following were the attributed root causes:

- 'Training';
- 'Management';
- 'Design';
- 'Equipment/Component/Material';
- 'Human Factors'; and
- 'Maintenance Procedures'.

Occurrence Related Trends

Figure 19 shows the number of occurrences to which TSSA has responded over the last two fiscal years. A statistical analysis of this data indicates that there are no statistically significant trends over the last two fiscal years. It should be noted that this graph does not account for occurrence inspections that are in progress; however, the impact on the analysis outcome would be insignificant.

Figure 19: Occurrences involving elevators over the last two fiscal years.

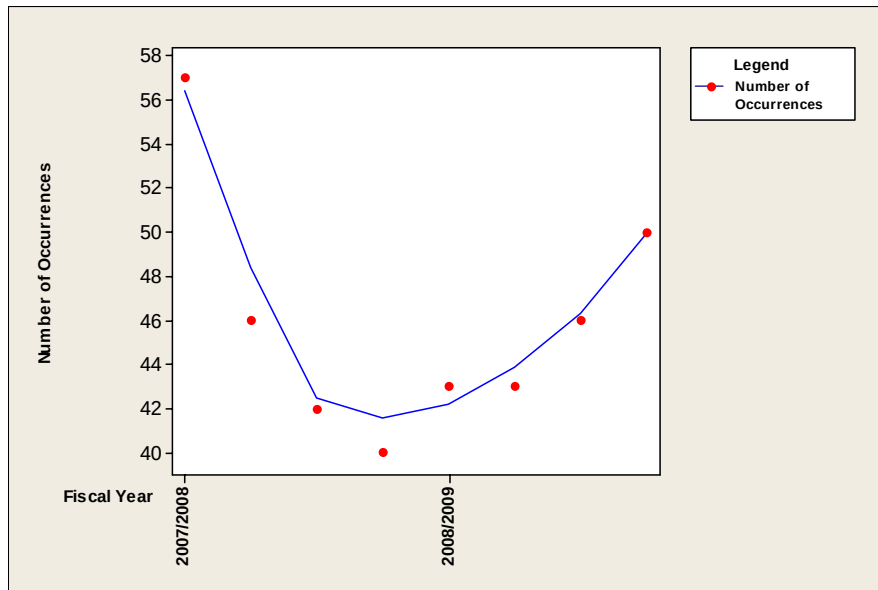


Figure 20 charts the number of fatalities and serious injuries on elevators over the last five fiscal years. As illustrated, there have been no fatalities on elevators within TSSA's jurisdiction during this period. A statistical analysis of this data indicates that the number of serious injuries has experienced a downward trend over the last five fiscal years.



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Figure 20: Fatalities and serious injuries involving elevators over the last five fiscal years (analyzed occurrences).

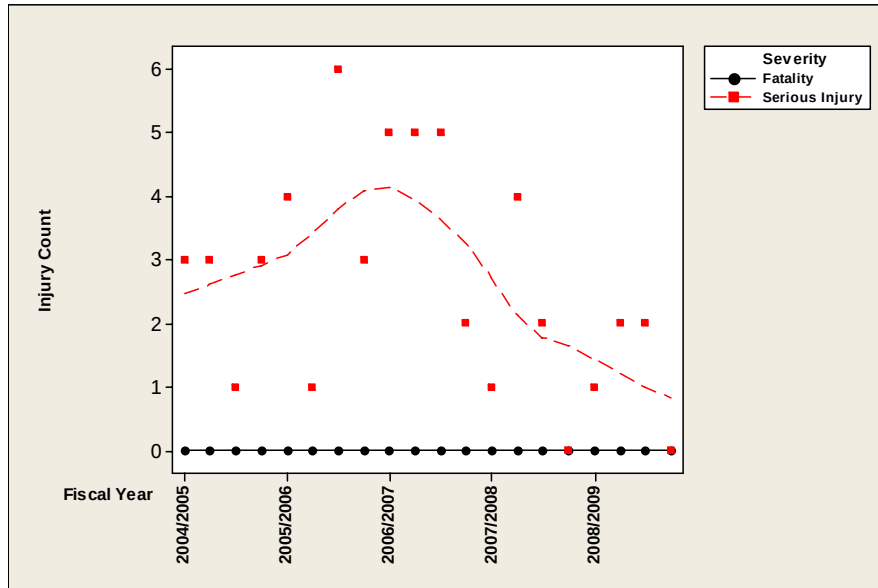
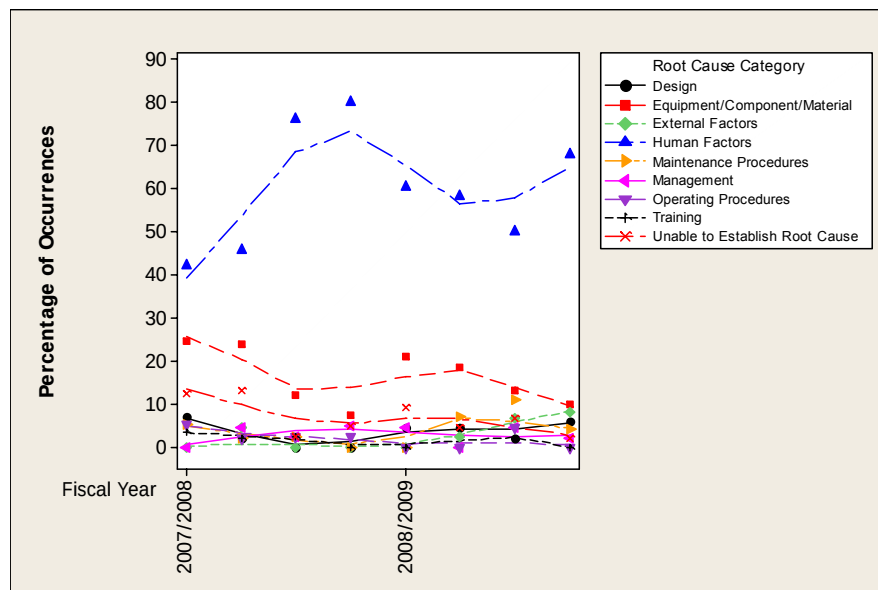


Figure 21 illustrates the distribution of root causes for inspected occurrences (in percentages) over the last two fiscal years. A statistical analysis of this data indicates that there is a downward trend in the percentage of occurrences with the root cause 'Operating Procedures'. All the other root cause categories do not significantly vary over the last two fiscal years, with 'Human Factors' being 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 21: The percentage of each root cause category attributed in elevator occurrences over the last two fiscal years.





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Compliance Analysis

Periodic Inspections

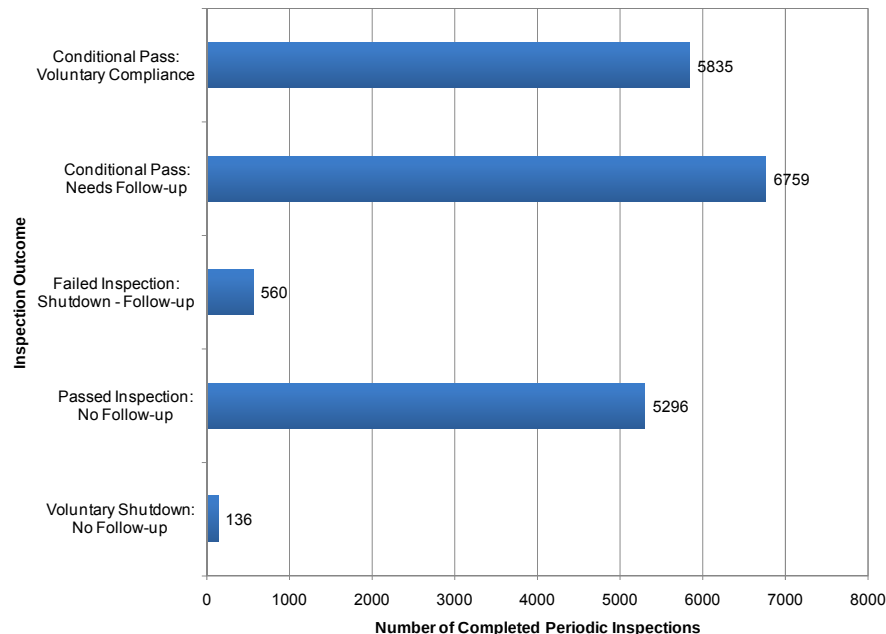
The number of periodic inspections completed since January 1, 2008 are presented in Table 7. The total number of deficiencies in these periodic inspections are also included in the table.

Table 7: Activity measures for periodic inspections on elevators.

Period	Number of Periodic Inspections	Number of Deficiencies
January 1, 2008 – April 30, 2008	7,597	18,595
May 1, 2008 – April 30, 2009 Fiscal Year 2008/2009	18,586	43,860
Total Inspections January 1, 2008 – April 30, 2009	26,183	62,455

Each of these inspections results in an outcome as determined by a TSSA inspector, shown in Figure 22. Of all periodic inspections completed in fiscal year 2008/2009, 28.49% passed on the first visit.

Figure 22: Outcomes from elevator periodic inspections completed in fiscal year 2008/2009.



Compliance Related Trends

Figure 23 charts the number of periodic inspections over the last five fiscal years. A statistical analysis of this data indicates that the number of periodic inspections has not significantly varied over the last five fiscal years.



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Figure 23: Periodic inspections completed on elevators over the last five fiscal years.

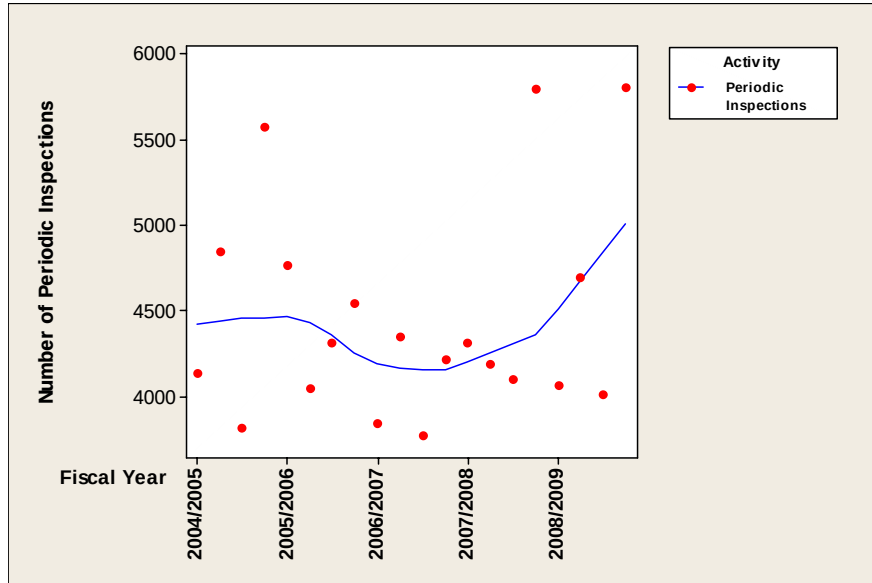


Figure 24 provides the average number of deficiencies per inspection for the last five fiscal years. A statistical analysis of this data indicates that the average number of deficiencies per inspection has an upward trend over the last five fiscal years, while the number of inspections has remained relatively constant.

Figure 24: The average number of deficiencies per periodic inspection on elevators over the last five fiscal years.

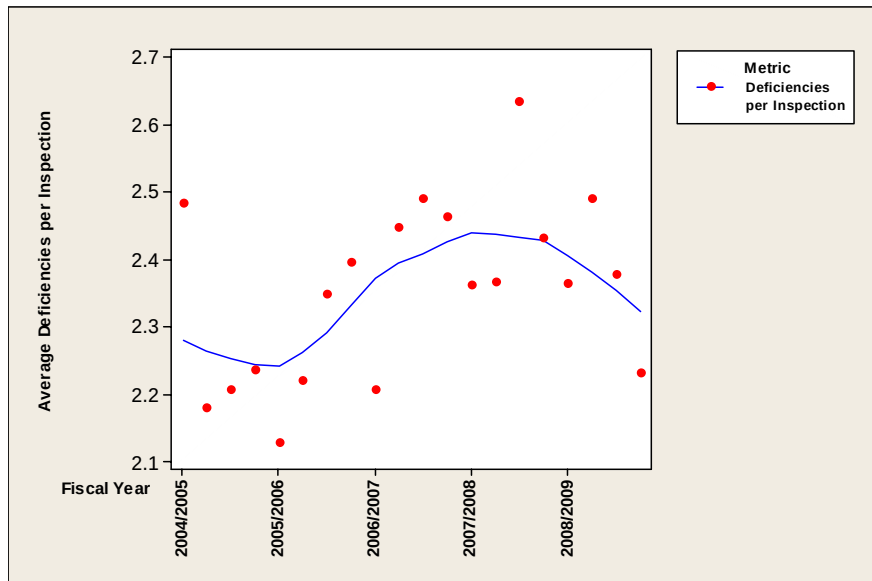
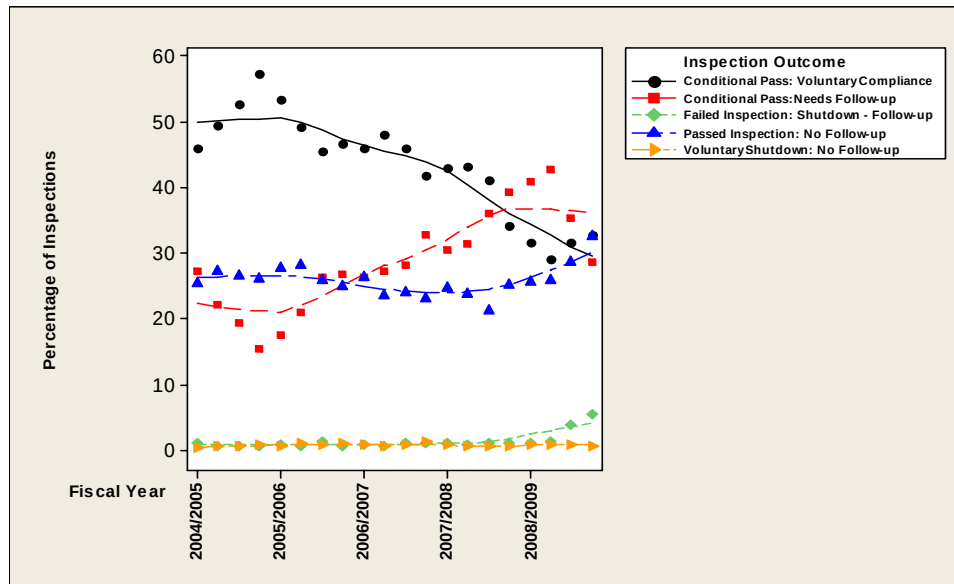


Figure 25 charts the outcomes from the periodic inspections over the last five fiscal years. A statistical analysis of this data indicates that there are upward trends in both the percentage of 'Conditional Pass: Needs Follow-up' and 'Failed Inspection: Shutdown – Follow-up' outcomes, and a downward trend in the percentage of 'Conditional Pass with Voluntary Compliance' inspection outcomes. This analysis also shows that all other outcomes did not significantly vary over the last five fiscal years. It should be noted that the percentage of inspections that demonstrated compliance on the first visit has shown an upward trend for the last two fiscal years, as a result of a specific Director's Order issued by TSSA and described in the TSSA Actions section.



Figure 25: The percentage outcomes of periodic inspections completed on elevators over the last five fiscal years.



Other Safety and Risk Analysis Results

An analysis of the deficiencies during periodic inspections contributing to the increase in non-compliance, as shown in Figure 25, has revealed that there has been significant non-compliance with annual, two and five-year safety inspections and tests. These types of deficiencies have been the number one type of deficiency for the last five fiscal years, being identified more than twice as much as the next leading type of deficiency. The Statutory Director has utilized the results of this analysis to take specific action to manage this type of non-compliance.

The catastrophic failure of an in-ground cylinder hydraulic elevator that caused serious injuries in 2006 led TSSA to investigate the potential health impacts resulting from a catastrophic failure of in-ground cylinder hydraulic elevators due to oil loss in the system. The specific purpose was to assist the Statutory Director of the Elevating and Amusement Devices Safety Program to decide how to manage any public safety issues that may be identified from the historical failures of devices with unprotected single bulk head cylinders.

Initial results indicate that there are significant public health risks associated with the potential failure of single bulk head hydraulic elevators and that controlling those risks is dependent on the owners of these elevators demonstrating compliance with the oil loss monitoring program required by the *Director's Order 212/07*. The primary sources of risk stem from failures due to corrosion of buried in-ground cylinders without oil loss detection programs or mitigation devices.

Public Safety Decisions

TSSA Actions

Improving Compliance

TSSA's Elevating and Amusement Devices Safety Program has observed continuing non-compliance with annual, two and five-year safety inspections and tests performed by elevator maintenance contractors. In December 2007, TSSA issued Enforcement Procedure Bulletin, *218/07*, to gain greater safety compliance and reduce the number of follow-ups. The bulletin, along with associated safety regulations and applicable elevator safety codes, confirm the *minimum* requirements for the safe operation of an elevator, including safety testing and maintenance, based on sound engineering principles agreed upon by industry.



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This is not the first time that TSSA has sought to address this critical safety issue. TSSA has issued orders, talked to contractors, and engaged industry through the Elevating Devices Advisory Council for a number of years; however, the non-compliances continued to increase. As a result, TSSA has enhanced its efforts to achieve greater levels of safety compliance. Increased enforcement measures regarding overdue annual, two or five-year inspections and tests came into effect on December 1, 2008. These include shutting down elevators where these examinations and tests are overdue as well as doubled fees on follow-up inspections where the contractor has not addressed the non-compliances. The objective of TSSA's increased enforcement efforts is to ensure maintenance is completed in a timely manner.

As the compliance analysis on elevating devices included in previous sections illustrate, non-compliances continue to create an elevated exposure to risk, and that risk is magnified by a failure to resolve such non-compliances in a timely manner. During fiscal year 2009/2010, the Elevating and Amusement Devices Safety Program will build on the increased enforcement actions initiated in fiscal year 2008/2009 by engaging industry stakeholders regarding common non-compliances, and create various additional incentives and deterrents to reduce such non-compliances and the time taken to resolve them. This will lead to a reduction in the number of follow-up inspections which will then allow time to complete all scheduled periodic inspections and eliminate the current backlog. Improving compliance is integral to TSSA's safety mandate as the organization will be better able to ensure elevated exposures to risk are mitigated.

TSSA developed requirements for the regulation of parking garage lifts as well as advised the elevating devices industry of the rules for compliance through Enforcement Procedure Bulletin, 194/08. This bulletin is a result of meetings with industry in order to set standards for design, operation and ongoing maintenance of these devices, and deals with requirements for newly installed devices as well as existing devices.

Managing Safety Issues

In order to address safety issues associated with hydraulic elevators, TSSA is engaged in a special inspection study focused on determining the state of compliance of hydraulic elevators with single flat bottom cylinders. Specifically, these inspections are focused on determining compliance with the current Director's Order on oil loss monitoring and documenting the results.

The Elevating and Amusement Devices Safety Program will continue to analyze occurrence and inspection data involving hydraulic elevators with single bulkhead in-ground cylinders and determine the appropriate mitigation approach. TSSA will then propose regulatory changes with these devices, while considering other impacts, including the cost to owners.

TSSA has plans for fiscal year 2009/2010 to enhance its current risk-based inspection model. This fine-tuning of the risk model will help further reduce the number of incidents and injuries while taking additional parameters into consideration, such as modernization to equipment. TSSA will additionally ensure all periodic inspections are completed in accordance with the risk-based inspection schedule.

Improving its risk-based inspection model and completing all periodic inspections are integral to TSSA's safety mandate where TSSA will be better prepared to improve resource allocation, gain additional risk-based parameters and enhance its model to further reward compliant behaviour.

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

Regulatory Improvements

TSSA recommended to MSBCS updates to Ontario Regulation 209/01, *Elevating Devices*, with the following changes being effective January 1, 2009:

- definitions include new devices such as material lifts, shopping cart conveyors, limited use/limited application elevators, parking garage lifts, and portable lifts for persons with physical disability;
- new requirement for owners to ensure use of registered contractors for all installations and alterations;
- minor alterations reporting time extended to 30 days;
- amendment and clarification of incident reporting, conveying owner/contractor requirements; and
- amendment of an Elevating Device Mechanic (EDM)-B certificate to include man-lifts utilizing rack and pinion drives.



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TSSA implemented continuing education requirements for elevator mechanics as a result of recommendations from a coroner's jury. Effective January 1, 2011 all classes of EDMs must complete the continuing education requirement as a condition of each certificate renewal.

TSSA worked as a facilitator in an industry-led partnership with the Ministry of Labour to draft a guideline for elevator machine room equipment guarding which is posted on TSSA's website.

Escalators and Moving Walks

TSSA regulates the safety of 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 8 summarizes the escalator and moving walk occurrences reported to TSSA since January 1, 2008. 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. The number of victims and their injury severity from the occurrences are also included. It should be noted that the reason that 619 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 8: Activity breakdown for escalator and moving walk occurrences.

Occurrence Detail	Period		
	January 1, 2008 – April 30, 2008	May 1, 2008 – April 30, 2009 Fiscal Year 2008/2009	Total Occurrences January 1, 2008 – April 30, 2009
Number of Incidents	80	370	450
Number of Near-Misses	59	182	241
Completed Causal Analysis	24	44	68
Unable to Establish Root Cause	0	1	1
In Progress	1	2	3
Not Requiring Formal Inspection	114	505	619
Total Occurrences	139	552	691
Number of Fatalities	0	0	0
Number of Serious Injuries	3	4	7
Number of Minor Injuries	97	398	495



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All of the seven serious injuries occurred on escalators. There were three serious injuries on one escalator; the root cause of that occurrence was 'Design'. The root causes of the rest of the injuries were as follows (one serious injury per occurrence):

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

Occurrence Related Trends

Figure 26 shows the number of occurrences to which TSSA has responded over the last two fiscal years. A statistical analysis of the data indicates that there is no significant variation in the number of occurrences on escalators and moving walks. It should be noted that this graph does not account for occurrences that are pending TSSA response; however, the impact on the analysis outcome would be insignificant.

Figure 26: Occurrences involving escalators and moving walks over the last two fiscal years.

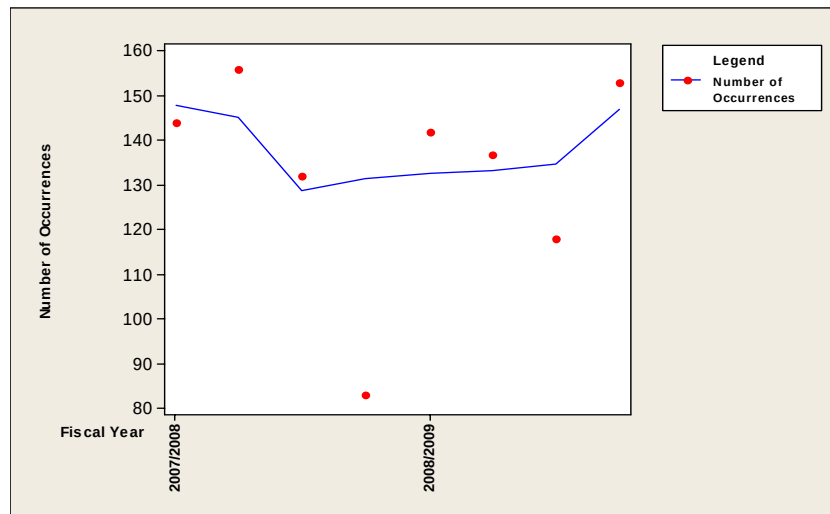
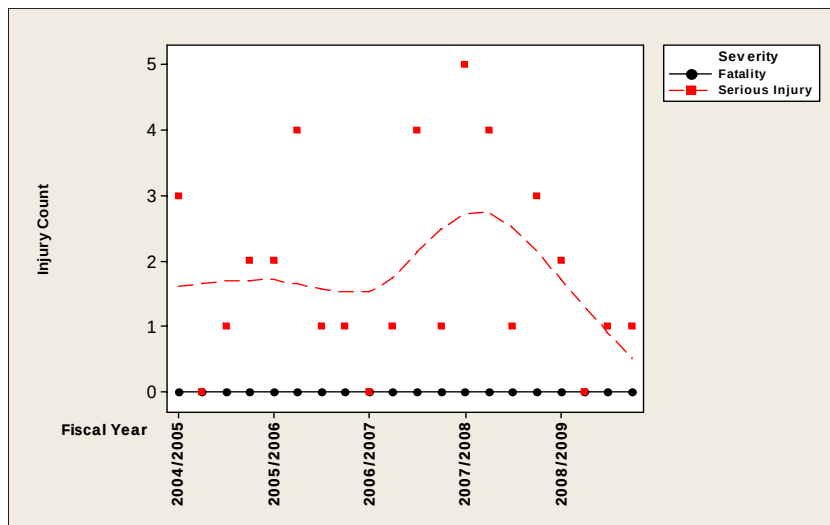


Figure 27 charts the number of fatalities and serious injuries on escalators and moving walks over the last five fiscal years. As illustrated, there have been no fatalities within TSSA's jurisdiction during this period. A statistical analysis of this data indicates that the number of serious injuries has had no significant variation over the last five fiscal years.

Figure 27: Fatalities and serious injuries on escalators and moving walks over the last five fiscal years (analyzed occurrences).





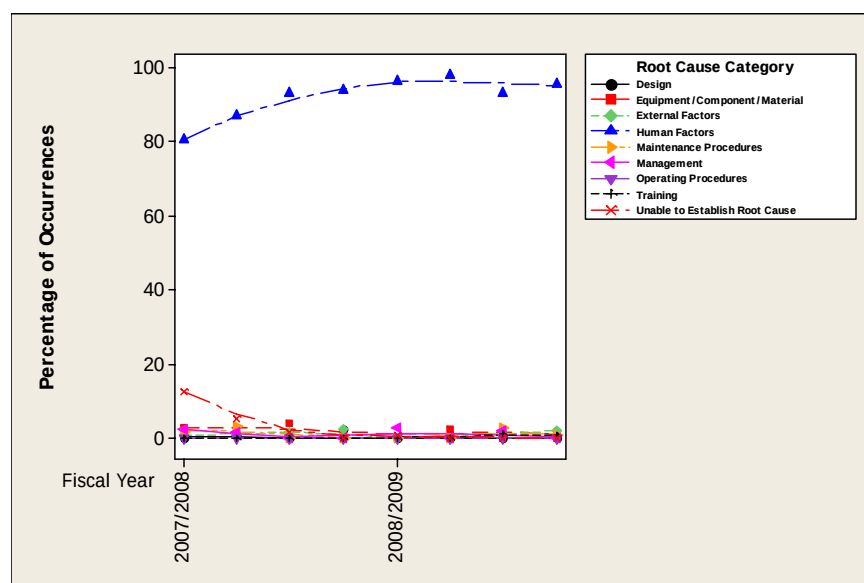
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Figure 28 illustrates the distribution of root causes for inspected occurrences (in percentages) over the last two fiscal years. A statistical analysis of this data indicates that there are upward trends in the percentage of occurrences with the root causes 'Human Factors' and 'Training', and a downward trend in the percentage of occurrences 'Unable to Establish Root Cause'. All the other root cause categories do not significantly vary over the last two fiscal years, with 'Human Factors' being the dominant root cause category 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 28: The percentage of each root cause category attributed in escalators and moving walks occurrences over the last two fiscal years.



Compliance Analysis

Periodic Inspections

The number of periodic inspections completed since January 1, 2008 are presented in Table 9. The total number of deficiencies identified in these periodic inspections are also included in the table.

Table 9: Activity measures for periodic inspections on escalators and moving walks.

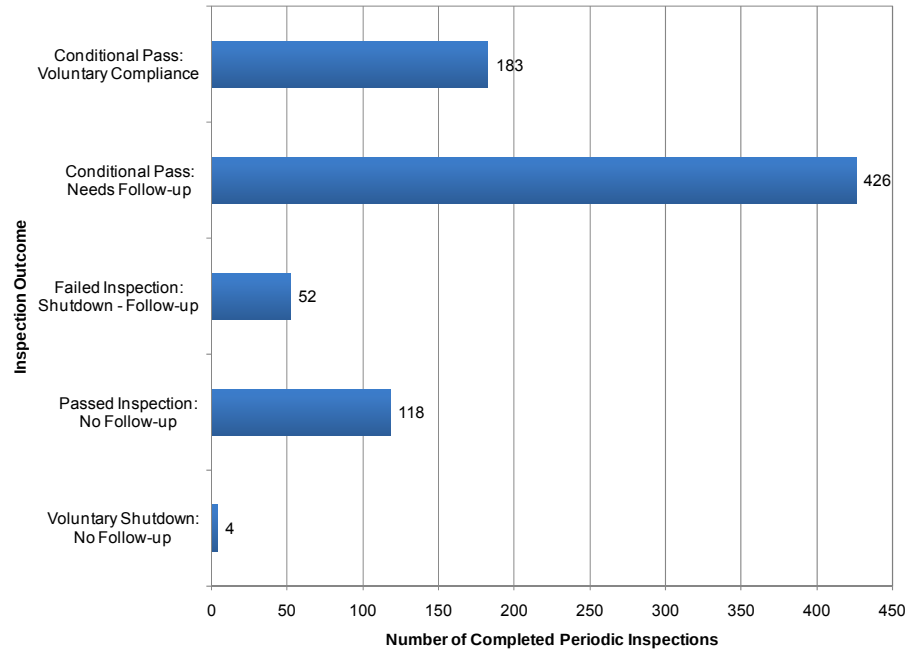
Period	Number of Periodic Inspections	Number of Deficiencies
January 1, 2008 – April 30, 2008	353	1,099
May 1, 2008 – April 30, 2009 Fiscal Year 2008/2009	783	1,952
Total Inspections January 1, 2008 – April 30, 2009	1,136	3,051

Each of these inspections results in an outcome as determined by a TSSA inspector, shown in Figure 29. Of all periodic inspections completed in fiscal year 2008/2009, 15.07% passed on the first visit.



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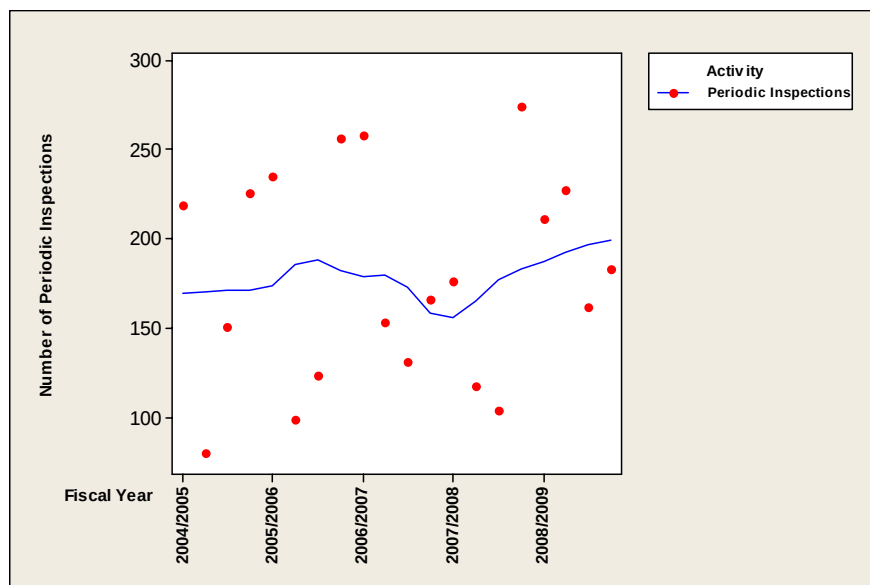
Figure 29: Outcomes from periodic inspections completed on escalators and moving walks in fiscal year 2008/2009.



Compliance Related Trends

Figure 30 charts the number of periodic inspections over the last five fiscal years. A statistical analysis of this data indicates that the number of periodic inspections has not significantly varied over the last five fiscal years.

Figure 30: Periodic inspections completed on escalators and moving walks over the last five fiscal years.





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Figure 31 provides the average number of deficiencies per inspection for the last five fiscal years. A statistical analysis of this data indicates that the average number of deficiencies per inspection has an upward trend over the last five fiscal years.

Figure 31: The average number of deficiencies per periodic inspection on escalators and moving walks over the last five fiscal years.

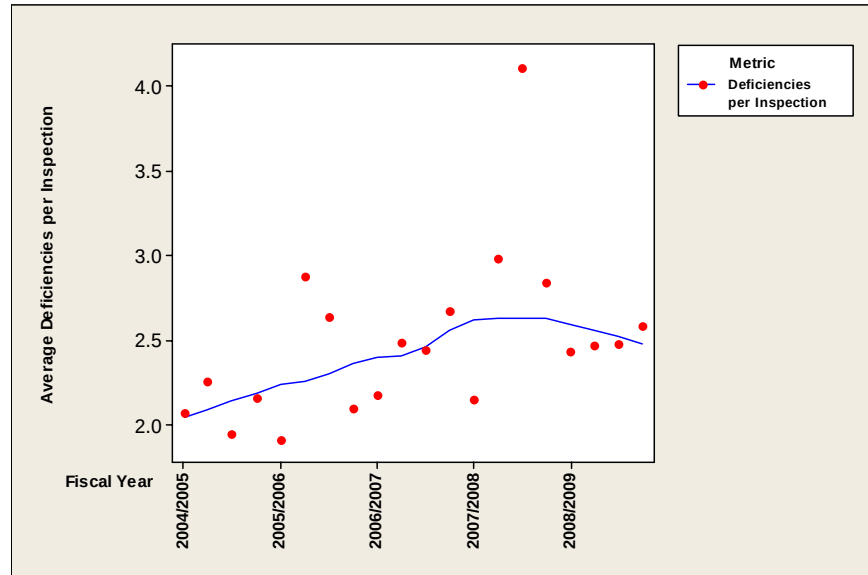
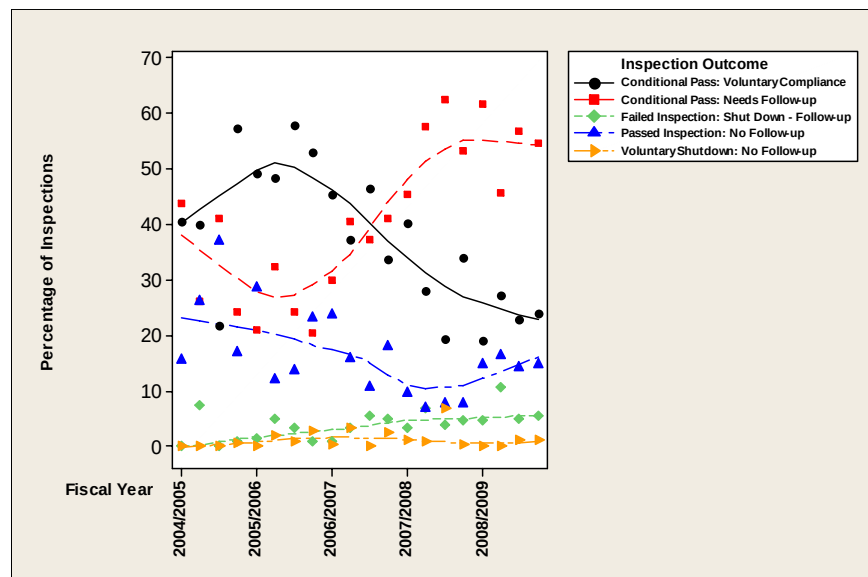


Figure 32 charts the outcomes from the periodic inspections over the last five fiscal years. A statistical analysis of this data indicates that there are downward trends in the percentages of inspections resulting in 'Conditional Pass: Voluntary Compliance' and 'Passed Inspection – No Follow-up' outcomes, upward trends in the 'Conditional Pass: Needs Follow-up' and 'Failed Inspection: Shutdown – Follow-up' outcomes, and no significant variation in the 'Voluntary Shutdown: No Follow-up' outcome.

Figure 32: The percentage outcomes of periodic inspections completed on escalators and moving walks over the last five fiscal years.





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Other Safety and Risk Analysis Results

An analysis of the deficiencies during periodic inspections has revealed that there has been significant non-compliance with annual safety inspections and tests. This type of deficiency has been the number one type of deficiency over the last five fiscal years.

Public Safety Decisions

TSSA Actions

Improving Compliance

In response to the increasing rate of deficiencies per inspection as indicated above, TSSA is currently analyzing the major deficiencies. Based on the results of this analysis, TSSA will identify appropriate measures to address the non-compliances.

TSSA continues to use its risk-based inspection program to prioritize and direct its resources to inspecting escalators and moving walks in Ontario.

Managing Safety Issues

In response to a preliminary analysis with respect to occurrences involving escalators and the associated injury trends as discussed in the previous sections, TSSA identified escalator entrapments and brake related failures as issues contributing to these trends. As a result, TSSA has formed a risk reduction group including industry experts with the goal of reducing escalator entrapments. In addition to stepped up enforcement by TSSA inspectors of the application of friction reducing agents on skirts, the risk reduction group will evaluate various options, such as mandating existing escalator changes with regard to brushes, skirt step index requirements, and comb step impact switches.

Regulatory Improvements

TSSA recommended to MSBCS updates to Ontario Regulation 209/01, *Elevating Devices*, with the following changes being effective January 1, 2009:

- definitions include new devices such as material lifts, shopping cart conveyors, limited use/limited application elevators, parking garage lifts, and portable lifts for persons with physical disability;
- new requirement for owners to ensure use of registered contractors for all installations and alterations;
- minor alterations reporting time extended to 30 days; and
- amendment and clarification of incident reporting, conveying owner/contractor requirements.

Ski Lifts

TSSA regulates the safety of chair lifts, bar lifts, 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 (OSRA) 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.



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Public Safety Analysis

Occurrence Analysis

Results

Table 10 summarizes the ski lift occurrences reported to TSSA since January 1, 2008. 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. 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.

Table 10: Activity breakdown for ski lift occurrences.

Occurrence Detail	Period		
	January 1, 2008 – April 30, 2008	May 1, 2008 – April 30, 2009 Fiscal Year 2008/2009	Total Occurrences January 1, 2008 – April 30, 2009
Number of Incidents	43	91	134
Number of Near-Misses	39	19	58
Completed Causal Analysis	19	13	32
Unable to Establish Root Cause	0	0	0
In Progress	0	0	0
Not Requiring Formal Inspection	63	97	160
Total Occurrences	82	110	192
Number of Fatalities	0	0	0
Number of Serious Injuries	5	2	7
Number of Minor Injuries	62	93	155

There were six serious injuries on chair lifts and one serious injury on a bar lift. 'Human Factors' was the root cause in all the occurrences but one, where the root cause was 'Operating Procedures' on a chair lift.

Occurrence Related Trends

Figure 33 shows the number of occurrences to which TSSA has responded over the last two fiscal years. A statistical analysis of this data indicates that the number of occurrences on ski lifts does not demonstrate any statistically significant trends. It should be noted that this graph does not account for occurrences that are pending TSSA action; however, the impact on the analysis outcome would be insignificant.



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Figure 33: Occurrences involving ski lifts over the last two fiscal years.

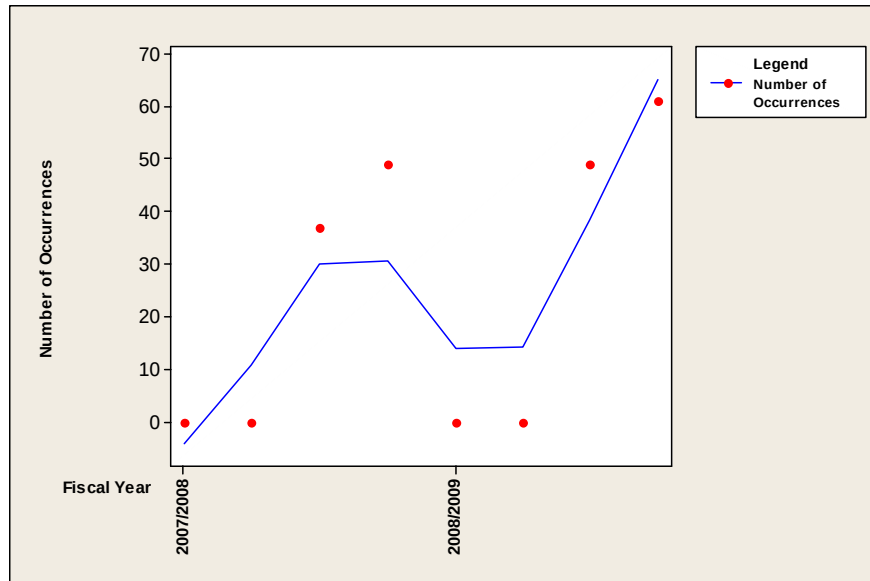
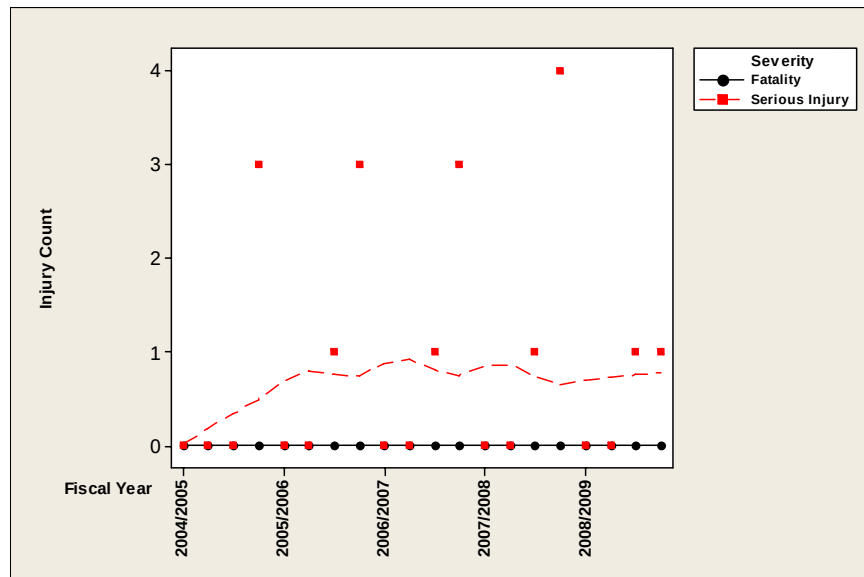


Figure 34 charts the number of fatalities and serious injuries over the last five fiscal years. As illustrated, there have been no fatalities on ski lifts within TSSA's jurisdiction during this period. A statistical analysis of this data indicates that the number of serious injuries has experienced no significant variation over the last five fiscal years.

Figure 34: Fatalities and serious injuries on ski lifts over the last five fiscal years (analyzed occurrences).





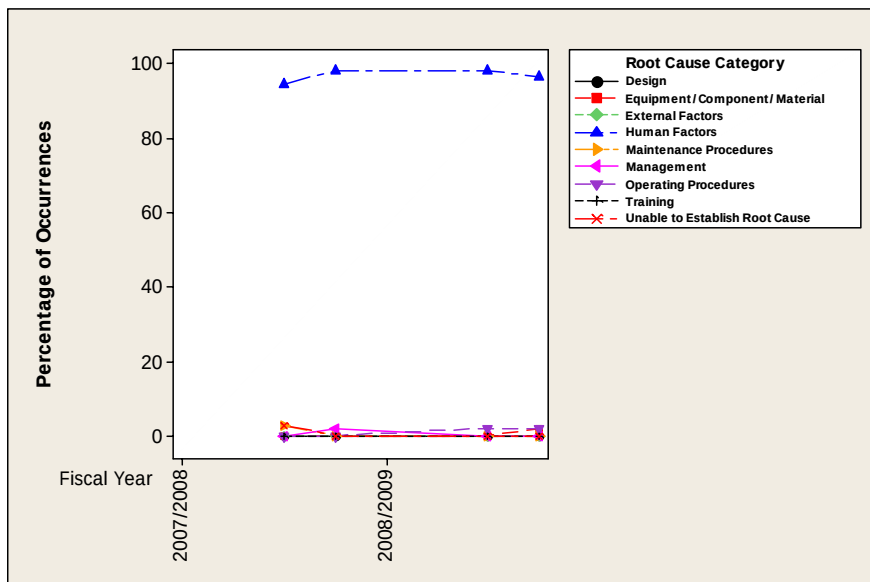
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Figure 35 illustrates the distribution of root causes for inspected occurrences (in percentages) over the last two fiscal years. A statistical analysis of this data indicates that there are no statistically significant trends. This distribution shows 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 35: The percentage of each root cause category attributed in ski lift occurrences over the last two fiscal years.



Compliance Analysis

Periodic Inspections

The number of periodic inspections completed since January 1, 2008 are presented in Table 11. The total number of deficiencies in these periodic inspections are also included in the table.

Table 11: Activity measures for periodic inspections on ski lifts.

Period	Number of Periodic Inspections	Number of Deficiencies
January 1, 2008 – April 30, 2008	38	191
May 1, 2008 – April 30, 2009 Fiscal Year 2008/2009	165	447
Total Inspections January 1, 2008 – April 30, 2009	203	638

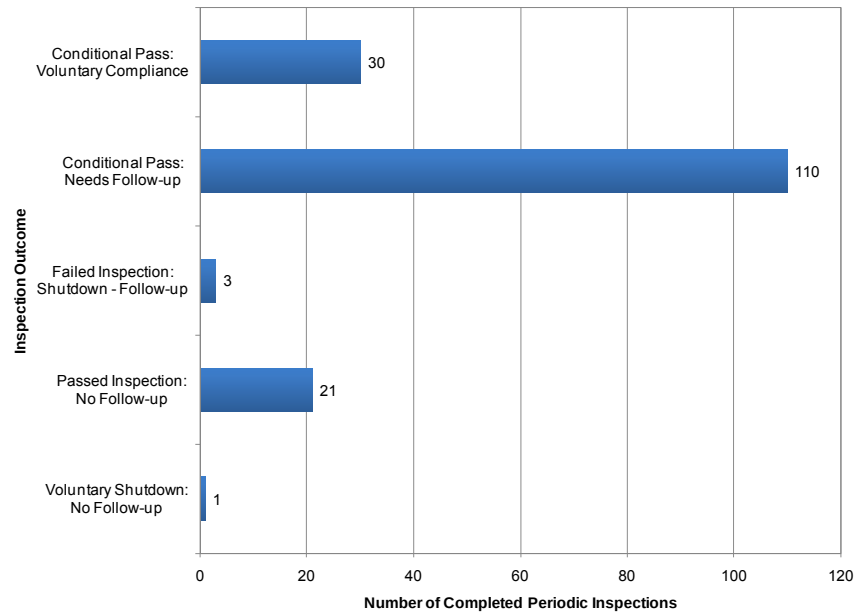
Each of these inspections results in an outcome as determined by a TSSA inspector, shown in Figure 36. Of all periodic inspections completed in fiscal year 2008/2009, 12.73% passed on the first visit.



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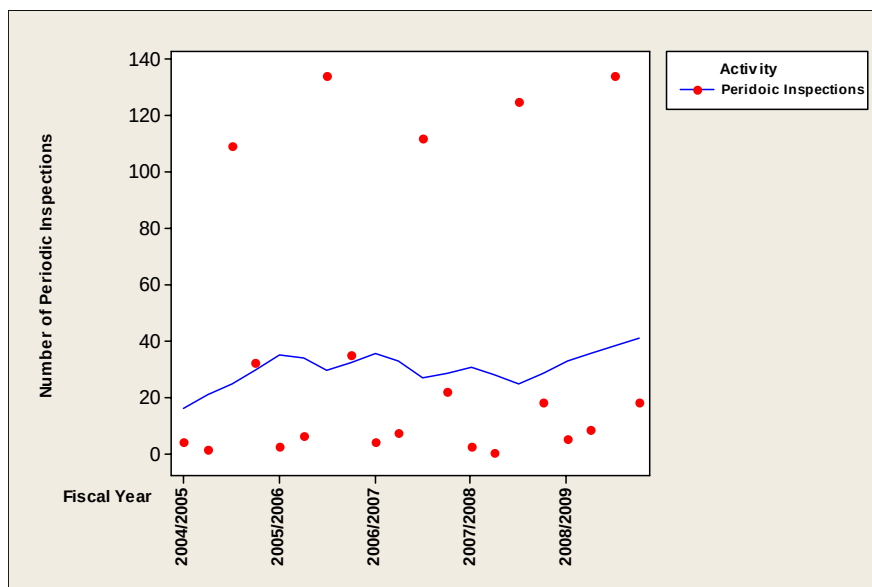
Figure 36: Outcomes from periodic inspections completed on ski lifts in fiscal year 2008/2009.



Compliance Related Trends

Figure 37 charts the number of periodic inspections over the last five fiscal years. A statistical analysis of this data indicates that the number of periodic inspections has not significantly varied over the last five fiscal years. It should be noted, however, that ski lift operations are seasonal in nature and inspections are carried out accordingly.

Figure 37: Periodic inspections completed on ski lifts over the last five fiscal years.





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Figure 38 provides the average number of deficiencies per inspection for the last five fiscal years. A statistical analysis of this data indicates that the average number of deficiencies per inspection has an upward trend over the last five fiscal years.

Figure 38: The average number of deficiencies per periodic inspection on ski lifts over the last five fiscal years.

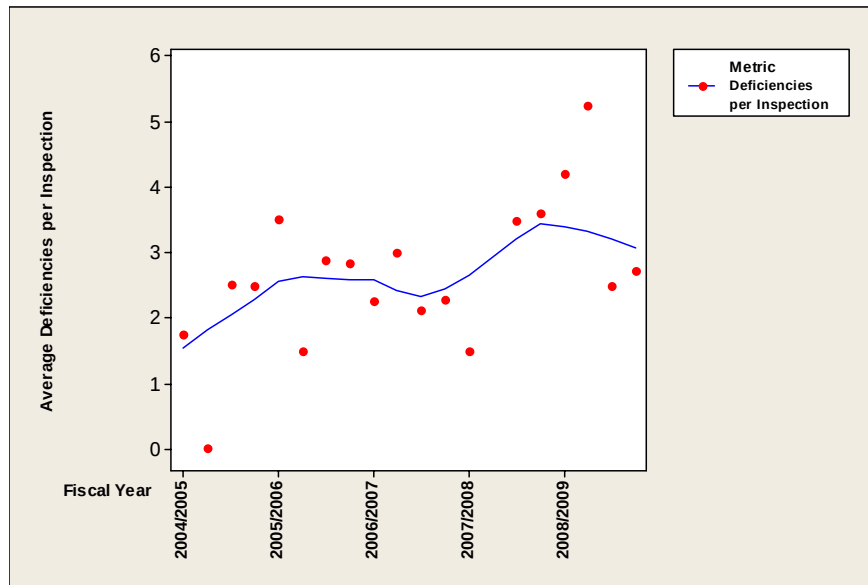
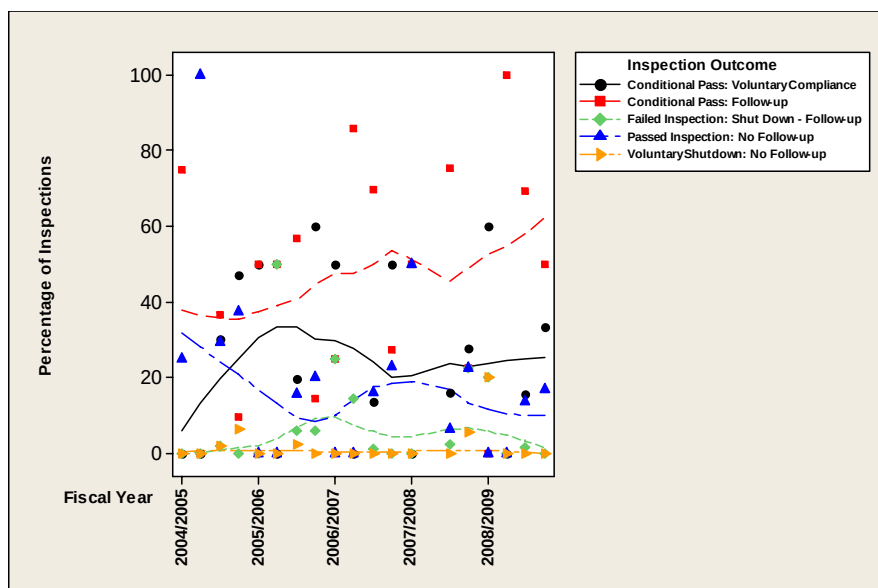


Figure 39 charts the outcomes from the periodic inspections over the last five fiscal years. A statistical analysis of this data indicates that outcomes from the periodic inspections have not significantly varied over the last five fiscal years.

Figure 39: 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's 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 no significant compliance issues requiring TSSA response presently.

Managing Safety Issues

In response to a number of occurrences involving riders falling out of chairlifts, a risk reduction group was formed comprised of industry stakeholders, including ski operators, manufacturers and TSSA. The mandate of the risk reduction group is to examine recorded occurrences of persons falling from chairlifts and to make recommendations for short term initiatives and long term solutions that will drive the province toward zero incidents of this type. This group introduced *Safety Alert Bulletin 221/07* which was a questionnaire that was to be completed by industry in order to collect information to help the group make a more effective decision. From the information collected it was determined that public education, as well as additional specifically placed signage telling passengers when their lap bars could be raised were the key to minimize or eliminate this hazard. Anecdotal evidence supports that there has been a reduction in the number of falls from chairs.

TSSA continues to partner with industry to deliver the Look, Load & Lower campaign, raising rider responsibility and safety awareness.

Regulatory Improvements

As a result of the risk reduction group described above, new requirements have been introduced for signage. This, along with increased enforcement on the part of operators, has resulted in a reduction in the number of falls from chairs.



Fuels

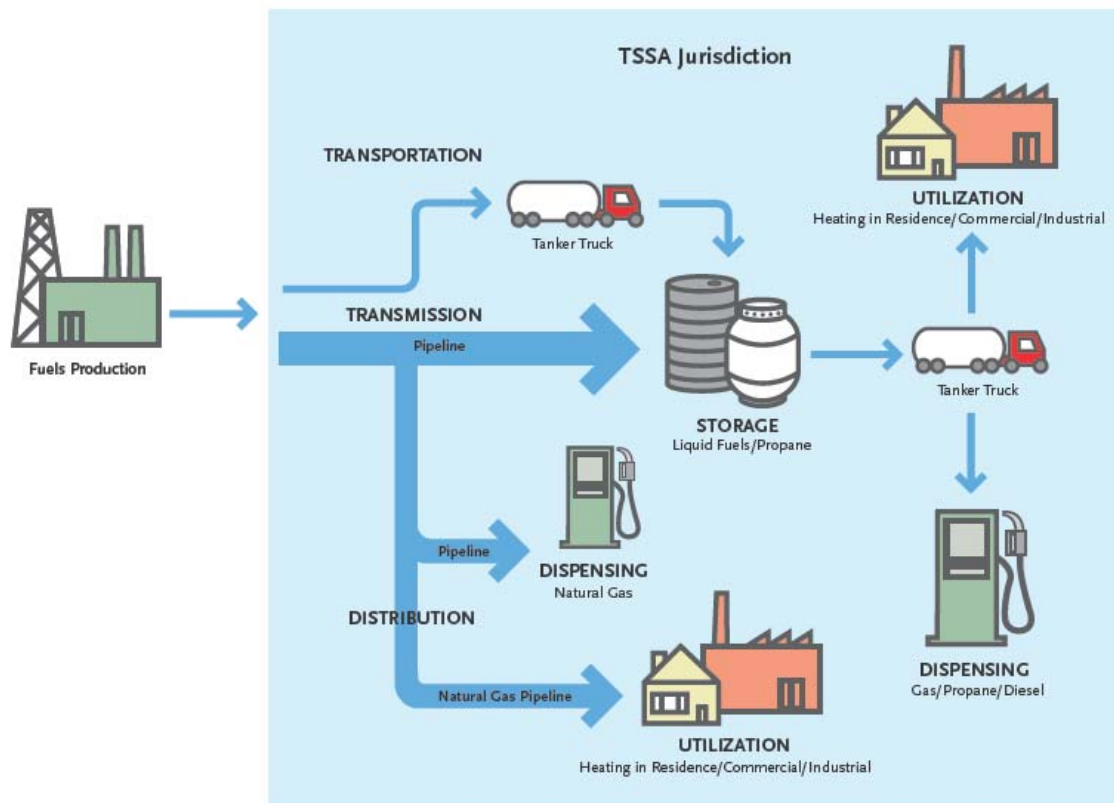
TSSA regulates the safe transportation, storage, handling and use of fuels as defined in the regulations. These fuels include natural gas, propane, butane, hydrogen, digester gas, landfill gas, fuel oil, gasoline and diesel. TSSA licenses fuel facilities, registers contractors and certifies tradespersons 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 40 are:

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

Figure 40: The fuels life cycle.





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Public Safety Analysis

Occurrence Analysis

The Incident Management Information System (IMIS), TSSA's occurrence information tracking database, categorizes each type of occurrence that is reported to TSSA. Table 12 provides a summary of the occurrences by type since January 1, 2008.

Table 12: Fuels occurrence types.

Occurrence Type	Period		
	January 1, 2008 – April 30, 2008	May 1, 2008 – April 30, 2009 Fiscal Year 2008/2009	Total Occurrences January 1, 2008 – April 30, 2009
Carbon Monoxide Release	101	2 62	363
Discovery of a Petroleum Product	15	125	140
Explosion	12	49	61
Fire	44	138	182
Leak	126	255	381
Liquid Petroleum Spill	24	94	118
Pipeline Strike	354	2233	2587
Vapour Release	60	365	425
Total Occurrences	736	3521	4257

Table 13 displays the health impacts and their related occurrence type since January 1, 2008. 'Carbon Monoxide Releases' are the primary cause of fatalities and serious injuries.

Table 13: Fuels health impacts since January 1, 2008.

Occurrence Type	Number of Fatalities	Number of Serious Injuries
Carbon Monoxide Release	10	65
Discovery of a Petroleum Product	0	0
Explosion	2	5
Fire	3	4
Leak	0	0
Liquid Petroleum Spill	0	0
Pipeline Strike	0	0
Vapour Release	0	3

Due to the distinct nature of pipeline strike occurrences, their status and health impact summary is presented separately from the other types of occurrences. Table 14 presents the number of pipeline strike 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. The number of victims and their injury severity from the occurrences are also included.



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Table 14: Activity breakdown for pipeline strike occurrences.

Occurrence Detail	Period		
	January 1, 2008 – April 30, 2008	May 1, 2008 – April 30, 2009 Fiscal Year 2008/2009	Total Occurrences January 1, 2008 – April 30, 2009
Number of Incidents	348	2215	2563
Number of Near-Misses	6	18	24
Completed Causal Analysis	345	2135	2480
Unable to Establish Root Cause	0	11	11
In Progress	8	86	94
Not Requiring Formal Inspection	1	1	2
Total Occurrences	354	2233	2587
Number of Fatalities	0	0	0
Number of Serious Injuries	0	0	0
Number of Minor Injuries	0	0	0
Occurrences Outside TSSA Jurisdiction ²	32	282	314

There were no health impacts from pipeline strikes in the measured period.

Table 15 breaks down the pipeline strike occurrences into their involved fuel type. Nearly all of the strikes involve natural gas.

Table 15: Fuel types for pipeline strike occurrences.

Fuel Type	Period		
	January 1, 2008 – April 30, 2008	May 1, 2008 – April 30, 2009 Fiscal Year 2008/2009	Total Occurrences January 1, 2008 – April 30, 2009
Diesel	1	0	1
Fuel Oil	0	2	2
Gasoline	0	1	1
Natural Gas	44	2148	2492
Not Confirmed: Occurrences Pending Inspection	8	81	89
Not Confirmed: Formal Inspection not required	1	1	2

Table 16 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. The number of victims and their injury severity from the occurrences are also included.

² These occurrences are not considered in further analysis.



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Table 16: Activity breakdown for non-pipeline strike fuels occurrences.

Occurrence Detail	Period		
	January 1, 2008 – April 30, 2008	May 1, 2008 – April 30, 2009 Fiscal Year 2008/2009	Total Occurrences January 1, 2008 – April 30, 2009
Number of Incidents	312	1218	1530
Number of Near-Misses	70	70	140
Completed Causal Analysis	339	990	1329
Unable to Establish Root Cause	11	73	84
In Progress	30	222	252
Not Requiring Formal Inspection	2	3	5
Total Occurrences	382	1,288	1,670
Number of Fatalities	2	13 ³	15
Number of Serious Injuries	16	61	77
Number of Minor Injuries	21	31	52
Occurrences Outside TSSA Jurisdiction ⁴	217	676	893

Table 17 shows the fuel types involved in these occurrences.

Table 17: Fuel types for non-pipeline strike fuels occurrences.

Fuel Type	Period		
	January 1, 2008 – April 30, 2008	May 1, 2008 – April 30, 2009 Fiscal Year 2008/2009	Total Occurrences January 1, 2008 – April 30, 2009
Diesel	19	55	74
Fuel Oil	129	302	431
Gasoline	11	29	40
Natural Gas	187	646	833
Other Hydrocarbon Fuel	0	7	7
Propane	22	77	99
Used Oil	0	1	1
Not Confirmed: Occurrences Pending Inspection	12	168	180
Not Confirmed: Formal Inspection not required	2	3	5

³ This count does not include health impacts from the Sunrise Propane incident as the occurrence inspection is still in progress. While TSSA acknowledges and deeply regrets the consequences of this incident, analysis of incidents are not conducted and documented in the TSSA information system until the occurrence inspection is complete. TSSA public reports are designed to reflect the most accurate and auditable information documented within the TSSA information system.

⁴ These occurrences are not considered in further analysis.



Occurrence Related Trends

Figure 41 shows the number of occurrences to which TSSA has responded over the last two and a half fiscal years by occurrence type. A statistical analysis indicates that there is a downward trend in the number of liquid petroleum spills over the last two and a half fiscal years. All other occurrence types do not have statistically significant trends. It should be noted that this graph does not account for occurrence inspections that are in progress; however, the impact on the analysis outcome would be insignificant.

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

Figure 41: Occurrences by occurrence type over the last two and a half fiscal years.

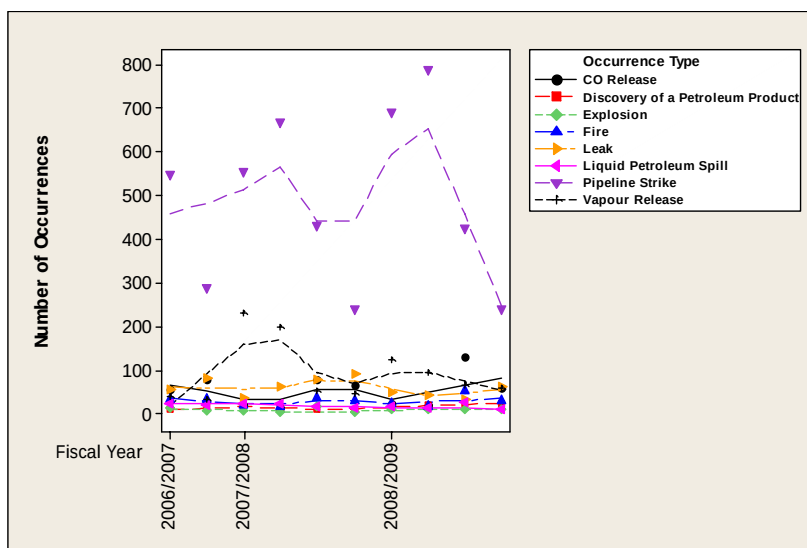
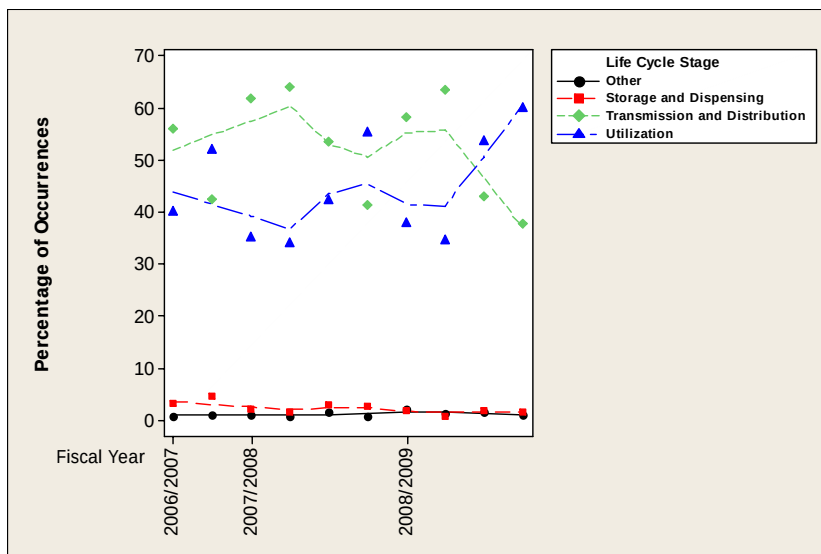


Figure 42 shows the percentage distribution of occurrences across the fuels life cycle over the last two and a half fiscal years. A statistical analysis of this data indicates that there is a downward trend in the percentage of occurrences in the storage and dispensing life cycle stage. This downward trend in the storage and dispensing stage can be attributed to a decrease in the number of occurrences at retail fuels stations.

Figure 42: The percentage of occurrences by life-cycle stage over the last two and a half fiscal years.





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Figure 43 shows the percentage distribution of occurrences, excluding pipeline strike occurrences, across the different fuel types over the last two and a half fiscal years. A statistical analysis of this data indicates that there is an upward trend in the percentage of these occurrences involving gasoline, and a downward trend in the percentage of these occurrences involving other hydrocarbon fuels. All other fuel types demonstrate no significant trends, with natural gas and fuel oil being the dominant fuel types.

Figure 43: The percentage of occurrences by fuel type, excluding pipeline strikes over the last two and a half fiscal years.

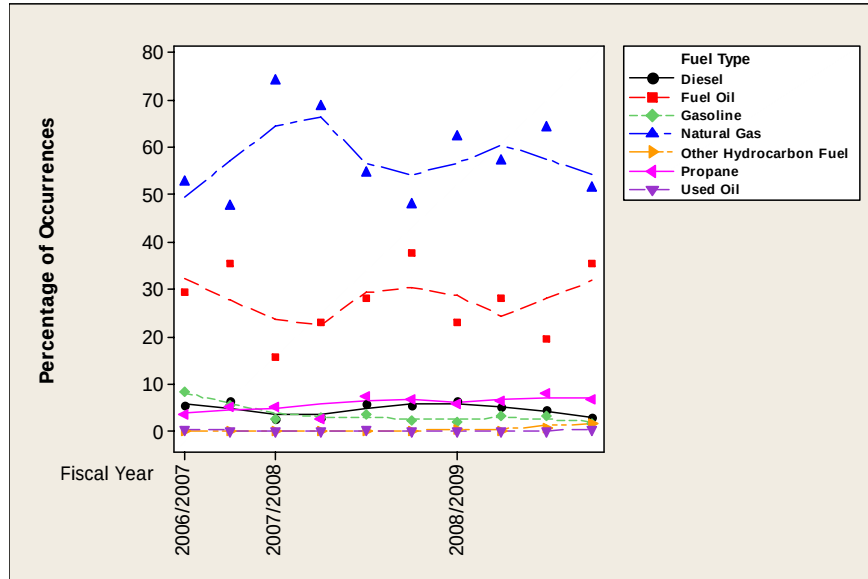


Figure 44 charts the number of fatalities and serious injuries over the last five fiscal years. A statistical analysis of this data indicates that the number of fatalities has exhibited no significant trend. This analysis also revealed that the number of serious injuries has experienced an upward trend over the last five fiscal years. TSSA continues to engage its stakeholders to improve the quality of occurrence reporting. It is important to note that this trend does not take into account the effect of those occurrences that have multiple serious injuries.

A further analysis of serious injuries indicates that there is an upward trend in carbon monoxide related health impacts during the utilization life cycle stage.

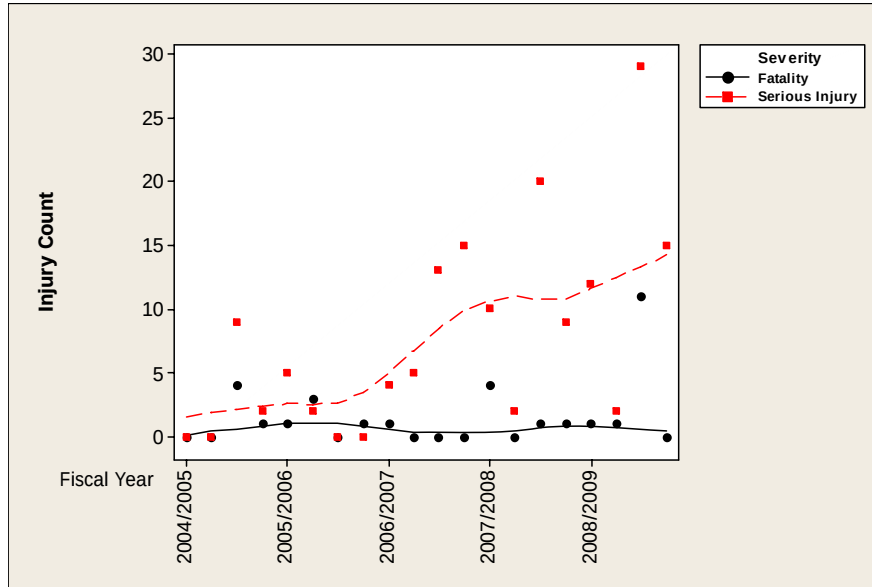
The number of occurrences with fatalities and serious injuries during the utilization stage involving the natural gas, propane and fuel oil fuel types has shown an increasing trend. The use of appliances utilizing these fuel types in private dwellings is the dominant category contributing to this increase. Significant health impact occurrences at commercial and industrial facilities have demonstrated an upward trend while campsites continue to be a prevalent category.



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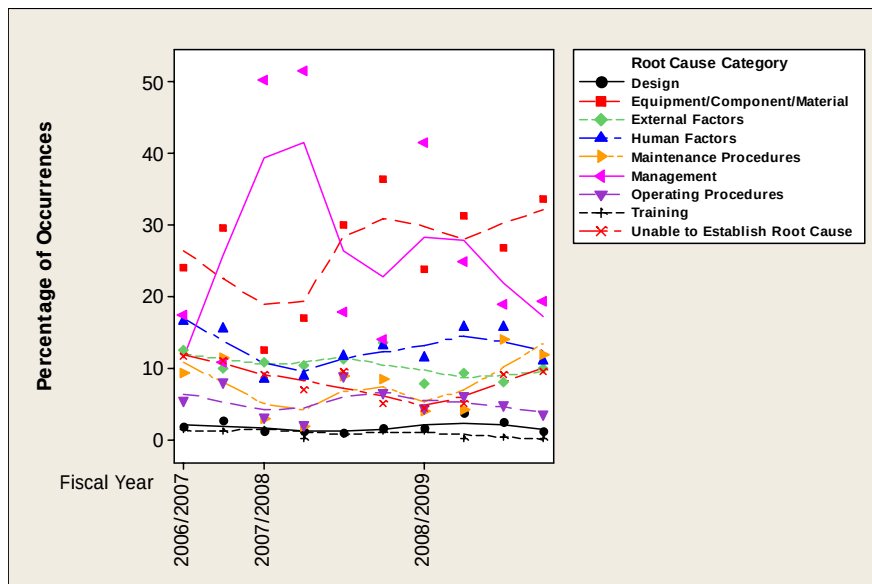
Figure 44: Fuels fatalities and serious injuries over the last five fiscal years (analyzed occurrences).



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 the other types of occurrences.

Figure 45 illustrates the distribution of root causes for inspected occurrences (in percentages) over the last two and a half fiscal years, excluding pipeline strike occurrences. A statistical analysis reveals that there are no significant trends over the measured period. 'Management' and 'Equipment/Component/Material' factors are the dominant root cause categories relative to all the other causal categories.

Figure 45: The percentage of occurrences by root cause category, excluding pipeline strikes over the last two and a half fiscal years.



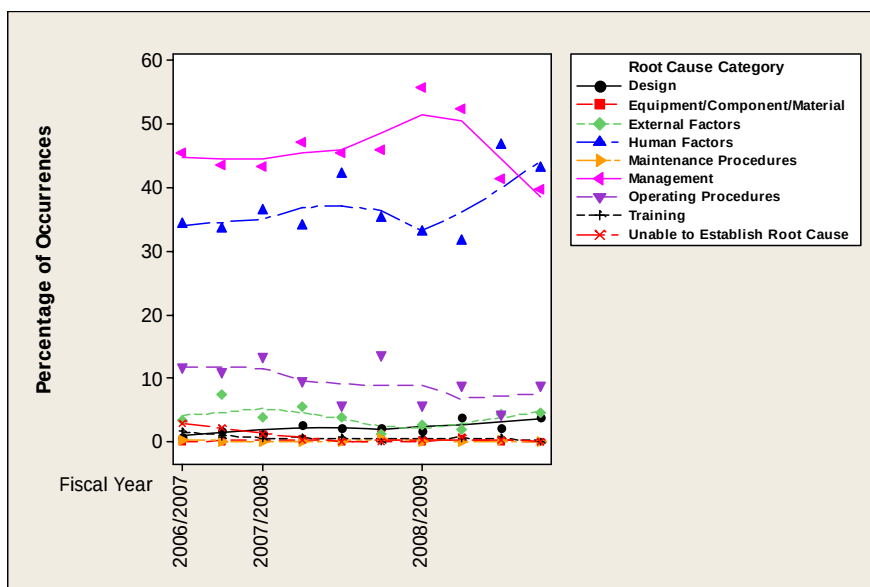


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Figure 46 illustrates the distribution of root causes for inspected occurrences (in percentages) over the last two and a half fiscal years for pipeline strike occurrences. A statistical analysis reveals that there are downward trends in the percentage of pipeline strike occurrences with the root cause 'Operating Procedures' and those that are 'Unable to Establish Root Cause'. All other root cause categories demonstrate no significant trends over the measured period, with 'Management' and 'Human Factors' being the dominant root cause categories relative to all the other causal categories.

Figure 46: The percentage of pipeline strike occurrences by root cause category over the last two and a half fiscal years.



Compliance Analysis

Periodic Inspections

The number of periodic inspections completed since January 1, 2008 are presented in Table 18. The total number of deficiencies in these periodic inspections are also included in the table.

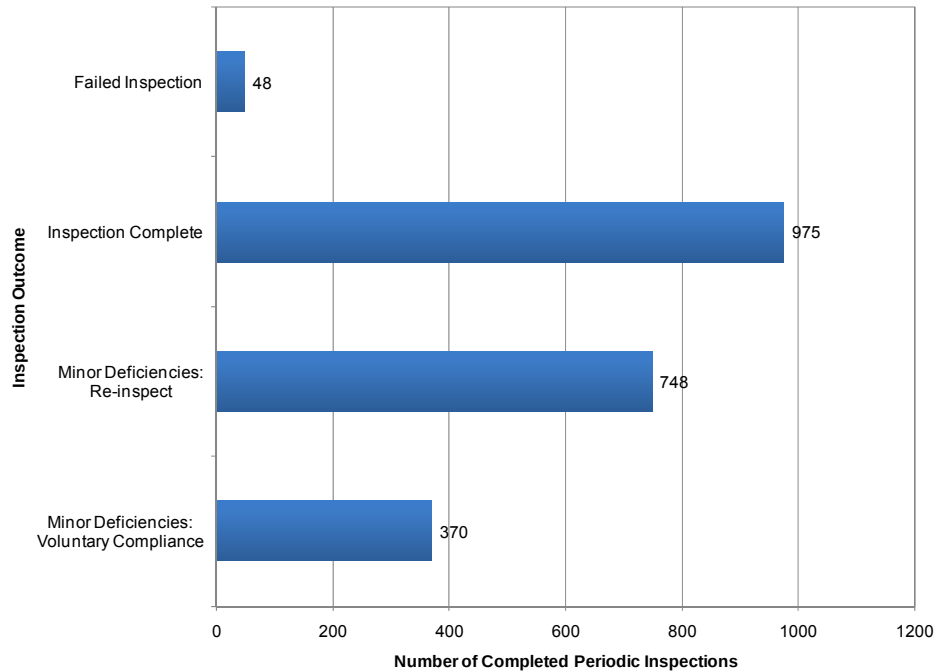
Table 18: Activity measures for fuels licensed sites periodic inspections.

Period	Number of Periodic Inspections	Number of Deficiencies
January 1, 2008 – April 30, 2008	351	762
May 1, 2008 – April 30, 2009 Fiscal Year 2008/2009	2,141	3,997
Total Inspections January 1, 2008 – April 30, 2009	2,492	4,759

Each of these inspections results in an outcome as determined by a TSSA inspector, shown in Figure 47. Of all periodic inspections completed in fiscal year 2008/2009, 45.54% were executed with no non-compliances or hazards found.



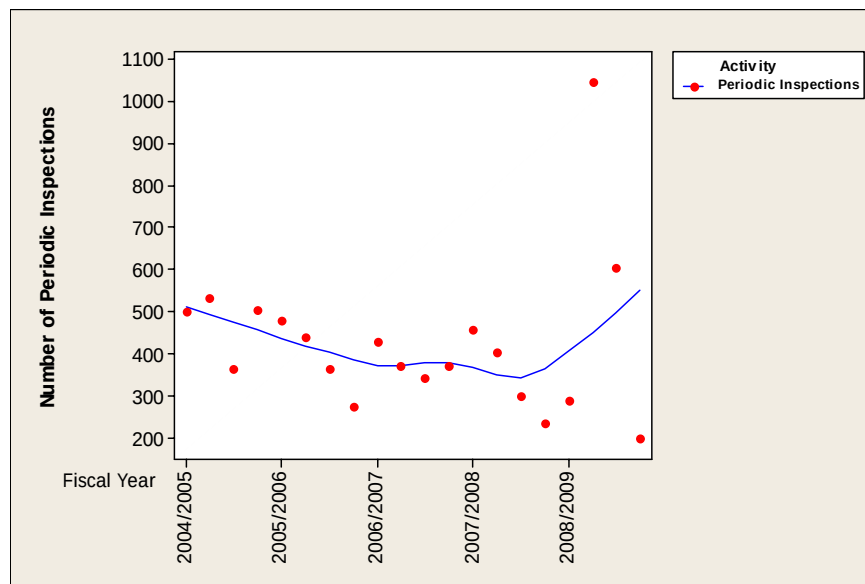
Figure 47: Outcomes from periodic inspections completed on fuels licensed sites in fiscal year 2008/2009.



Compliance Related Trends

Figure 48 charts the number of periodic inspections over the last five fiscal years. A statistical analysis of this data indicates that the number of periodic inspections has exhibited a downward trend over the last five fiscal years.

Figure 48: Fuels periodic inspections completed over the last five fiscal years.





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Figure 49 provides the average number of deficiencies per inspection for the last five fiscal years. A statistical analysis of this data indicates that the average number of deficiencies per inspection has a downward trend over the last five fiscal years, while the number of inspections is also decreasing.

Figure 49: The average number of deficiencies per fuels periodic inspection over the last five fiscal years.

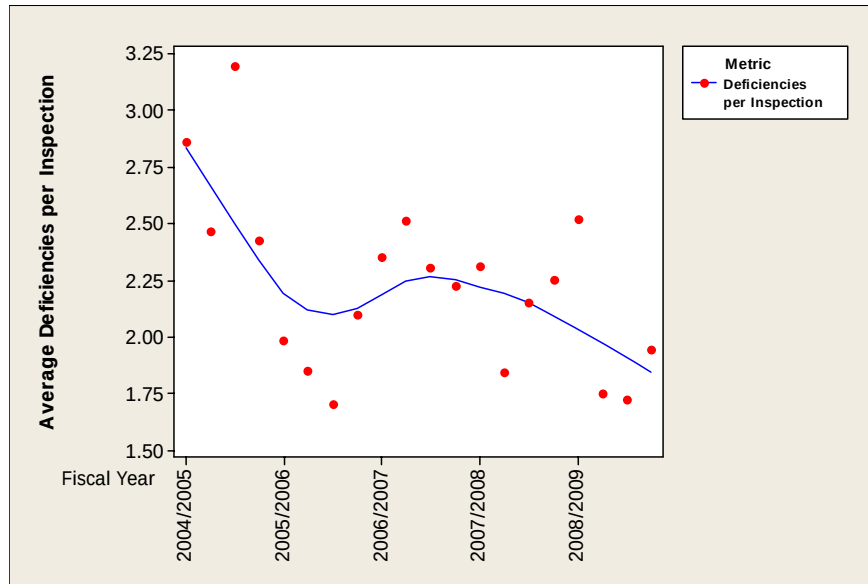
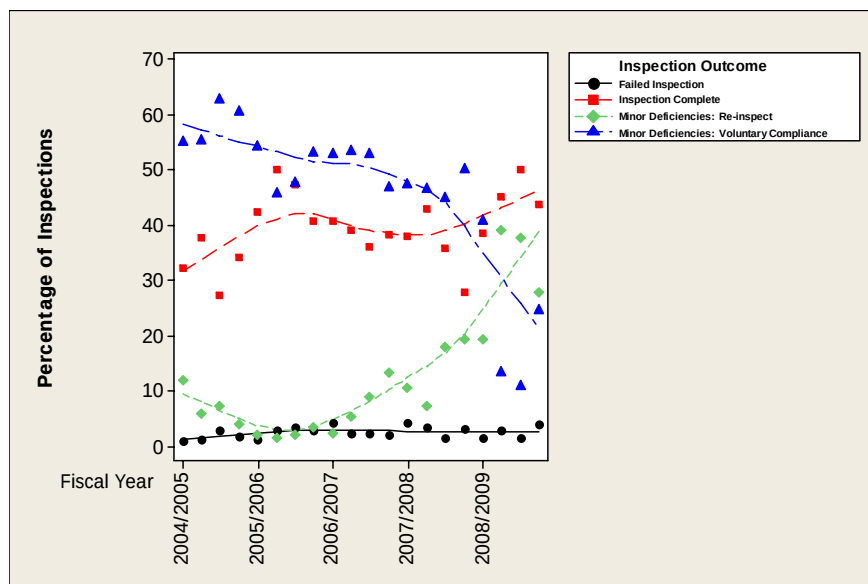


Figure 50 charts the outcomes from the periodic inspections over the last five fiscal years. A statistical analysis of this data indicates that there is an upward trend in the percentage of 'Minor Deficiencies: Re-inspect' outcomes and a downward trend in the percentage of 'Minor Deficiencies: Voluntary Compliance' inspection outcomes. This analysis also shows that all other outcomes did not significantly vary over the last five fiscal years.

Figure 50: The percentage outcomes of fuels periodic inspections completed over the last five fiscal years.





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Ad Hoc Inspections

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

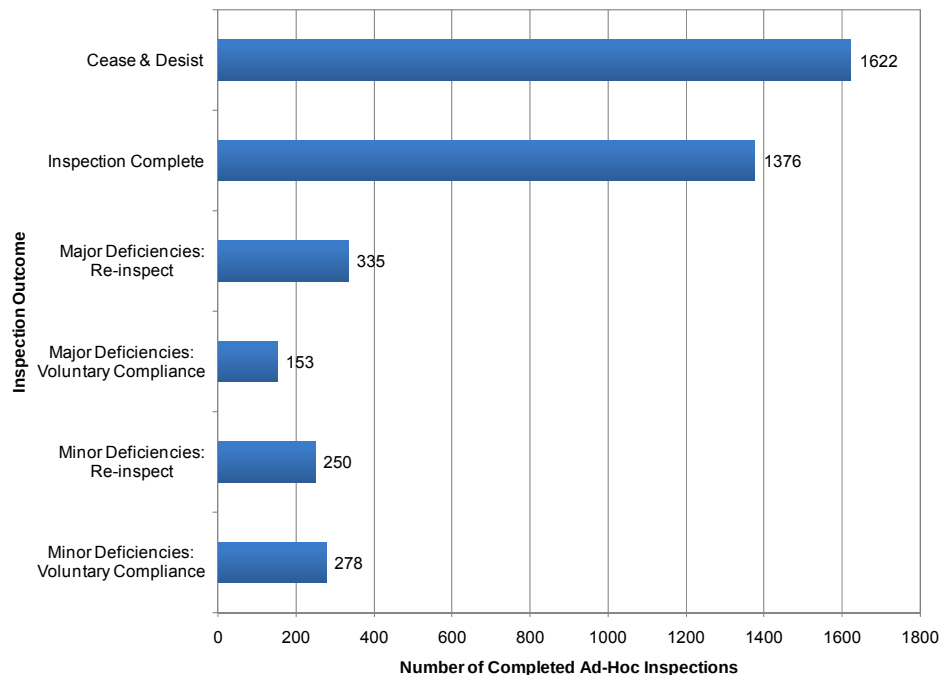
The number of ad hoc inspections completed since January 1, 2008 are presented in Table 19. The total number of deficiencies identified in those ad hoc inspections are also included in the table.

Table 19: Activity measures for fuels ad hoc inspections.

Period	Number of Ad Hoc Inspections	Number of Deficiencies
January 1, 2008 – April 30, 2008	1,430	3,714
May 1, 2008 – April 30, 2009 Fiscal Year 2008/2009	4,014	8,293
Total Inspections January 1, 2008 – April 30, 2009	5,444	12,007

Each of these inspections results in an outcome as determined by a TSSA inspector, shown in Figure 51. Of all ad hoc inspections completed in fiscal year 2008/2009, 34.28% were executed with no non-compliances or hazards found.

Figure 51: Outcomes from fuels ad hoc inspections completed in fiscal year 2008/2009.



Compliance Related Trends

Figure 52 charts the number of ad hoc inspections over the last five fiscal years. A statistical analysis of this data indicates that the number of ad hoc inspections has not significantly varied over the last five fiscal years.



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Figure 52: Fuels ad hoc inspections completed over the last five fiscal years.

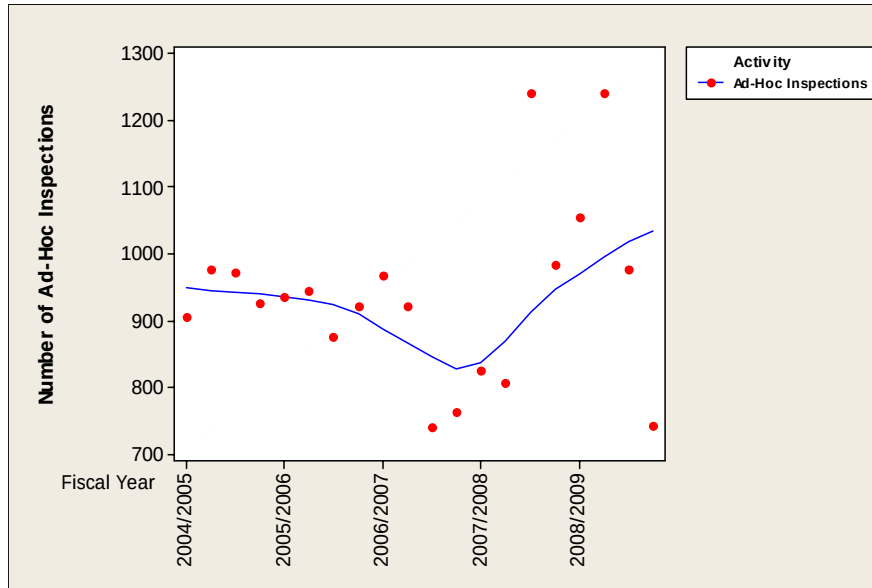
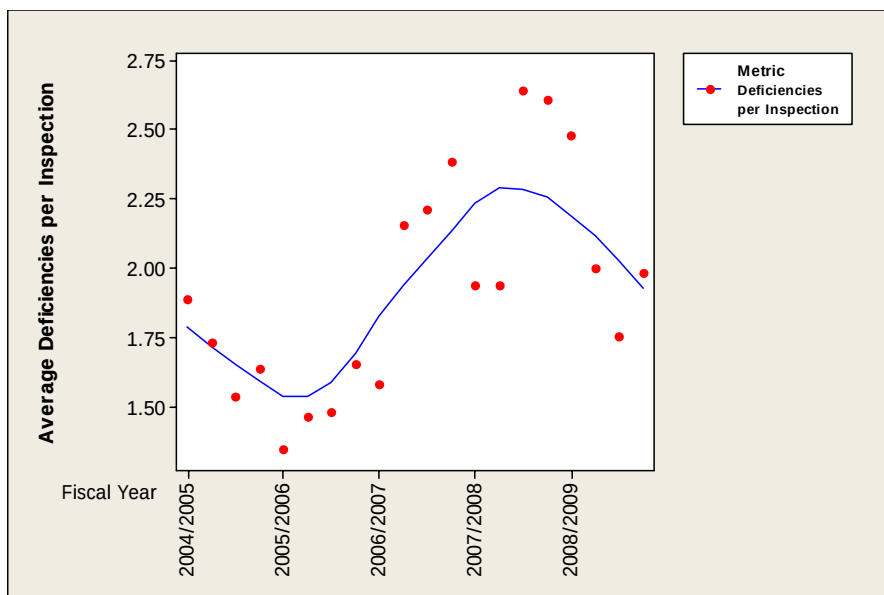


Figure 53 provides the average number of deficiencies per inspection for the last five fiscal years. A statistical analysis of this data indicates that the average number of deficiencies per inspection has an upward trend over the last five fiscal years, while the number of inspections has remained relatively constant.

Figure 53: The average number of deficiencies per fuels ad hoc inspection over the last five fiscal years.



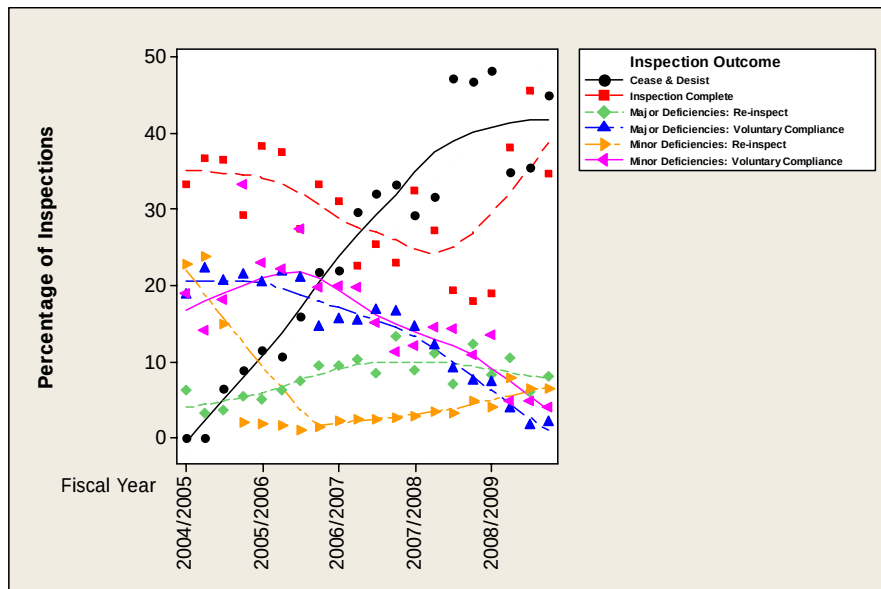


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Figure 54 charts the outcomes from the ad hoc inspections over the last five fiscal years. A statistical analysis of this data indicates that there are upward trends in the percentages of both types of 'Re-inspect' outcomes and the 'Cease and Desist' outcome, and downward trends in both of the 'Voluntary Compliance' outcomes. This percentage of inspections executed with no non-compliances or hazards found has not significantly varied over the last five fiscal years.

Figure 54: The percentage outcomes of fuels ad hoc inspections completed over the last five fiscal years.



Contractor Audits

The number of contractor audits completed since January 1, 2008 are presented in Table 20. The total number of deficiencies in these audits are also included in the table. The number of audits is inclusive of multiple visits to the same contractor within the same measured period.

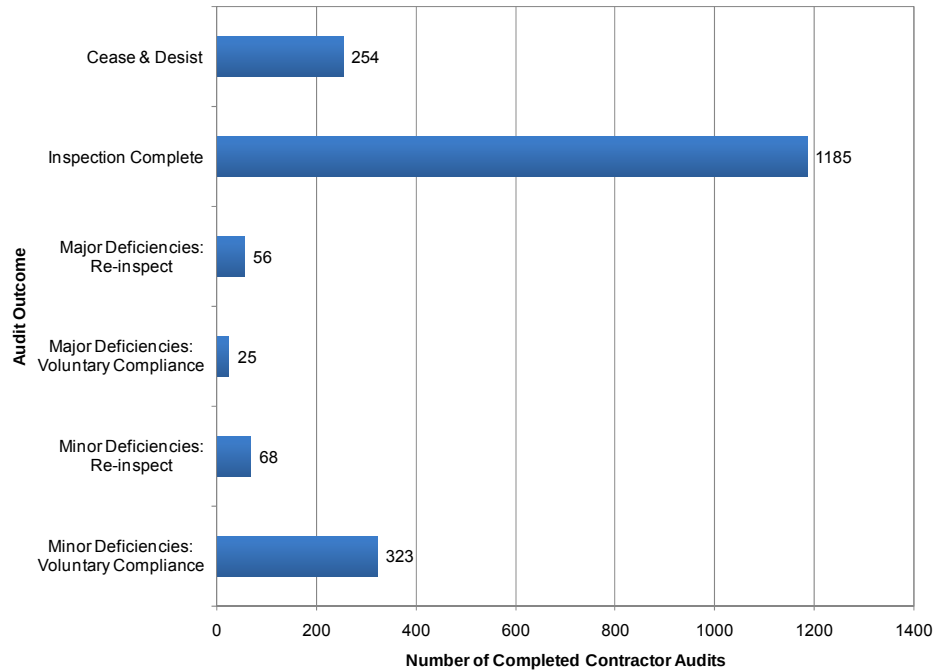
Table 20: Activity measures for fuels contractor audits.

Period	Number of Audits	Number of Deficiencies
January 1, 2008 – April 30, 2008	710	473
May 1, 2008 – April 30, 2009 Fiscal Year 2008/2009	1,911	2,343
Total Audits January 1, 2008 – April 30, 2009	2,621	2,816

Each of these audits result in an outcome as determined by a TSSA inspector, shown in Figure 55. Of all audits completed in fiscal year 2008/2009, 62.01% were executed with no non-compliances or hazards found.



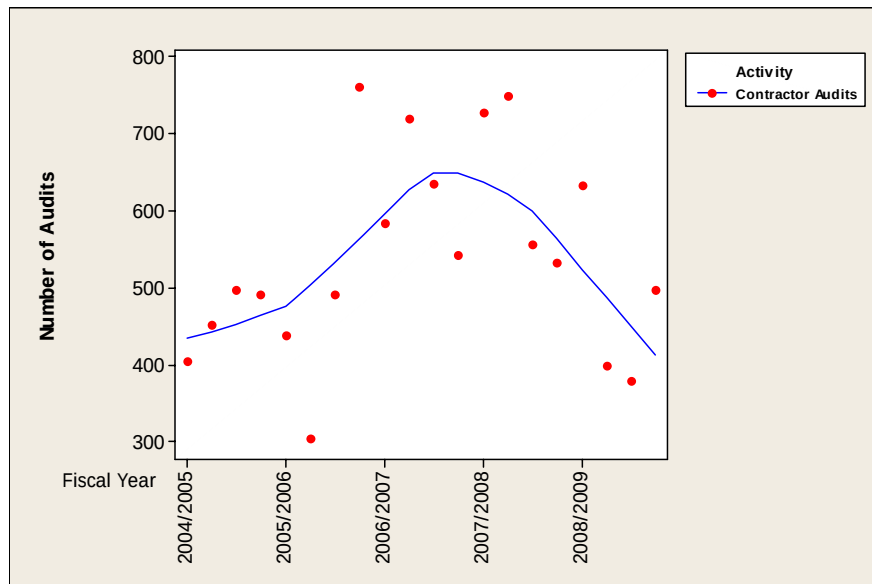
Figure 55: Outcomes from contractor audits completed in fiscal year 2008/2009.



Compliance Related Trends

Figure 56 charts the number of contractor audits over the last five fiscal years. A statistical analysis of this data indicates that the number of contractor audits has not significantly varied over the last five fiscal years.

Figure 56: Fuels contractor audits completed over the last five fiscal years.





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Figure 57 provides the average number of deficiencies per audit for the last five fiscal years. A statistical analysis of this data indicates that the average number of deficiencies per audit has not significantly varied over the last five fiscal years.

Figure 57: The average number of deficiencies per fuels contractor audit over the last five fiscal years.

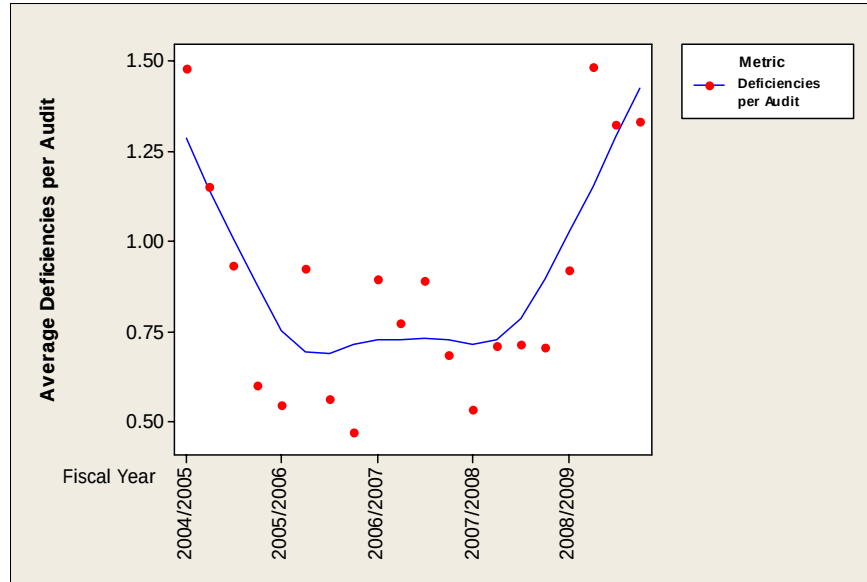
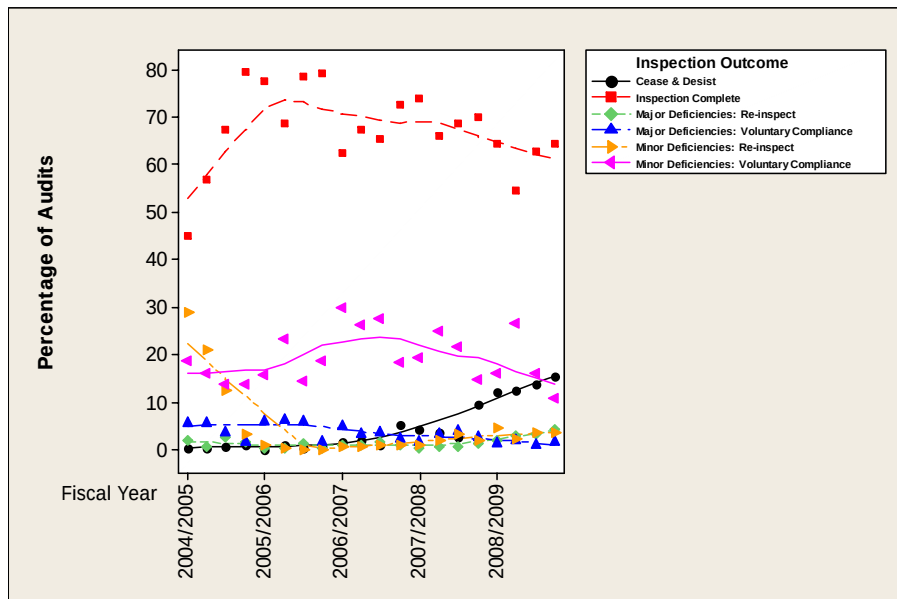


Figure 58 charts the outcomes from the contractor audits over the last five fiscal years. A statistical analysis of this data indicates that the percentage of audits resulting in a 'Cease and Desist' outcome has exhibited an upward trend over the last five fiscal years. The percentage of audits with the 'Major Deficiencies: Voluntary Compliance' outcome has shown a downward trend over the last five fiscal years. All other outcomes have not significantly varied over the last five fiscal years.

Figure 58: The percentage outcomes of fuels contractor audits completed over the last five fiscal years.





Other Safety and Risk Analysis Results

There is an increase in the percentage of occurrences caused by 'Equipment/Component/Material' related factors over fiscal year 2008/2009 (excluding pipeline strike occurrences). Further analysis revealed that the occurrences with 'Equipment/Component/Material' root cause factors were related to fuel oil and occurred during the utilization stage.

Residential Boilers

TSSA has undertaken a risk assessment study to quantify carbon monoxide risks associated with the depressurization and design of natural draft boilers that would facilitate making informed safety decisions. Two sources of evidentiary information – the incident history and data gathered by one of the large heating contractors in the province during the two heating seasons of fiscal years 2005/2006 and 2006/2007 – have been utilized in the risk assessment. The data gathered by the contractors included information on carbon monoxide observations, equipment knowledge and other relevant factors at residential homes visited during this period. The human health risk assessment is associated with indoor carbon monoxide exposure because of continuous indoor spillage of the flue gas resulting primarily from backdrafting.

The findings and conclusions of the risk assessment are summarized as follows:

- a few observed flue gas carbon monoxide concentrations were significantly higher than the threshold value of 100 ppm and potentially harmful to human health if there were additional circumstances that impaired proper venting of the flue products;
- the risk assessment study has provided the evidence of existing safety issues associated with the spillage of the flue gas with high concentrations of carbon monoxide; and
- this assessment recommends the development of a detailed causal sequence analysis for the spillage of flue products and high carbon monoxide concentration hazards, and the exploration of the possible controls to prevent these hazard causes.

Portable Camp Heaters

TSSA has conducted a statistical analysis of incidents related to outdoor camp heaters to determine the risk associated with the device primarily due to misuse of the equipment indoors. The Fuels Safety Program incident data from the last 8.5 years, specific to propane fueled devices and incidents ranging from carbon monoxide exposures, fires and explosions, was included in the analysis.

The key findings are as follows:

- the average rate of fatalities due to propane camp heaters in carbon monoxide exposure incidents and fires was 0.83 fatalities per year (over the last 8.42 years);
- there were 27 occurrences reported and seven fatalities for these incidents:
 - for carbon monoxide exposures alone, there were 10 occurrences reported and five fatalities;
 - for fire exposures alone, there were 17 occurrences reported, of which 11 reported property damage, and two fatalities; and
- the report also predicts that if no safety related changes are made, there is a 1.2% chance that more than three fatalities will occur in a given year due to these incidents.

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.

TSSA is also 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



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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.

Managing Safety Issues

Residential Boilers

Four 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 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. TSSA, with input from the risk reduction group, has issued a Director's Order mandating maintenance on this equipment whenever a technician enters a home with a natural draft boiler.

Additionally TSSA, in each heating season, has partnered with a large service company to gather carbon monoxide data regarding these boilers. The risk assessment described in the previous section was conducted using this information provided by the service company and revealed that additional controls should be considered. Specifically, the next steps include the evaluation of the following using the risk reduction group process:

- re-issue of the current Director's Order with additional mitigation(s);
- identify, evaluate and implement additional mitigations that could range from boiler design considerations and modifications, installation modifications, isolation of equipment, venting modifications, and any other regulatory requirements as applicable; and
- monitor the effectiveness of the chosen controls and review the risk assessment in the future based on constituted controls.

Portable Camp Heaters

With occurrence history indicating the existence of potential risks with the use of portable camp heaters, TSSA has developed a risk assessment demonstrating that this equipment poses a risk which needs further examination. Utilizing this information, TSSA has planned the following next steps:

- TSSA will be reviewing the risk assessment with other Canadian regulators to gain their input and suggestions;
- TSSA has initiated a risk reduction group that will begin meeting in October 2009 to discuss possible options to address the concerns; and
- the risk assessment report and options will be reviewed by the risk reduction group so that TSSA can gain input and make the best decision moving forward.

TSSA continues to play an important role in the Ontario Regional Common Ground Alliance⁵ by participating in awareness and education programs on issues surrounding pipeline strikes. Additionally, TSSA inspectors periodically conduct education seminars and presentations to various stakeholders, including excavators and landscapers, on the importance of obtaining locates prior to digging and other safety related requirements.

TSSA has initiated a risk assessment process to evaluate the cause of the increase of fuel oil occurrences with 'Equipment/Component/Material' root causes to determine if safety issues pertaining to leaking storage tanks exist. TSSA will take appropriate action if risks associated with such failures are significant.

Propane Re-Audit

As a result of a propane explosion in August 2008, TSSA conducted a re-audit of all propane facilities in Ontario using a risk informed approach. Resources were allocated on a priority basis using this approach. The action plan excluded cylinder exchange and vehicle conversion shops, as these sites do not involve a filling process and are perceived to be low risk.

The re-audit program was completed in December 2008. The findings indicate that the results of the Action Plan to Re-Audit are generally consistent with the results from TSSA's cyclical audit process. The vast majority of non-compliances continue to be focused on low risk items generally considered as routine site maintenance. At sites

⁵ The Ontario Regional Common Ground Alliance heads up the Canadian Common Ground Alliance, with five provincial chapters and over 230 member companies including the National Energy Board.



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that were operating without valid licences, safety performance levels were generally consistent with properly licenced sites. There were no general observations regarding sites with immediate hazards; non-compliances were generally site specific.

Regulatory Improvements

As part of its continuous improvement, TSSA has issued the following Director's Orders or advisories:

- installation of gaseous appliances in showrooms;
- six foot clearance from a roof edge;
- registration procedures for underground fuel oil tanks;
- secondary containment liners;
- extension for certification of special fittings for plastic venting;
- updating of the gas pipeline inspector curriculum;
- equipment approvals – maintenance versus modification;
- vent sizing for oil appliances;
- distance between gasoline and diesel dispensers;
- removal of foot valves from existing single wall liquid fuels suction systems;
- requirement for written notification for permanent closure for liquid fuels facilities;
- clarification that marinas can only be full serve facilities; and
- clarification for leak detection during commissioning of underground liquid fuel tanks.

When deficiencies are found for equipment in the field that is not installation specific but of a systemic nature, TSSA will investigate and issue safety orders when warranted to either not allow their use or only allow their use in a modified form. TSSA issued safety orders with respect to the residential natural draft boilers to require maintenance on:

- two models of direct vent fireplaces (retrofit of relief mechanism);
- two models of direct vent fireplace (disuse);
- one model of a water heater (retrofit of the venting); and
- three models of water heaters (disuse).

TSSA recommended to MSBCS updates to Ontario Regulation 215/01 *Fuel Industry Certificates*, and Ontario Regulation 216/01 *Certification of Petroleum Mechanics*, with changes being effective August 1, 2008:

- gas utility technician created to accommodate work conducted by employees of natural gas distributors;
- amendment and clarification of failure of qualification requirements;
- amendment of Oil Burner Technician (OBT)-1 certificate requirements, addressing a qualification training gap;
- amendment and clarification of OBT-3 certificate requirements, permitting comprehensive inspections with documented ability to perform such skills;
- amendment and clarification of Industrial Maintenance Technician (IMT) certificate requirements, no longer permitting an IMT certificate as a pre-requisite for OBT-1 certificate;
- amendment of Propane Truck Inspector (PTO) certificate requirements, permitting reactivation of equipment;
- amendment and clarification of minimum Petroleum Mechanic (PM) certificate requirements, and scope of PM4 and PMH work; and
- amendment to Crop Dryer Technician (CDT) certificate requirements, requiring certificate holders to a minimum of one-year experience before safely activating equipment.

As of December 11, 2008 Ontario Regulation 440/08 and Ontario Regulation 441/08 were filed by MSBCS amending Ontario Regulation 211/01, *Propane Storage and Handling*, and Ontario Regulation 215/01, *Fuel Industry Certificates*, respectively. The following is a summary of the changes which come into effect at various times over the next two years, until the end of 2011:

- the requirement for annual inspections;
- implementation of a risk and safety management plan and its annual review; such plans include a hazard analysis, the hazard distance, the assessed risk, a mitigation and control plan, and an emergency preparedness and response plan;
- fire service approval of the risk and safety management plan pertaining to fire safety, protection and emergency considerations;
- provision for municipal comments;
- training for officers and directors of the propane facility;
- site-specific training for personnel;



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- employee training for emergencies;
- practical knowledge requirement for training providers; and
- three-year renewal for training providers.

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 have been on-going and TSSA has drafted an advisory for the implementation of the amendments and guidelines for preparing a risk and safety management plan. The targeted finalization and mail out of the advisory and guidelines is September 2009.



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.

Public Safety Analysis

Inspection Analysis

The number of inspections completed since January 1, 2008 are presented in Table 21, separated by the type of inspection. The total number of deficiencies in those inspections are also included in the table.

Table 21: Activity measures for upholstered and stuffed articles inspections.

Activity	Period		
	January 1, 2008 – April 30, 2008	May 1, 2008 – April 30, 2009 Fiscal Year 2008/2009	Total Inspections January 1, 2008 – April 30, 2009
Annual Inspection	985	2,348	3,333
Complaints by Competitor Investigation	10	7	17
Complaints by Public Investigations	6	31	37
Follow-up Inspections	363	705	1,068
Initial Inspections	119	171	290
Initial Inspections Unregistered Entities Found by Inspector	115	174	289
Trade/Craft Show Inspections	1	125	126
Seasonal Inspections	54	163	217
Total Number of Inspections Conducted	1,653	3,724	5,377
Total Number of Directives Issued	3,292	8,446	11,738

Public Safety Decisions

TSSA Actions

Highlights from fiscal year 2008/2009 include:

- issuing 8,446 directives related to non-compliance with safety regulations;
- Ontario Regulation 218/01, *Upholstered and Stuffed Articles*, was amended by MSBCS to exempt manufacturers of padded undergarments, shoulder pads, and trimmings on articles of clothing;
- proactively reviewing all applicable applications to ensure products being manufactured are regulated and registered as required;
- working with Canada Customs to ensure that used furniture and mattresses are not being imported for sale in Ontario; and
- continuing to use a strategy of continuous communication and inspections to ensure that there is a level playing field and no company utilizes used materials in manufacturing or creating products without obtaining a valid registration.



Concluding Comments

This enhanced *Annual Public Safety Performance Report* demonstrates the evolution of TSSA's ability to analyze and report the state of public safety and compliance to Ontarians. This report also provides meaningful and transparent information on the TSSA decision making process. The analysis and reporting of annual patterns and trends provide good indicators of the overall effectiveness of the regulatory framework associated with the technologies, equipment and tradespersons falling under the TSSA regulatory purview.

TSSA continues to invest significant time and resources in improving the quality and reliability of information supporting the production of public reports and, more importantly, the enhancement of the integrity and transparency of public safety decision making. It is anticipated that future reports will exhibit continuous improvements in analysis, reporting and decision making.



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 have 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

Please note that each of these main categories may have one or more sub-categories that are self-explanatory.

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, 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.



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Appendix B

Category	Definition	Sub-Categories
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.
Root Cause	The most basic reason (underlying cause) for an occurrence that can be reasonably identified.	
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.



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Appendix C

Glossary of Terms

Term	Definition
Ad Hoc Inspection	Due to the broad scope of authority, Fuels inspectors conduct many inspections at sites and on persons who have not been authorized by TSSA. Examples would be construction sites, residences, campsites, private petroleum sites, etc. The inspection work conducted for these entities is categorized as an 'ad hoc' inspection.
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.
Conditional Pass	A device is allowed to remain in operation with low hazards or minor non-compliances identified from inspection. - Conditional Pass: Voluntary Compliance - from the inspector's judgment, low enough risk based on likelihood and consequence to allow for voluntary reporting of compliance. - Conditional Pass: Follow-up - similar to above but, based on the inspector's judgement, requires follow-up inspection to ensure corrective action and does not qualify for voluntary reporting of compliance (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: Follow-up	Non-compliances found that warrant correction and verification.
Directives Issued: Re-inspect	Non-compliances found that warrant correction and verification.
Failed Inspection	Non-compliances and/or conditions present which pose immediate or significant hazards based on the inspector's judgment. Devices cannot be operated until non-compliance has been rectified and verified by an inspector.
Failed Inspection: Shutdown – Follow-up	Cannot operate device until non-compliance has been rectified and verified by an inspector (refer to TSSA document ED0028 – Enforcement Procedure Bulletin for <i>Inspections and Follow-Ups to Periodic Inspection on Elevating Devices</i>).
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 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 Management Information System	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.



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Appendix C

Term	Definition
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.
Major Deficiencies	Non-compliances and/or conditions posing immediate hazards are identified as major deficiencies. - Major Deficiencies: Re-inspect - major deficiencies for which an inspector, based on judgment, determines that a follow up is required. - Major Deficiencies: Voluntary Compliance - major deficiencies for which an inspector, based on judgment, determines a voluntary compliance is required.
Minor Deficiencies	Non-compliances and/or conditions posing non-immediate hazards are identified as minor deficiencies. - Minor Deficiencies: Re-inspect - minor deficiencies for which an inspector, based on judgment, determines that a follow up is required. - Minor Deficiencies: Voluntary Compliance - minor deficiencies 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 readying equipment for inspection, and owner or their staff unavailability. Any outstanding items will be inspected in a follow-up.
Passed Inspection	An inspection that has been executed with no non-compliances (no hazards) found.
Passed & Seal/Unseal Equipment	An outcome that relates to plants with equipment commissioned into or out of service during a periodic inspection or in a specific call to seal/unseal equipment.



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Appendix C

Term	Definition
Passed Inspection: No Follow-up	Compliant device or non-compliances that are deemed not sufficiently significant to warrant a voluntary compliance or a follow-up.
Periodic Inspection	An inspection conducted at such intervals required by code or regulation or as may be determined by the Statutory Director for the purpose of ensuring the safe operation of the device/facility.
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 WHO.
Voluntary Compliance	An allowance provided by the inspector for a person to comply with Inspector's 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: No Follow-up	Non-compliances were found which would have warranted a failed inspection, a shutdown or conditional pass but the owner has voluntarily decided to shut the device down.



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