

Annual Public Safety Performance Report

For the period May 1, 2010 to April 30, 2011



Technical Standards
and Safety Authority

A Message from the President and CEO

President and CEO: Kathy Milsom



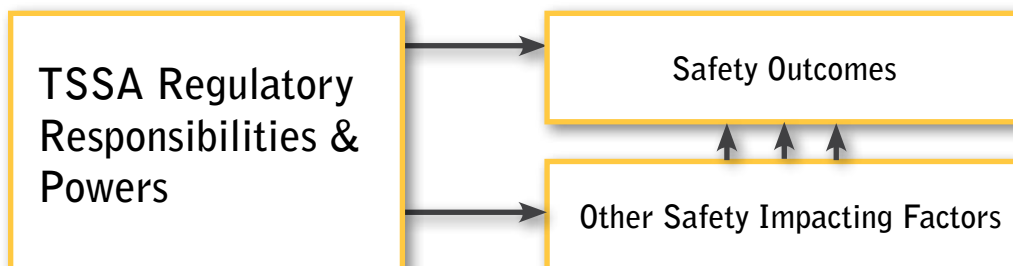
Our job is to keep Ontarians safe, every waking hour of every day. From the time Ontarians lift their heads from an upholstered pillow in the morning, to when they cook breakfast on a gas stovetop, drive their gasoline-powered car to work, ride an elevator up to their office, return home at night to adjust the thermostat and keep their family warm, to summer time fun at an amusement park or winter ski vacations, to a safe night's sleep at day's end, we are there to administer safety standards that protect all Ontario citizens. That's the mandate of the Technical Standards and Safety Authority (TSSA), an innovative, not-for-profit organization dedicated to public safety.

We administer and enforce public safety laws in Ontario under the *Technical Standards and Safety Act, 2000* in designated industry sectors such as amusement devices, boilers and pressure vessels, elevating devices, fuels, power plants, ski lifts, and upholstered and stuffed articles. The Ontario Ministry of Consumer Services (MCS) retains authority for the *Technical Standards and Safety Act, 2000*, and is responsible for setting public safety standards and policy, overseeing delivery, and monitoring our performance.

While our delegated powers from the government of Ontario are largely regulatory in nature, in the interest of public safety, we have strategically embraced a much broader role and responsibility – that of overall positive safety outcomes.

Although causal factors of incidents and injuries can be eliminated or constrained through regulations, codes, design, training, inspections and a variety of other means contained within the delegated authority provided to us by the government, other causal factors, particularly those related to operator or user behaviour, can at best only be influenced by us. The nature of this broader role is illustrated below.

TSSA Total Perceived Responsibilities



As we cannot control all aspects that contribute to safety outcomes, such as behavioural factors, we seek to mitigate risk through strategic and operational actions that both meet our regulatory responsibilities and enhance public safety beyond our regulatory mandate. We act as both a regulator and educator – firmly committed to positive safety outcomes.

In this regard, we take a systematic approach to deliver on our safety mandate. An effective safety system consists of a number of interrelated components which, in combination, act to eliminate or significantly mitigate technology-related risk.

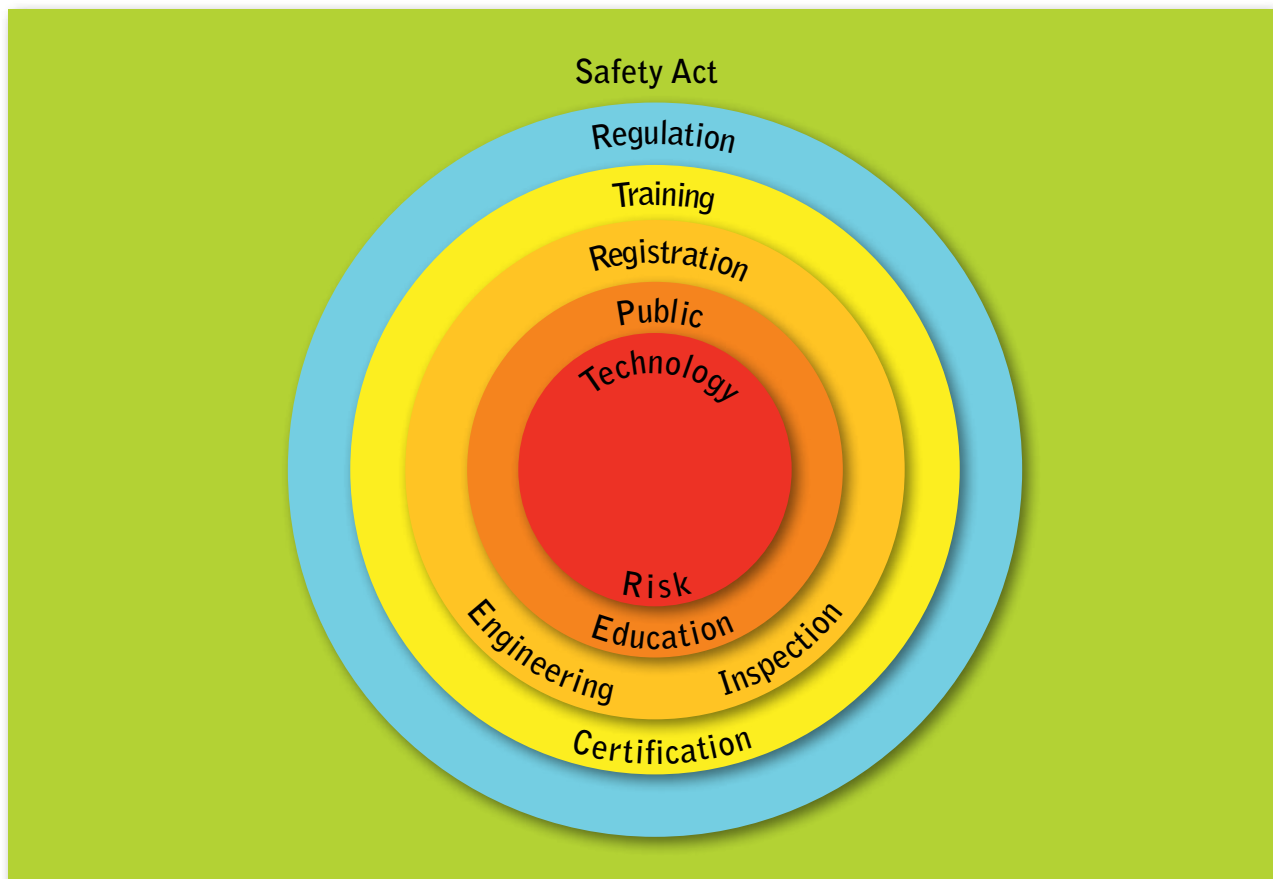
Effective risk mitigation has benefits not only in terms of enhanced safety outcomes, and the protection of the health and well-being of Ontarians, it also results in the avoidance of financial and economic losses.

Our Safety System® consists of the hierarchical components of:

- the *Technical Standards and Safety Act, 2000*, being our primary risk containment and control instrument;
- its regulations, which outline specific prescriptions to restrain risk, including the identification of persons having roles and responsibilities within the Safety System®;
- training and certification to ensure that those persons are appropriately and adequately qualified to effectively discharge their responsibilities;
- engineering review, registration and inspection activities to ensure that safety prescriptions are being applied, supported and conformed with for effective risk control;
- public education activities to increase awareness and enhance understanding of safety issues to ultimately result in safer behaviour; and
- the technology risk itself which, if the foregoing instruments are effectively applied, is restrained.

These instruments and their interrelationships are depicted in the following diagram and are applicable to varying degrees to each of our program areas.

Comprehensive TSSA Safety System® to Restrain Risk





Each of these safety services continues to contribute to enhancing positive safety outcomes for Ontarians. For example, by conducting regular inspections of various devices we are able to confirm that they meet regulatory requirements or identify issues that need to be addressed. In those cases where a device does not meet all applicable requirements, we issue orders that must be addressed to bring it into full compliance. Considering the diversity and complexities of the devices we regulate, the number and type of orders issued will vary across the sectors we regulate. Our subsequent actions depend on the nature of the orders and may include, for example, follow-up inspections or, in the rare instances of significant non-compliances, immediate shutdown of the device. Regardless, we follow-up on all orders issued to ensure that they are addressed and that the devices are brought into full compliance with the Act and regulations. Through this and other similar actions associated with our other safety services, we are able to effectively discharge our public safety mandate.

At TSSA, we are excited about some of our recent initiatives in the interest of continuing to enhance public safety. The most notable contributor to our safety achievements is the evolution of our innovative approach to risk management. Our safety and compliance strategies are guided by our application of risk-informed decision making (RIDM) to ensure a systematic, scientific process, based on sound risk management principles, leading to a safer Ontario.

Fiscal year 2010/2011 is also the first year we publicly introduced our leading-edge safety outcome metric, the Disability-Adjusted Life Years (DALY) metric. Developed by the World Health Organization and adapted by TSSA, the DALY metric is a proven, international best practice approach to measuring and reporting health outcomes. TSSA has adapted this metric to measure and report on injury outcomes. In simple terms, a DALY of 1.0 is the loss of one year of healthy life of a single person due to an injury. DALYs provide a rational and objective way of combining injuries of different severities into a single unit of measure. The metric provides a scientific basis for both health impacts reporting, and also for safety decision making. DALYs enable us to quantitatively measure and externally benchmark health impacts, and focus our resources where the greatest potential exists to reduce negative impacts on public health.

Although we remain committed to moving toward zero serious injuries and fatalities in all the sectors we regulate, and continue to report on these outcomes as well, DALYs provide an effective way to monitor specific trends and benchmark health impacts year-over-year. They also have the potential of benchmarking against other jurisdictions. We report DALYs in three categories based on our ability to influence safety outcomes:

- non-compliance with regulatory requirements, which indicates the extent of health impacts that result from a safety system participant who has specific responsibilities under the Act or regulations not complying with the legal requirements;
- potential inadequacy of the regulatory structure, which indicates the extent of health impacts that result from a potential weakness in the regulations; and
- factors external to the regulatory structure, which indicates the extent of health impacts that result from, for example, situations where the public using the technologies we regulate inadvertently put themselves at risk through their own behaviours.

Both RIDM and the DALYs enhance our performance by helping us make informed decisions with respect to all of the activities we undertake and services we deliver in the interest of public safety.

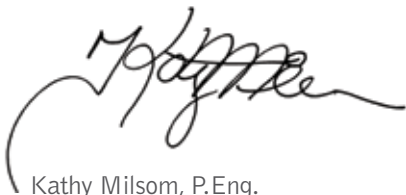
Throughout the year, we continued to support MCS and industry with the implementation of the regulatory changes for propane, introduced by MCS in 2008. We have been committed, active and engaged with MCS, industry and other key stakeholders to communicate the new regulatory requirements, and to assist with the implementation of the required risk and safety management plans. Fiscal year 2010/2011 demonstrated a number of accomplishments from compliance with regulatory requirements and associated safety outcomes perspectives. For example, serious injuries have continued the downward trend in effect since 2007, with 1.2 fewer serious injuries occurring by quarter.

We introduced a number of key enforcement initiatives in the elevating devices sector to achieve positive compliance trends, including a cost-effective, voluntary reporting for low risk non-compliance, a zero tolerance policy for overdue safety tests resulting in elevator shutdowns and the implementation of financial deterrents for non-compliance. These enforcement activities resulted in an increase of 10.4% for the fiscal year over the prior year in the percentage of devices found to be in full compliance with the regulatory requirements on the first visit from a periodic inspection. We continued to work collaboratively with contractors in the fuels sector through the pre-registration process to ensure better understanding of code and regulatory requirements, including a new guide book for TSSA safety audits. In the boilers and pressure vessels sector, we began industry consultation on internal in-service inspection requirements and more effective communication regarding code changes.

Working with our industry partners to keep improving public safety throughout our regulated sectors is critical to our primary focus, safety for all Ontarians. In shared pursuit and partnership, together we are on our way to establishing our sectors as champions of public safety across the province. That is what makes this *Annual Public Safety Performance Report* so critical. This report summarizes our performance over the year ended April 30, 2011, provides relevant analysis and highlights our achievements toward making our province safer for all Ontarians.

When we succeed, Ontarians safely enjoy their everyday activities. Working with partners in industry, government, advisory councils and the public, we strive for zero serious injuries and fatalities in the industry sectors we regulate.

We have a team of more than 340 safety professionals, approximately 75% of whom work in operations – all of whom are passionate about protecting the safety of every Ontario citizen, and I am very proud of and grateful for their ongoing dedication and meaningful contributions to a safer Ontario. At TSSA, we are always working in the spirit of continuous improvement. We recognize we have more opportunities ahead. We welcome your feedback on how we may improve our services and we thank you for your continued support as we all work together toward a safer Ontario.



Kathy Milsom, P.Eng.
President and Chief Executive Officer



Preface

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

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

- Public Safety Analysis; and
- Public Safety Decisions.

Public Safety Analysis

This section provides the readership with an overview of the activities undertaken by TSSA from May 1, 2010 to April 30, 2011 specific to inspecting occurrences, and periodic inspections and audits across the various regulated technologies and tradespersons. This overview includes measurement indicators and metrics that illustrate the body of work that TSSA has carried out in the province to proactively manage compliance and determine the causes of any incidents or failures that could have led to or have had health impacts on the public.

This section also provides the results of a detailed analysis on trends and outcomes of these activities. The analysis gives readers a perspective on the state of compliance and the associated state of safety over a continuous period of time and as based on information available to TSSA. Specific indicators and metrics allowing the readers to understand and evaluate the outcomes of TSSA activities are included.

The information used to generate a trend for each indicator is also used to determine expected values for fiscal year 2011/2012 through the use of a prediction interval. More details on the prediction interval are provided in Appendix A. On a quarterly basis, the indicators will be compared against their prediction interval to determine if they follow the behaviour of historical observations.

TSSA is also introducing a new methodology for characterizing and reporting on the severity of health impacts associated with occurrences. Over the past three years, TSSA developed and tested an innovative approach to measuring safety performance based on international best practices. Designed by the World Health Organization (WHO) and adapted by TSSA, the total Disability-Adjusted Life Years (DALYs) metric quantifies the burden of injury, which is defined as the cumulative health impact on an exposed population. A DALY of 1.0 is the loss of one year of healthy life of a single person due to an injury. For comparison purposes, DALYs are expressed per million of population. In simpler terms, the metric is the total of the individual DALYs resulting from all injuries sustained by Ontarians related to the sectors regulated by TSSA over the reporting period. The DALY approach best represents the true safety impact of incidents and their consequences in areas regulated by TSSA. More details regarding this metric, its calculation and its applicability are provided in Appendix C.

Public Safety Decisions

This section describes TSSA actions that have been implemented or are being planned in response to the results of the public safety analysis carried out from May 1, 2010 to April 30, 2011 and observed trends. TSSA also manages anticipated public safety risks by engaging external stakeholders in gathering information and analysis. This section includes specific cases of proactive TSSA decision making to improve compliance and/or address public safety issues.

Characterization of Trends

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

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

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

It is also possible that the presented curves of best fit can highlight local trends that may not be reflected in the long-term statistical trend tests. The reader is cautioned that the statistical trends are global in nature; they are based on a longer period and analyze the behaviour of the data as a whole. Trend tests on smaller time frames have been conducted where relevant; such results are presented and contextualized with respect to recent actions and/or decisions.

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

Assumptions and Sources of Uncertainty

It is important for the readers to note that, while in general, analysis on trends will be provided over a ten-year period, the trends in this report are based on shorter time periods due to improvements in data gathering and analysis systems. 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 ten-year time period. For compliance information, the time period begins May 1, 2004. For safety information, the time period starts May 1, 2007, except where noted.

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



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Executive Summary

Message from the Chief Advisor, Public Safety Risk Management

Chief Advisor: Srikanth Mangalam



Gathering knowledge on the state of compliance provides insight into potential safety risks that may manifest in the future. Observation of the levels of compliance through TSSA inspections and audits has two functions. It primarily mitigates the manifestation of potential safety risks; additionally, it provides valuable information on the nature and extent of compliance issues related to these safety risks.

Incident and near-miss occurrences are the ultimate realization of safety risks and can result from any one of three causal categories:

- Category 1 – Causal factors related to potential inadequacies in available regulatory controls
- Category 2 – Causal factors related to non-compliance with current regulatory controls
- Category 3 – Causal factors not within the purview of current regulatory controls

The significance of occurrences which have resulted in health impacts (injuries and fatalities) are better understood by the use of a new metric known as the Disability-Adjusted Life Year (DALY). A detailed description of the methodology used to calculate DALYs associated with health impacts are provided in Appendix C. For the purposes of this section, one DALY may be better understood as the loss of one year of healthy life resulting from an injury.

The overall aim of this report is to provide analysis of both the observation of compliance during TSSA inspections and audits across each safety sector and the information of incident and near-miss occurrences resulting from any of the previously mentioned categories. These two sets of knowledge allow TSSA to make informed decisions on improving compliance and thereby reduce the potential for the realization of safety risks arising from casual factors related to non-compliance with current regulatory controls. Additionally, the information from causal factors related to potential inadequacies in available regulatory controls and factors not within the purview of current regulatory controls can be used to identify opportunities to review and enhance current regulatory controls, or identify other risk management instruments, like using public education to modify user behaviour.

This section of the executive summary serves two purposes. The first is to give insight into key findings of the analysis of compliance and occurrence outcomes. The second is to present important observations to each TSSA director having statutory responsibilities for their consideration when establishing their public safety strategy.

Some of the results discussed in this section may represent the amalgamation of information related to multiple sets of technologies (such as combining elevators, escalators, and passenger ropeways) and/or contained in multiple sets of analysis (such as combining outcomes of inspections or different occurrence details) provided in the main body of the report. There are three components to this message:

1. Consolidated analysis of health impacts
2. Program-specific highlights of compliance and safety outcomes
3. Risk-informed decision making (RIDM) initiatives

Consolidated Analysis of Health Impacts

658 (36.82%) of all occurrences that were found to be under TSSA jurisdiction and documented in TSSA's information system during the last fiscal year resulted in health impacts to Ontarians. These health impacts were comprised of 671 injuries and two fatalities.

The aggregate DALYs¹ resulting from these incidents with health impacts is estimated to be approximately 41.92. Assuming that the entire population of Ontario² is exposed to one or more of these technologies, this translates to approximately 3.2 DALYs in one million Ontarians, or the equivalent of 0.07 fatalities in a million people (assuming 44 DALYs is the estimated equivalent of one fatality³). One fatality in a million people per annum is a typically used international criterion⁴ for individual involuntary risks.

Key points of interest include:

1. There is a decreasing trend in the overall number of occurrences⁵ per quarter since fiscal year 2007/2008⁶. Additionally, the number of occurrences with causal factors related to potential inadequacies in available regulatory controls and non-compliance with current regulatory controls demonstrate decreasing trends, while the number of occurrences with causal factors not within the purview of current regulatory controls demonstrates an increasing trend during the same period.
2. There is a decreasing trend in the number of serious injuries each quarter since the first quarter of fiscal year 2007/2008.
3. The aggregate health impacts, represented in DALYs per quarter, have experienced a decreasing trend over the last four fiscal years. Health impacts resulting from causal factors related to potential inadequacies in available regulatory controls and non-compliance with current regulatory controls also demonstrate decreasing trends.

1 Calculation based on a deterministic analysis that does not account for the uncertainties associated with the exposure variability, injury severity, age variability, and reporting bias.

2 Assumed to be 13 million.

3 Based on the standard life expectancy of Ontarians using published data from the Ministry of Finance (2008), the mean DALY value for a fatality is estimated to be approximately 44 DALYs.

4 Source is a document prepared by the University of British Columbia, titled "Risk Acceptability Criteria for effective regulation of technological risks".

5 Pipeline strikes are excluded from this analysis.

6 This is the first quarter the incident management system was in use for all programs.

Program-specific Highlights of Compliance and Safety Outcomes

Boilers and Pressure Vessels

TSSA inspects uninsured boilers and pressure vessels in the province in accordance with the requirements of the regulation. Uninsured devices are believed to represent less than 10% of all equipment currently in use in the province. Trends observed based on TSSA periodic inspections may not provide a reflection of the general state of compliance across all pieces of equipment in the province.

Safety Outcomes – Key Findings

1. One incident was reported during the last fiscal year and the number of occurrences in this program continues to remain between 0 and 4 in a given year since fiscal year 2007/2008. No fatalities or serious injuries have been observed over the same period.

Compliance Outcomes – Key Findings

1. Of the 369 periodic inspections conducted during the last fiscal year, 91.60% were compliant with regulations on first visit. A decreasing trend is observed for inspections compliant with regulations on first visit over the last seven fiscal years. Correspondingly, an increasing trend in the number of inspections requiring a follow-up due to observed non-compliance has been noted.

Observations for Consideration

- BPV-1: In order to get a relevant representation of the state of compliance across the boilers and pressure vessels program, it is essential to obtain an understanding of the level of compliance observed with insured equipment that forms the bulk of the provincial inventory. In particular, levels and reasons for non-compliance and associated trends across the whole inventory will better assist in establishing compliance strategy, if necessary.
- BPV-2: Reporting on near-misses, if any, will also provide useful information for analyzing and characterizing risks in this sector. In this regard, the effectiveness of the recently incorporated reporting guidelines⁷ may be evaluated.

Operating Engineers

TSSA conducts periodic inspections of over 3,100 plants with operating engineers in the province of Ontario.

Safety Outcomes – Key Findings

No occurrences have been observed at operating plants over the last three fiscal years.

⁷ The reporting guidelines list the requirements for owners of boilers and pressure vessels to report to TSSA any incidents involving the equipment. The guidelines can be found on the web at <http://www.tssa.org/regulated/boilers/inspections/boilersInspections09.asp>.

Compliance Outcomes – Key Findings

1. Of the 2,092 inspections completed during the last fiscal year (covering 67.48% of the plant inventory), 48.14% found the plant to be compliant with the regulations during the first visit. There is a decreasing trend observed over the last seven fiscal years with respect to this inspection outcome and an increasing trend in the number of inspections requiring follow-up due to observed non-compliances.
2. Low water volume power plants (both low- and high-pressure) have the lowest rates of compliance while steam powered traction plants and steam primer mover plants were found to be most compliant.
3. The most common reasons for non-compliances found were related to the installation, replacement or servicing of safety valves and pressure relief devices. They accounted for nearly 77% of all non-compliances found over the last two fiscal years.

Observations for Consideration

- OE-1: TSSA's continued evolution of a risk-informed inspection process should assist in focusing more on the plants contributing to increasing rates of non-compliance.
- OE-2: Pressure relief devices and safety valves are identified as significant risk mitigation devices and the proactive recognition and management of non-compliance with respect to these devices can be seen as a key component of TSSA's inspection activity.



Amusement Devices

TSSA conducts inspections on all amusement devices prior to their use each year. The result of these inspections are documented and subsequently analyzed when measuring compliance indicators.

Safety Outcomes – Key Findings

1. There were 93 reported occurrences on amusement devices during fiscal year 2010/2011, which accounts for an aggregate health impact of 0.77 DALYs, translating to 0.06 DALYs per million Ontarians. 99.36% of these DALYs resulted from factors external to the current regulatory system (typically attributed to users failing to follow user instructions).
2. There is a decreasing trend in the number of occurrences resulting from non-compliance with regulatory requirements since fiscal year 2007/2008. This decreasing trend is also observed in the DALYs resulting from the same causal category.
3. Go-karts and waterslides account for most occurrences with health impacts. These devices also account for the most number of DALYs per occurrence during the last four fiscal years.

Compliance Outcomes – Key Findings

1. No major non-compliance findings were observed based on the analysis of information collected during the last fiscal year.
2. No demonstrable trend has been observed over the last seven fiscal years with respect to the quarterly rate of inspections compliant with regulations on first visit or being shut down. There is a decreasing trend in the rate of inspections requiring follow-up due to observed non-compliances.

Observations for Consideration

- AD-1: Further analysis with respect to occurrences being caused by factors external to the current regulatory system may be carried out to establish appropriate regulatory or other proactive safety improvement strategies; particularly with respect to the usage of go-karts and waterslides.
- AD-2: There have been incidents reported during the last couple of years in other provinces and in the United States that are a result of aging and associated poor maintenance. Proactive risk assessments of amusement devices from an aging perspective will allow TSSA to manage these risks before their manifestation.



Elevating Devices

TSSA has administrative powers and is required to inspect all elevating devices, inclusive of elevators, escalators and passenger ropeways, in the province at such frequencies determined to be adequate by the statutory director. The result of these inspections are documented and subsequently analyzed when measuring compliance indicators.

Safety Outcomes – Key Findings

1. There is a decreasing trend in the number of occurrences on elevators, escalators, and passenger ropeways caused by non-compliance with regulatory requirements. There is an increasing trend in the number of occurrences on, elevators caused by factors external to the current regulatory system, with "Failure to follow user instructions" being the dominant cause.
2. There is a decreasing trend in the number of serious injuries on elevators since the start of fiscal year 2007/2008.
3. There were 739 reported occurrences on elevators and escalators during the fiscal year 2010/2011, which accounts for an aggregate health impact of 2.45 DALYs, translating to 0.19 DALYs per million Ontarians. 87.26% of the DALYs were caused by factors external to the current regulatory system (typically attributed to users failing to follow user instructions) with the largest fraction (58.64%) occurring on escalators. Passenger elevators accounted for 29.17% of these DALYs.
4. Over the last four fiscal years, escalators accounted for the largest fraction of DALYs (90.88%). 12.53% of these DALYs resulted from non-compliance with regulatory requirements, which is showing a decreasing trend during this period. 87.37% of the total DALYs on escalators resulted from external factors to the regulatory system.
5. Almost all of the 0.87 DALYs (0.07 DALYs per million Ontarians) on passenger ropeways last fiscal year resulted from factors external to the current regulatory requirements (typically attributed to users failing to follow user instructions).



Compliance Outcomes – Key Findings

1. Of the 16,676 periodic inspections conducted by TSSA during the last fiscal year on elevators and escalators (representing 31.54% of the current inventory of devices), 36.62% found the device to be compliant with regulations during the first visit. An increasing trend has been observed in the number of elevators compliant with regulations on first visit per quarter over the last seven fiscal years. In particular, the increasing trend has been more pronounced since the fourth quarter of the fiscal year 2007/2008 when Director's Order 218/07⁸ was issued to address certain frequent non-compliances.
2. The rate of inspections requiring a follow-up due to observed non-compliances per quarter has decreased over the last seven years, while the trend associated with devices being shut down as a result of non-compliance per quarter has shown to be increasing during the same period. The device types with the highest rate of non-compliance inspected over the last seven fiscal years (with a total inventory size greater than 1,000 devices) were escalators (79.86%), freight elevators (78.39%) and passenger elevators (73.26%)⁹.
3. Based on historical observations, it is expected¹⁰ for fiscal year 2011/2012 that 21.79% to 39.48% of periodic inspections conducted on elevators and escalators each quarter will be compliant with regulations on first visit. This is better than the expectation determined for the last fiscal year, confirming the increasing trend in compliance. It is also predicted that the expected range of inspections with non-compliances found will decrease.

Observations for Consideration

- ED-1: Based on the analyzed data, inspection results suggest that the highest prevalence of non-compliance relates to the operation and maintenance of escalators. Requirements associated with brake maintenance are identified as the leading source of non-compliance. The assessment of the nature and significance of non-compliance to safety risks may assist in establishing ongoing strategies for compliance enhancement.
- ED-2: Factors external to current regulatory controls available to TSSA contribute most to reported occurrences and corresponding health impacts. Typical causes involve user behaviour and related issues.

Fuels

TSSA conducts periodic inspections of licensed facilities storing and dispensing fuels, which includes annual inspections of facilities storing and dispensing propane. In addition to these licenced site inspections, TSSA conducts audits of contractors who install and maintain fuel burning devices such as heating appliances in residential homes. The periodic inspection and audit compliance results presented in this document are limited to these activities.

Safety Outcomes – Key Findings

1. 1,276 occurrences were reported and found to be within TSSA jurisdiction during the last fiscal year. There is a decreasing trend in the number of occurrences observed since the third quarter of the fiscal year 2006/2007.
2. Vapour releases (32.06%), leaks (19.56%), carbon monoxide (CO) releases (17.48%), and fires (11.8%) were the most prevalent type of occurrences during the last fiscal year. Explosions, which contributed approximately 2% of the total number of occurrences, show a decreasing trend since the third quarter of the fiscal year 2006/2007.

8 Director's Order 218/07 confirms the minimum requirements for the safe operation of an elevator, including safety testing and maintenance, based on engineering principles agreed upon by industry. TSSA shuts down elevators where inspectors find annual, two- and five-year tests are overdue. The objective of TSSA's increased enforcement efforts is to ensure maintenance is completed in a timely manner.

9 Percentage of inspections resulting in a 'Follow-up' or a 'Shutdown' inspection outcome is combined.

10 Obtained using prediction intervals discussed in Appendix A.

3. 73.73% of all inspected occurrences took place during the utilization of fuels¹¹, while 17.82% of these occurrences took place during transmission, distribution and/or transportation of fuels. Occurrences during the utilization of fuels demonstrate an increasing trend since the third quarter of fiscal year 2006/2007.
4. 70% of all completed occurrence inspections resulted from non-compliance with regulations during the last fiscal year. Approximately 71% of these types of occurrences took place during the utilization of fuels. The most common location (operation type) wherein these occurrences happened was at private dwellings, followed by commercial operations.
5. Three fatalities and two serious injuries resulted from occurrences during the last fiscal year; these are within expected patterns based on past observations that indicate the range to be 0 to 8 (for fatalities) and 0 to 25 (for serious injuries).
6. The three fatalities and two serious injuries, combined with the 26 minor injuries, contributed 37.82 DALYs (2.91 DALYs in a million Ontarians) during the last fiscal year. Nearly 50% of these DALYs resulted from occurrences where non-compliance to regulatory requirements was identified as the primary cause. The DALYs due to this causal category demonstrates a decreasing trend over the last four and a half fiscal years.
7. All health impacts (37.82 DALYs) resulted from occurrences during the utilization of fuels in the last fiscal year. 49.90% of these health impacts were from occurrences at private dwellings and 49% resulted during the use of fuel at camp sites. Nearly half of the occurrences at private dwellings leading to injuries were due to CO releases.

11 TSSA has jurisdiction over three phases of the fuels life cycle: transmission, distribution and transportation, storage and dispensing, and utilization.



8. Since the third quarter of the fiscal year 2006/2007, 92% of all occurrences resulting in health impacts took place during utilization of fuels, with a significant majority (73%) in private dwellings. CO release (39%) is the leading occurrence type resulting in health impacts during this period.

Compliance Outcomes – Key Findings

1. Of the 2,263 periodic inspections conducted at fuels licensed sites during the last fiscal year, 46.88% were found to be compliant with regulations on first visit. An increasing trend has been observed in the number of such sites compliant with regulations on first visit over the last seven fiscal years. Correspondingly, the number of licensed sites requiring a follow-up inspection due to observed non-compliance is showing a decreasing trend during the same seven year period.
2. Of the 2,339 contractor audits conducted, 73.45% were found to be compliant with regulations on first visit. Though no demonstrable trends have been observed during the last seven years with respect to this indicator, a decreasing trend is noted with respect to audits requiring follow-up due to observed non-compliances.
3. In fiscal year 2011/2012, based on historical observations, it is expected¹² that 27% to 55% of periodic inspections of licensed sites conducted per quarter will be compliant with regulations on first visit. This expected compliance rate is within the range expected for the last fiscal year (27% to 57%), which suggests a gradual rate of increase in compliance.

Observations for Consideration

- FS-1: In general, locations that are periodically inspected by TSSA (storage and dispensing of fuels) have had approximately 5% of all occurrences over the last four fiscal years.
- FS-2: Most occurrences continue to occur where fuels are being utilized in private dwellings (nearly 48%). They also lead to the most number of health impacts, with varying degrees of severities.
- FS-3: The lack of maintenance of fuel burning equipment in private dwellings is the cause of the most occurrences leading to health impacts.
- FS-4: Contractor audits reveal the compliance levels at dwellings where technicians may have performed maintenance/service related activities. However, the number of private dwellings without any formal maintenance plans is currently unknown.

Upholstered and Stuffed Articles

TSSA is at early stages of documenting and analyzing information on compliance in this sector. Initial analysis indicates that the primary sources of non-compliances are unregistered manufacturers and products being sold with no provincial labels. More analysis will be conducted over the next several quarters to obtain statistically valid results including trends.

Risk-Informed Decision Making Initiatives

TSSA's RIDM framework assists in enhancing and continually improving TSSA's public safety management decision process. RIDM aids the statutory directors of each safety program in evaluating the current regulatory framework, identifying gaps and developing potential solutions for managing public safety risks through the use of formal risk assessment methods that are based on international best practices. In this regard, several RIDM initiatives are currently underway. Two major initiatives demonstrating TSSA's ongoing application of RIDM are described on the next page.

¹² Obtained using prediction intervals discussed in Appendix A

Risk-Informed Management of Aging Technology and Infrastructure

As technologies, infrastructure, and devices under TSSA's jurisdiction reach the end of their defined or perceived service lives, the potential for age-induced failures tends to increase due to a variety of reasons, including the environment in which they operate, wear and tear, fatigue, and becoming technologically obsolete. In response to age-related incidents in the past and to proactively manage age-induced health risks associated with the various technologies, TSSA has been working on pilot projects in several safety programs over the past couple of years. TSSA will establish a formal risk-informed aging technology management strategy based on the results of these pilot studies. Projects currently underway include the following:

- assessment of age-induced risks and establishment of service lives for single walled above ground storage tanks that are used for storing fuel oil in residential locations;
- characterization and evaluation of risks associated with over-speed conditions of elevators designed to older codes and standards;
- development of feasibility studies evaluating the need to mandate internal inspections of boilers and vessels due to potential risks associated with age-induced internal failures; and
- review and identification of opportunities to enhance risk assessment requirements used to manage pipeline failures due to aging.

Results of these studies and TSSA's strategic courses of action will be provided in future editions of this report.

Risk-Informed Periodic Inspection Scheduling and Enforcement

In line with international risk management best practices and as part of TSSA's continual improvement of its decision making framework, TSSA is currently working on significantly enhancing the risk-informed inspection scheduling and enforcement model. Described as RBS 2.0, major elements of this model include the following:

- quantitative prediction of the operational risks of technologies based on their performance/incident history and integrating DALYs as risk measures;



- scheduling and enforcement decision making based on the comparison of operational risks against internationally used risk criteria; and
- optimization of inspection scheduling within risk constraints with respect to resource allocation and other operational considerations.

The RBS 2.0 relies on the accuracy of the completeness of the database that contains the technical and historical performance information of the regulated technologies. The first instalment of RBS2.0 is being designed and implemented in the elevating devices program and will be phased in for other relevant safety programs throughout the course of the next three fiscal years.

Messages from the Statutory Directors

Introduction

The *Annual Public Safety Performance Report* is a valuable tool for the statutory directors as it provides information collected through safety activities in each program area. This information assists the directors in appropriately allocating resources and focuses on any issues and trends that may need attention in order to reduce incidents and increase public and worker safety.

Director's Role

The program directors are responsible for providing direction and the overall leadership for their program areas, including the engineering and inspection functions. They also have delegated statutory powers under the *Technical Standards and Safety Act, 2000* for all general supervisory and administrative issues with respect to all parts of the Act.

Boilers and Pressure Vessels, and Operating Engineers

Statutory Director: Mike Adams



Commentary on Key Findings

Periodic inspection for power plants resulted in 48% of the plants found to fully meet the requirements of the regulation on first inspection; this is primarily due to the extensive checklist that is used, comprised of 167 hazard-ranked criteria, of which 29 are deemed high-risk. Through the application of RIDM, the inspection results are a source of input for the determination of future inspection frequencies. The safety outcomes, as evidenced by the incident data, are very positive for these sectors.

Responses and Actions to Observations for Consideration

- BPV-1: TSSA is working with the Insurance industry to develop a mutually beneficial process by which the complete status of all pressure retaining components in Ontario is known and appropriate actions taken to assure public safety. The current action plan has TSSA continuing to fulfill its responsibility of inspecting uninsured pressure vessels and introducing a quality assurance process this year with respect to inspections performed by insurance companies on insured pressure vessels.

- BPV-2: TSSA is also working with the industry advisory council to investigate means for capturing near-misses, if any. This will also provide useful information for analyzing and characterizing risks in this sector.
- OE-1: TSSA is continuing to refine the risk-informed inspection process by further validating the risk formulae and identifying discrepancies between assigned and required risk assignments.
- OE-2: TSSA is also focusing on pressure relief devices and safety valves during periodic inspections in particular repair and overhaul requirements.

Other Actions

Other activities for the fiscal year 2011/2012 include:

- TSSA identified a number of years ago a possible shortage of skilled operating engineers. In this regard, TSSA is continuing to work with operators and training organizations to address the future of operating engineers in Ontario. Options being considered range from increasing the availability and visibility of training programs through colleges and/or apprenticeship programs, to modernizing the operating engineering regulation to ease the training requirements, plant certification requirements and experience requirements. Dialogue with the Institute of Power Engineers as well as convening an advisory council risk reduction group is ongoing in this regard.

Elevating Devices and Amusement Devices

Statutory Director: Roland Hadaller



Commentary on Key Findings

Through the introduction of a number of key enforcement initiatives, compliance levels for elevating devices increased over the course of the year as evidenced by the percentage of inspections passing on the first visit increasing by 10.4% over the previous year. Furthermore, the number of orders per periodic inspection was lower for each quarter in fiscal year 2010/2011 than in the year previous, further indicative of improved industry compliance. This indicates that Director's Orders 218/07 and 218/07-r1, addressing revised enforcement procedures along with other enforcement activities, are producing the desired outcome of improved compliance. Despite

these positive outcomes, overall compliance in the elevating devices industry remains a concern and will continue to be an area of focus for TSSA.

For amusement devices, compliance with the regulations also increased, as indicated by the percentage of inspections passed on first visit increasing by 10.9% over the prior year.

Responses and Actions to Observations for Consideration

- ED-1: TSSA will be completing a risk assessment of safety issues with escalator brakes and issuing Director's Order 247/10 requiring a check of the elevator brake as part of the daily start-up.
- ED-2: TSSA is working with and supports the Elevator Escalator Safety Foundation of Canada and the related Safety Rider program with a focus on the safe use of elevators and escalators. In addition, TSSA conducts a program of safety messaging to individuals using elevating devices within their properties, in cooperation with property management firms and the Toronto Transit Commission.
- AD-1: To address these incidents, TSSA has a comprehensive public education program. Users in the targeted audiences have been exposed to important safety messaging in an effort to reduce incidents attributed to user behaviour.

- AD-2: TSSA will be completing a failure assessment in collaboration with industry on aging amusement devices, resulting in recommendations to review the current design of log books, enhancement of welding requirements and enhancement of non-destructive testing requirements.

Other Actions

Other activities for the fiscal year 2011/2012 include:

- adopting the latest edition of the CSA Z98 Code for Passenger Ropeway and Passenger Conveyors that has significant implications for ski lift control systems design by stating requirements in both prescriptive and performance based language, and also new requirements for some design elements to be supported through risk analysis; and
- working with the Ministry of Labour (MOL) and industry, completing a review of car top fall hazards and issuing Director's Order 245/10 mandating car top guard rails on all existing elevators by December 2013.

Fuels

Statutory Director: John Marshall



Commentary on Key Findings

There were no fatalities or injuries associated with pipeline damages this fiscal year; however, they are the leading cause of occurrence inspections this fiscal year. The damage to infrastructure is costly and presents a danger to public safety. To address this, the Fuels Safety Program has dedicated two damage prevention inspectors in the Greater Toronto Area, the location where most of the damages occur. The Fuels Safety Program also conducts safety presentations and dig safe days to audit excavation sites across the province to improve compliance and public safety.

In addition, TSSA supports the Ontario Regional Common Ground Alliance (ORCGA) initiative to implement Ontario One Call legislation to further reduce pipeline damages. Currently, requesting a locate may require calling as many as 13 companies in order to obtain all the locates. Mandatory legislation requiring everyone to belong to a one call system with only one number to call will result in less chance that people will not call and/or something will get missed.

Responses and Actions to Observations for Consideration

- FS-1: Periodic inspections at fuel storage and dispensing locations by TSSA have limited the number of occurrences at these locations over the last four years (approximately 5% of all occurrences). This provides an indicator of the value of continuing inspections in this area, as the level of safety is continually high; however, TSSA will look at initiatives in the fourth quarter of the fiscal year to improve the compliance rate of these inspections, which was 46.9% for the fiscal year, in order to further enhance public safety.
- FS-2: A high rate of occurrences takes place during the utilization of fuels and is showing a slight increasing trend. Contractor audits, which are TSSA's primary means of currently addressing these issues, are a key risk monitoring and control mechanism to reduce health risks at private dwellings. Enhancements to the contractor audit program, including the contractor audit program booklet and pre-registration inspection, are gaining momentum and continue to receive positive feedback as an effective tool to assist contractors in understanding their role and responsibilities.

- FS-3: The introduction of the Director's Order for natural draft boilers was the first step in addressing the safety issue relating to lack of maintenance of fuel-fired equipment in residences. As part of the regulatory review in the third quarter of the fiscal year, the results of this Director's Order will be considered to look for a possible extension of the order into other fuel areas. The Director's Order requires technicians to inspect boilers and take a CO reading when encountered, even if the original call was not for the boiler. If there is excess CO, the boiler must be cleaned and serviced on the spot or it will be shut off. Furthermore, the order requires the installation of a CO alarm and the isolation of natural draft boilers from living space when they are replaced.
- FS-4: The introduction of a pilot fuels supplier audit program during the last fiscal year may potentially assist in better understanding the risks at various locations, including private dwellings without a formal maintenance plan. The sample size of this program was not sufficiently large to make a final decision on a permanent program. Additional fuels supplier audits will be conducted in the second and third quarters of fiscal year 2011/2012 to further analyze the state of compliance.

Upholstered and Stuffed Articles

Statutory Director: Dara Vorkapic



Seasonal inspections are the primary source of finding articles that are non-compliant with the regulation. An important additional avenue of finding non-compliant articles is through monitoring by customers, who lodge complaints when a competitor does not follow the regulation.

To address non-compliance with articles that do not have their manufacturer registered or a provincial label affixed, TSSA educates customers on the requirements of the regulation.

Several retailers and importer/distributors have in turn passed on these requirements to their vendors, helping to reduce non-compliance. TSSA also communicates to retailers the requirement to affix a second-hand label at the point of sale to all returned articles, which is an important area of compliance.

TSSA monitors the furniture and mattress industry to ensure that contaminated products are not being sold. Whenever a product is discovered to be contaminated, orders are issued to ensure that it is destroyed.

Boilers and Pressure Vessels, and Operating Engineers

Boilers and Pressure Vessels

The Boilers and Pressure Vessels, and Operating Engineers Safety Program operates within a strong regulatory and Standards infrastructure which provides a profound “defence-in-depth” for protecting the Ontarian public from any incidents involving pressure vessels. TSSA is involved in all aspects of the life cycle of pressure vessels: from design, to manufacture, to installation, to operation and maintenance, to decommissioning plus the certification of operators.

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 in Ontario. The remaining insured boilers and pressure vessels are inspected by insurance companies licensed to underwrite boiler and machinery insurance. TSSA is responsible for the certification of the inspectors employed by the insurance companies.

Incidents involving this type of equipment and associated piping are infrequent. Nevertheless, cracked and corroded vessels or piping can leak or rupture, producing a variety of safety problems, including poisonings, suffocations, fires or explosions. Ruptures can be catastrophic and may immediately threaten life and property. The safe design, installation, operation, and maintenance of pressure vessels in accordance with appropriate codes and standards are essential to public safety. TSSA’s activities help ensure that safeguards are in place for the life cycle of this type of equipment.

Boilers and Pressure Vessels need to be inspected regularly as follows:

a)	Cushion Tank	every 2 years
b)	Deaerator	every 1 year
c)	High-Pressure Boilers	every 1 year
d)	Hydropneumatic Tank	every 2 years
e)	Low-Pressure Boiler	every 2 years
f)	Pressure Vessel	every 3 years
g)	Pressure Vessel fitted with quick-opening door	every 1 year

Public Safety Analysis

Occurrence Analysis

Table BPV-1 summarizes the occurrences involving boilers and pressure vessels reported to TSSA in accordance with the reporting guidelines provided to stakeholders. These occurrences can be categorized as an incident or a near-miss¹³, and the table includes their occurrence inspection status at the end of the fiscal year. The number of victims and their injury severity from these occurrences are also included.

Table BPV-1: Activity breakdown for boilers and pressure vessels occurrences.	
Occurrence Detail	Number of Occurrences May 1, 2010 – April 30, 2011
Number of Incidents	1
Number of Near-Misses	0
Occurrences Within TSSA Jurisdiction	1
▪ Completed Causal Analysis	0
▪ Unable to Establish Root Cause	1
▪ In Progress	0
▪ Not Requiring Formal Inspection	0
Total Occurrences	1
Occurrences Outside TSSA Jurisdiction	1
Number of Fatalities	0
Number of Serious Injuries	0
Number of Minor Injuries	0

The causal categorization and observed health impacts in terms of DALYs for fiscal year are presented in Table BPV-2. The categorization below is made on occurrences whose inspection has been completed.

Table BPV-2: Causal categorization for occurrences on boilers and pressure vessels.				
Causal Category	Number of Occurrences	Percentage of Occurrences	Health Impacts (DALYs)	Percentage of Total Health Impacts
1. Inadequate Current Regulatory System	0	0.00%	0.0000	0.00%
2. Non-compliance with Regulatory System	0	0.00%	0.0000	0.00%
3. External Factors	0	0.00%	0.0000	0.00%
4. Root Cause Not Established	1	100.00%	0.0000	0.00%

¹³ Please refer to the glossary in Appendix D for the definition of these terms.

Occurrence Related Trends

Figure BPV-1 shows the number of occurrences to which TSSA has responded over the last four fiscal years and the associated causal categorization of these occurrences. A statistical analysis of this data indicates that the number of occurrences involving boilers or pressure vessels does not demonstrate a significant trend over this period. This analysis also reveals that there are no significant trends in the number of occurrences in any of the causal categories. The occurrences in this program are relatively rare.

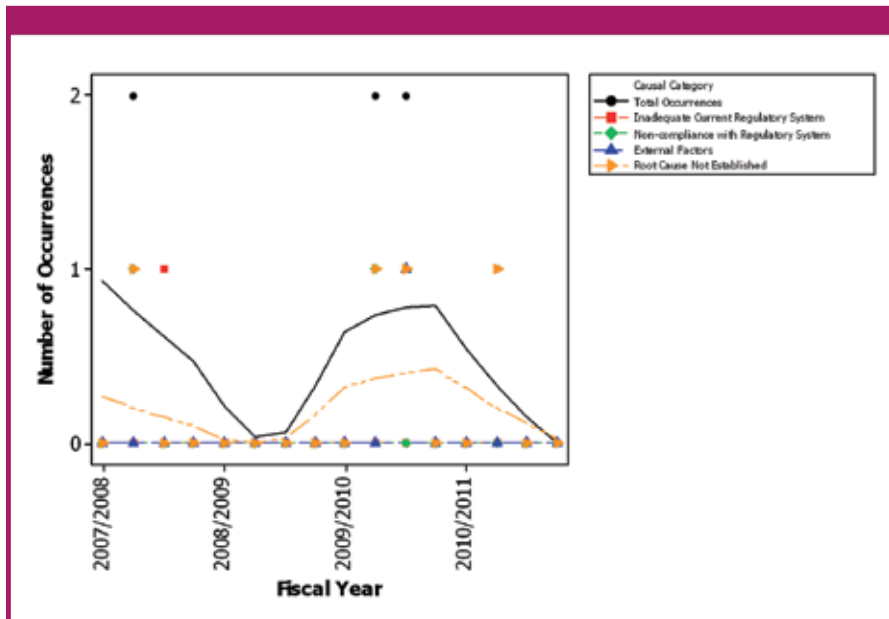


Figure BPV-1: Occurrences involving boilers and pressure vessels over the last four fiscal years.



Figure BPV-2 charts the number of fatalities and serious injuries involving boilers and pressure vessels over the last seven 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 demonstrates a decreasing trend over the measured time. There have been no injuries for most quarters and the trend is due to the injuries in the first few quarters in the covered period.

Figure BPV-2: Fatalities and serious injuries involving boilers and pressure vessels over the last seven fiscal years.

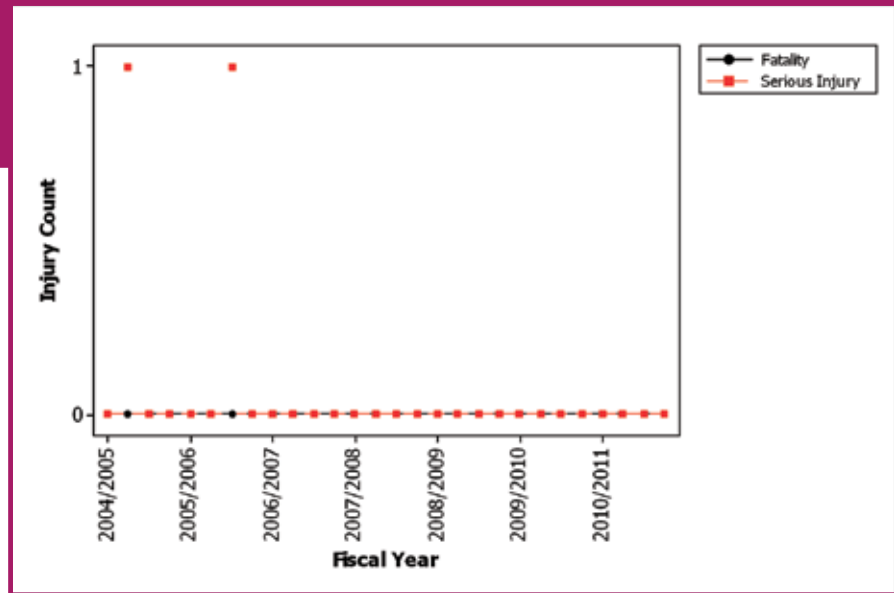


Figure BPV-3 illustrates the distribution of health impacts, as measured in DALYs, for inspected occurrences over the last four fiscal years. A statistical analysis of the data indicates that the total number of DALYs does not demonstrate a significant trend during this period. This analysis also reveals that the number of DALYs in each category do not exhibit significant trends over the measured time.

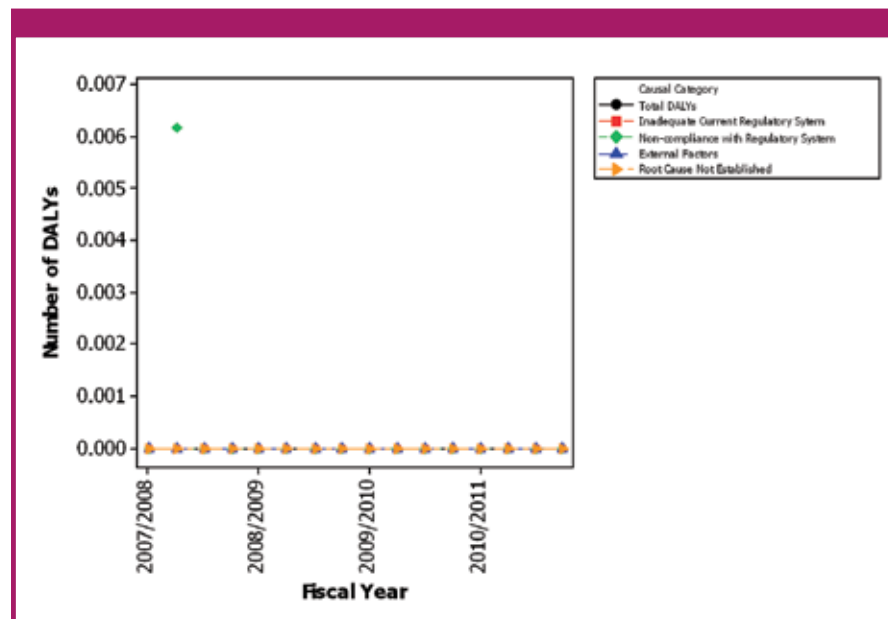


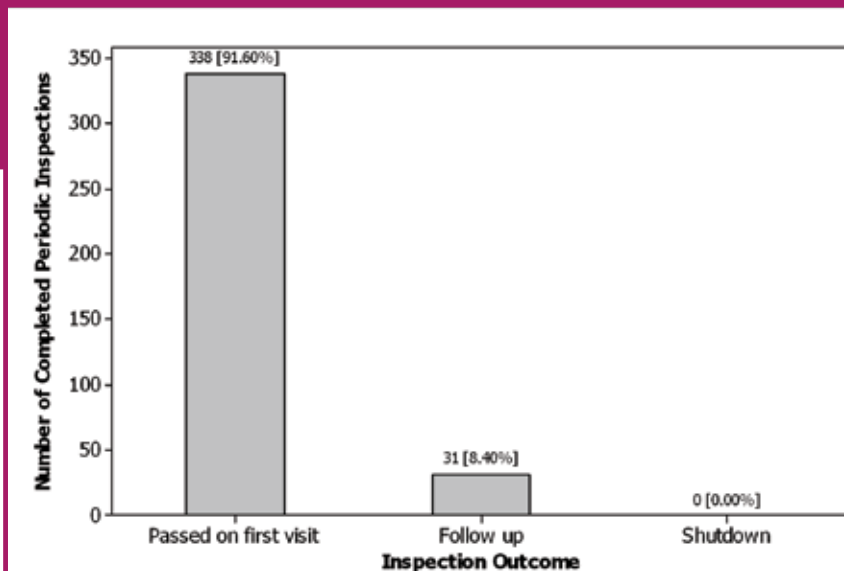
Figure BPV-3: The health impacts, as measured by DALYs, from occurrences involving boilers and pressure vessels and their causal categorization over the last four fiscal years.

Compliance Analysis

Periodic Inspections

There were 369 periodic inspections conducted in fiscal year 2010/2011. Each of these inspections results in an outcome as determined by a TSSA inspector, shown in Figure BPV-4. Of all periodic inspections completed in fiscal year 2010/2011, 91.60% were compliant on the first visit. Please note that the periodic inspections analyzed here only cover visits to facilities inspected by TSSA; that is, uninsured devices.

Figure BPV-4: Outcomes from boilers and pressure vessels periodic inspections completed in fiscal year 2010/2011.



TSSA inspectors issued a total of 23 inspection orders during the course of these periodic inspections. This yields an average number of inspection orders issued per inspection of 0.0623.



Compliance Related Trends

Figure BPV-5 charts the number of periodic inspections over the last seven fiscal years. A statistical analysis of this data indicates that the number of periodic inspections is seasonal and demonstrates a decreasing trend over the period at a rate of 2.45 inspections per quarter.

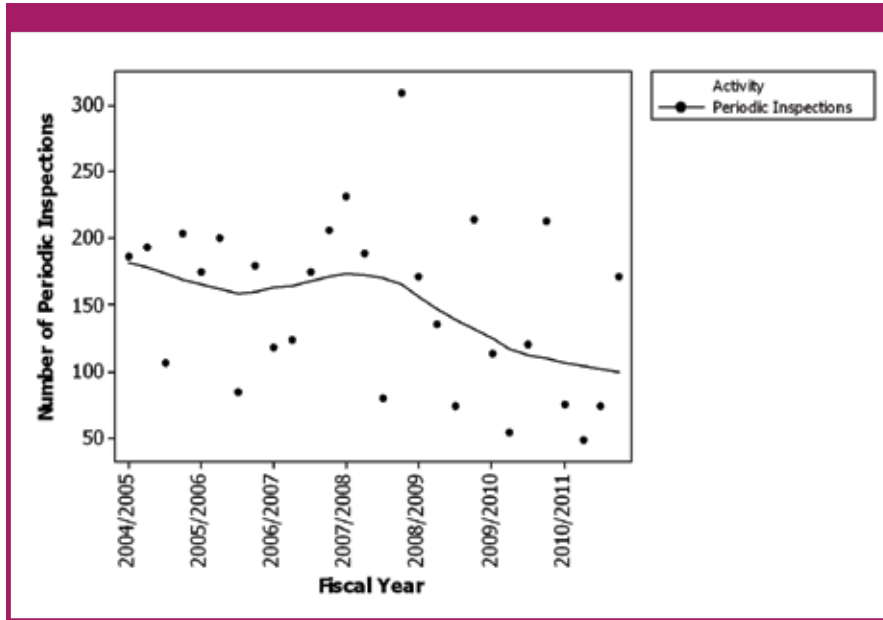


Figure BPV-5: Boilers and pressure vessels periodic inspections completed over the last seven fiscal years.

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

Figure BPV-6: The average number of inspection orders per boilers and pressure vessels periodic inspection over the last seven fiscal years.

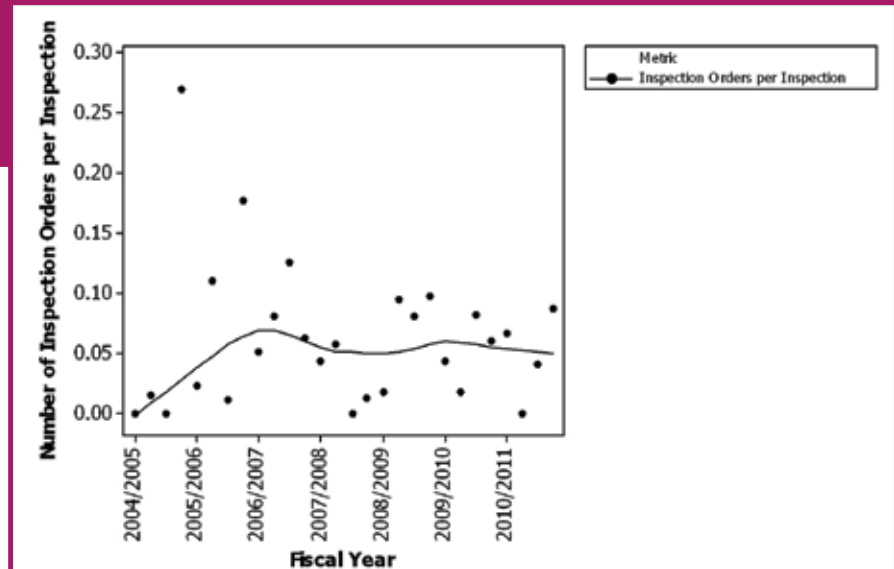
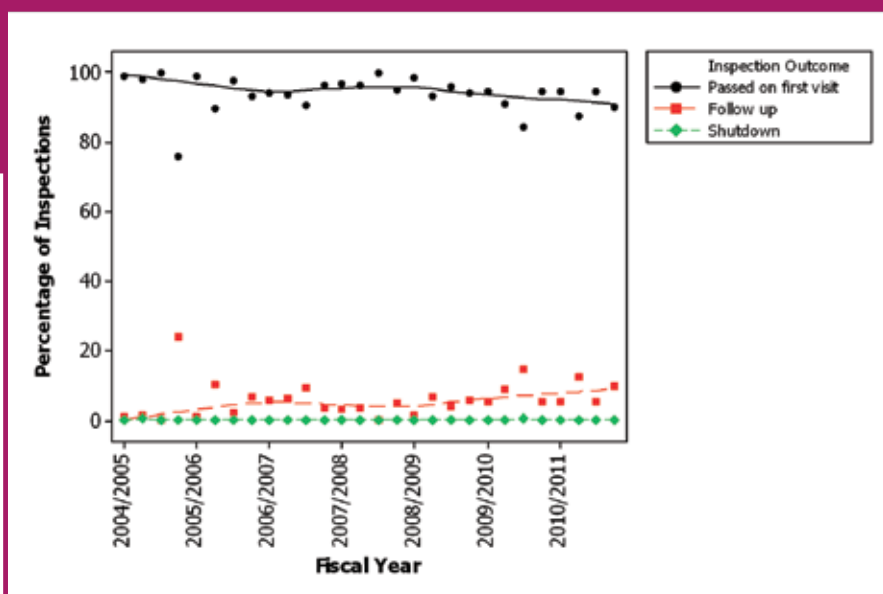


Figure BPV-7 charts the outcomes from the periodic inspections over the last seven fiscal years. A statistical analysis of this data indicates that there is an increasing trend in the percentage of 'Follow-up' inspection outcomes over the period at a rate of 0.19% per quarter. This analysis also reveals that there is a decreasing trend in the percentage of 'Passed on first visit' inspection outcome over the measured time at rate of 0.19% per quarter. The 'Shutdown' inspection outcome does not demonstrate a significant trend over this span. Since the average number of inspection orders per inspection is low, the level of compliance is expected to be high. The analysis shows that the percentage of inspections compliant with regulations on first visit dominates compared to all other inspection outcomes.

Figure BPV-7: The inspection outcomes of boilers and pressure vessels periodic inspections completed over the last seven fiscal years.



Other Safety and Risk Analysis Results

The prediction intervals, which represent the expected ranges of the indicator and are defined by the fifth and ninety-fifth percentiles of the trend data, for the compliance outcomes on boilers and pressure vessels are indicated in Table BPV-3.

Table BPV-3: Prediction intervals for compliance outcomes from boilers and pressure vessels for fiscal year 2011/2012.			
Activity	Indicator	Lower Prediction Bound	Upper Prediction Bound
Periodic Inspections	Percentage Passed on First Visit	79.72%	100.00%
	Percentage Follow-up	0.00%	19.90%
	Percentage Shutdown	0.00%	0.69%
	Number of Orders per Inspection	0.00	0.23

The prediction intervals generated from the trend data for the safety outcomes from boilers and pressure vessels are indicated in Table BPV-4.

Table BPV-4: Prediction intervals for safety outcomes from boilers and pressure vessels for fiscal year 2011/2012.			
Activity	Indicator	Lower Prediction Bound	Upper Prediction Bound
Occurrences	Number of Fatalities	0	0
	Number of Serious Injuries	0	1

Public Safety Decisions

TSSA Actions

Improving Compliance

New refrigerants with significantly higher pressure demands for installations usually using copper material require heavier wall copper tube and fittings. TSSA has held discussions with representatives in this industry sector to determine practical solutions for these installations since commercially available copper materials and components are potentially no longer rated appropriately.

Managing Safety Issues

Boilers – Internal Inspection

This risk reduction group in support of one of the safety priorities identified by the Boilers and Pressure Vessels Advisory Council last year has developed rationale from several sources in support of internal inspection requirements, including statistics and detailed accident reports from published sources as well as other pressure equipment legislation within North America. With the immediate focus on high- and low-pressure boilers, options are being explored for potentially a fixed internal inspection frequency and, where appropriate, a risk-based program for those facilities that can operate under a more comprehensive program.

Insurance Data Collection

TSSA is continuing to explore a process for receiving and collecting data electronically from insurers for insured pressure equipment. The benefits would include more effective control over insured pressure equipment inspections and a comprehensive consolidated equipment database for the province of Ontario, including technical data and location of installation.

Currently, information is received from insurers in hard copy form and requires significant administration time to manage. In an electronic system, each insurer would enter insurance status information and technical data for inspected equipment at the site.

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

Regulatory Improvements

TSSA participated in the development of two new annexes for the national Canadian Standards Association standard for pressure equipment, and both reached letter ballot status. One annex determines the requirements for finite element analysis reports and the other requirements for historical steam boilers. These issues are a shared concern by both Canadian jurisdictions and owner/users to establish requirements that can be applied consistently.

Operating Engineers

Operating engineers, known as power engineers in the majority of jurisdictions outside Ontario, are certified professional power plant managers and operators who oversee the provision of 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 3,100 plants in Ontario. In addition, the program is responsible, under the regulation, for the examination and certification of over 13,000 operating engineers and operators to confirm their qualifications. These activities ensure that all operating engineers and operators in Ontario have the skills and knowledge to safely manage, operate and maintain registered power plants.

Public Safety Analysis

Occurrence Analysis

There were no occurrences in the period May 1, 2010 to April 30, 2011.

Occurrence Related Trends

Figure OE-1 shows the number of occurrences to which TSSA has responded over the last four fiscal years and the associated causal categorization of these occurrences. A statistical analysis of this data indicates that the number of occurrences involving operating engineers does not demonstrate a significant trend over the period. This analysis also reveals that there are no significant trends in the number of occurrences in any of the causal categories. The occurrences in this program are relatively rare.

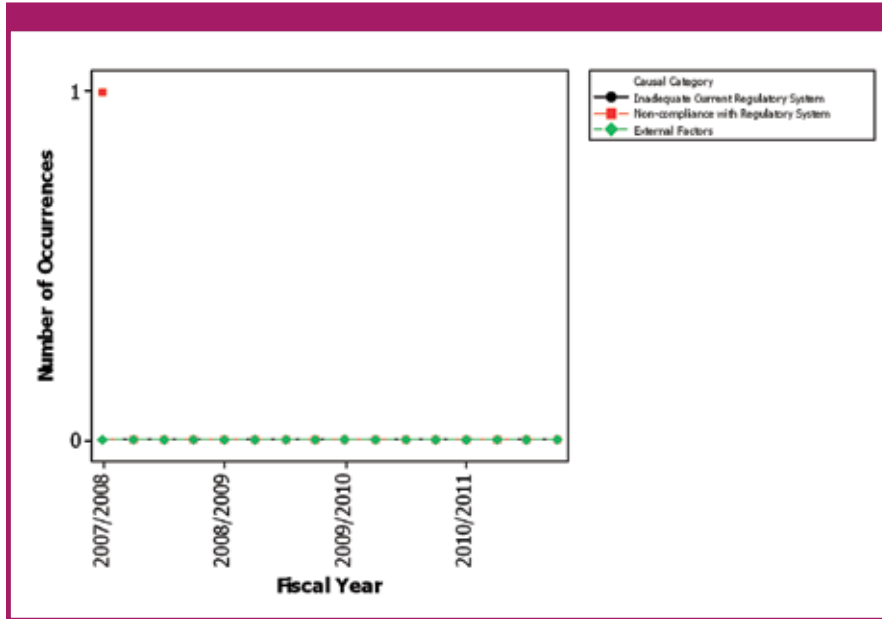


Figure OE-1: Occurrences involving operating plants over the last four fiscal years.

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

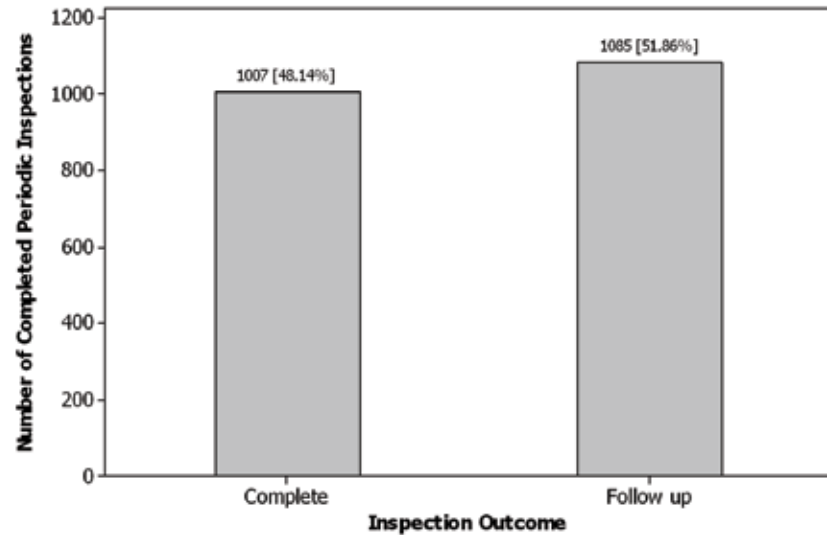
TSSA uses permissive powers provided in Section 21 of the Technical Standards and Safety Act, 2000 to inspect plants in Ontario with registered Operating Engineers. TSSA uses a risk-based approach to schedule these inspections that uses historic compliance performance information. The result is that inspections have a schedule with frequencies between six months and two years.

Compliance Analysis

Periodic Inspections

There were 2,092 periodic inspections conducted in fiscal year 2010/2011. Each of these inspections results in an outcome as determined by a TSSA inspector, shown in Figure OE-2. Of all periodic inspections completed in fiscal year 2010/2011, 48.14% were compliant on the first visit.

Figure OE-2: Outcomes from operating plant periodic inspections completed in fiscal year 2010/2011.



TSSA inspectors issued a total of 3,348 inspection orders during the course of these periodic inspections. This yields an average number of inspection orders issued per inspection of 1.60.

Compliance Related Trends

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

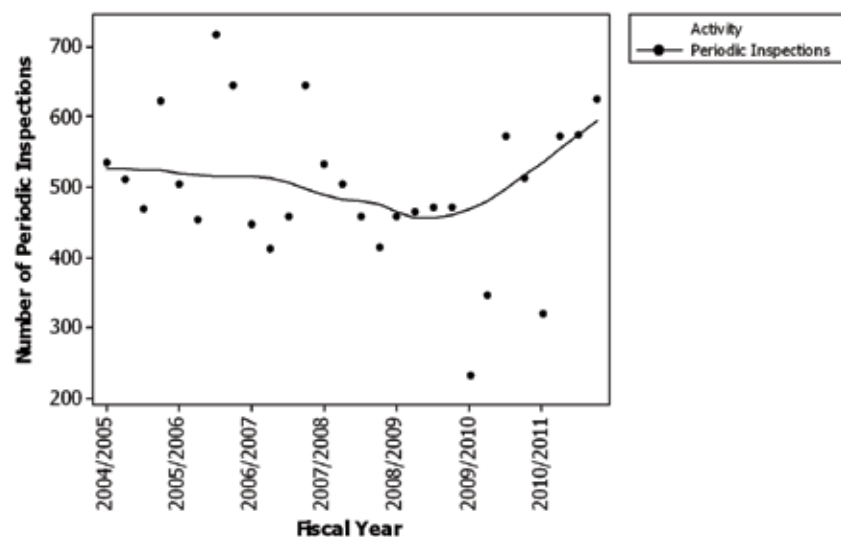


Figure OE-3: Operating plant periodic inspections completed over the last seven fiscal years.

Figure OE-4 provides the average number of inspection orders per inspection for the last seven fiscal years. A statistical analysis of this data indicates that the average number of inspection orders per inspection demonstrates a decreasing trend over the period at a rate of 0.05 per quarter.

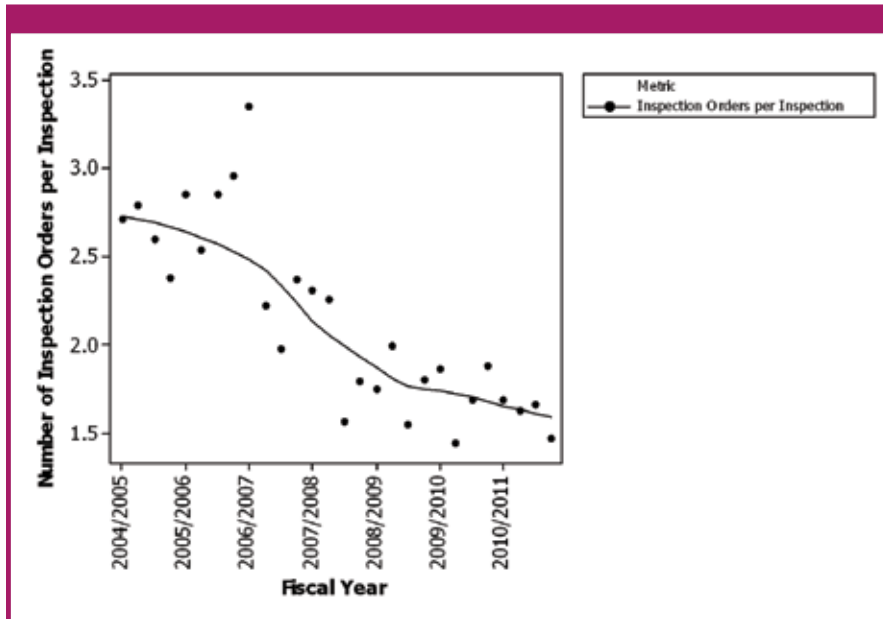
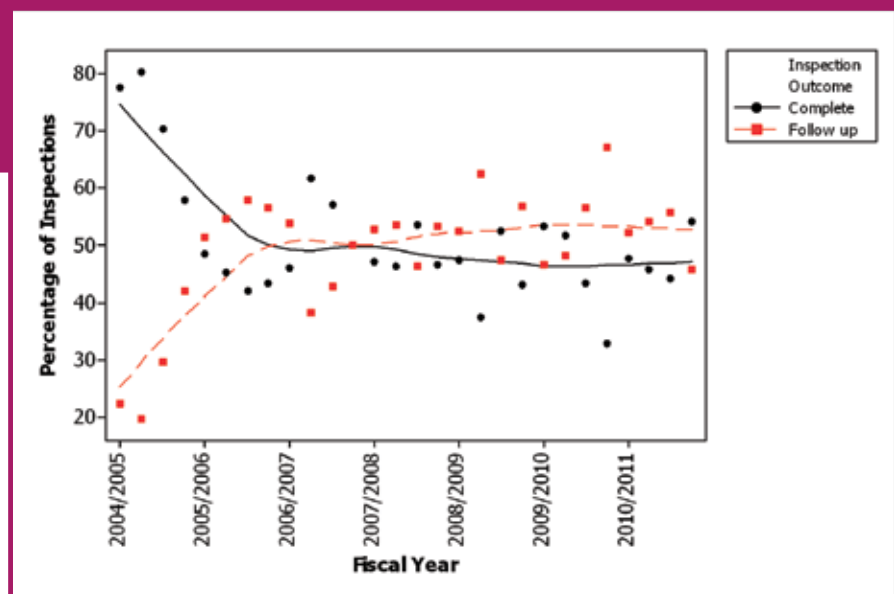


Figure OE-4: The average number of inspection orders per operating plant periodic inspection over the last seven fiscal years

Figure OE-5 charts the outcomes from the periodic inspections over the last seven fiscal years. A statistical analysis of this data over the entire period indicates there is an increasing trend in the percentage of 'Follow-up' inspection outcomes at a rate of 0.55% per quarter, and a decreasing trend in the percentage of 'Complete' inspection outcomes at a rate of 0.55% per quarter.

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



Other Safety and Risk Analysis Results

The prediction intervals, which represent the expected ranges of the indicator and are defined by the fifth and ninety-fifth percentiles of the trend data, for the compliance outcomes on operating plants are indicated in Table OE-1.

Table OE-1: Prediction intervals for compliance outcomes from operating engineers for fiscal year 2011/2012.

Activity	Indicator	Lower Prediction Bound	Upper Prediction Bound
Periodic Inspections	Percentage Complete	34.92%	79.14%
	Percentage Follow-up	20.86%	65.08%
	Number of Orders per Inspection	1.46	3.18

Public Safety Decisions

TSSA Actions

Improving Compliance

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

Managing Safety Issues

Steam Turbine Governors

A study of steam turbine governor systems has been completed. One of the findings of the study is that stop valves are the “weak link” in the turbine overspeed protection systems. The need for mandated test procedures and intervals, based on best practices and industry standards with Ontario, is being examined. The risk reduction group developed a questionnaire for industry and is currently working on getting sufficient responses in order to report back to the Advisory Council on the status of the industry response.

Thermal Oil Plants

Currently, Ontario does not regulate the operation of thermal oil plants. This technology has a higher relative potential than other technologies to cause hot oil burns and fires. A risk reduction group was formed to investigate this technology. TSSA will review any recommendations from the study and make recommendations to the government of Ontario on regulatory change to ensure the safe operation and maintenance of thermal oil plants.

Power Engineers

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

Regulatory Improvements

Revisions and amendments to Ontario Regulation 219/01, Power Engineering (formerly Operating Engineers), developed in consultation with industry, have been submitted to MCS for approval. The revised regulation addresses some of the issues associated with the above noted power engineers skills shortage risk by modifying training and certification requirements, plant registration levels, attendance requirements for newer technologies and other aspects of power engineering.



Elevating Devices and Amusement Devices

Amusement Devices

TSSA regulates over 1,500 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 (and other circular motion rides), waterslides, flume rides, dry slides, go-karts, bumper carts, inflatables (inflatable bouncers), bungee devices, bungee assisted bounces, zip lines (track and cable rides), and other generic spinning and whirling rides.

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

Public Safety Analysis

Occurrence Analysis

Table AD-1 summarizes the amusement devices occurrences reported to TSSA in accordance with the reporting guidelines provided to stakeholders. These occurrences can be categorized as an incident or a near-miss and Table AD-1 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.

In response to an incident in Alberta, TSSA constituted a focus group that involved industry participants to get an understanding of the potential failures of rides due to age related factors including fatigue, corrosion, wear, transportation and deficient maintenance. TSSA used an in-house developed failure analysis tool to facilitate discussions with the focus group. The utility of the tool was well appreciated by the industry participants. Amusement ride owners have requested TSSA to develop and create a similar tool to allow them to proactively carry out failure assessments and prevent equipment failure induced incidents.

Occurrences not requiring formal inspections do not involve a device-related failure. These are attributed to human factors that are outside of the control or influence of TSSA and have been treated accordingly in the health impact analysis.

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

Occurrence Detail	Number of Occurrences May 1, 2010 – April 30, 2011
Number of Incidents	93
Number of Near-Misses	6
Occurrences Within TSSA Jurisdiction	99
▪ Completed Causal Analysis	11
▪ Unable to Establish Root Cause	0
▪ In Progress	6
▪ Not Requiring Formal Inspection	82
Total Occurrences	99
Occurrences Outside TSSA Jurisdiction	0
Number of Fatalities	0
Number of Serious Injuries	2
Number of Minor Injuries	84

The two serious injuries occurred on the following devices: a freefall ride and a waterslide. Both of these occurrences were a result of factors external to the regulatory system. The full causal categorization for the fiscal year is presented in Table AD-2. The categorization below is made on occurrences whose inspection has been completed or those that did not require a formal inspection.

Table AD-2: Causal categorization for amusement devices occurrences.

Causal Category	Number of Occurrences	Percentage of Occurrences	Health Impacts (DALYs)	Percentage of Total Health Impacts
1. Inadequate Current Regulatory System	1	1.08%	0.0004	0.06%
2. Non-compliance with Regulatory System	2	2.15%	0.0041	0.53%
3. External Factors	89	95.70%	0.7649	99.36%
4. Root Cause Not Established	1	1.08%	0.0004	0.06%

For more details about TSSA's response to occurrences in the inadequate current regulatory system causal category, please see the Public Safety Decisions section.

Occurrence Related Trends

Figure AD-1 shows the number of occurrences to which TSSA has responded over the last four fiscal years and the associated causal categorization of these occurrences. A statistical analysis of this data indicates that the number of occurrences on amusement devices is seasonal and does not demonstrate a significant trend over the four year period. This analysis also reveals that the number of occurrences due to non-compliance with the regulatory system is seasonal and exhibits a decreasing trend over the measured time at a rate of 0.25 occurrences per quarter. All other causal categories do not show a significant trend. The primary contributor to the occurrences due to external factors continues to be "Failure to follow user instructions."

Figure AD-1: Amusement devices occurrences and their causal categorization over the last four fiscal years.

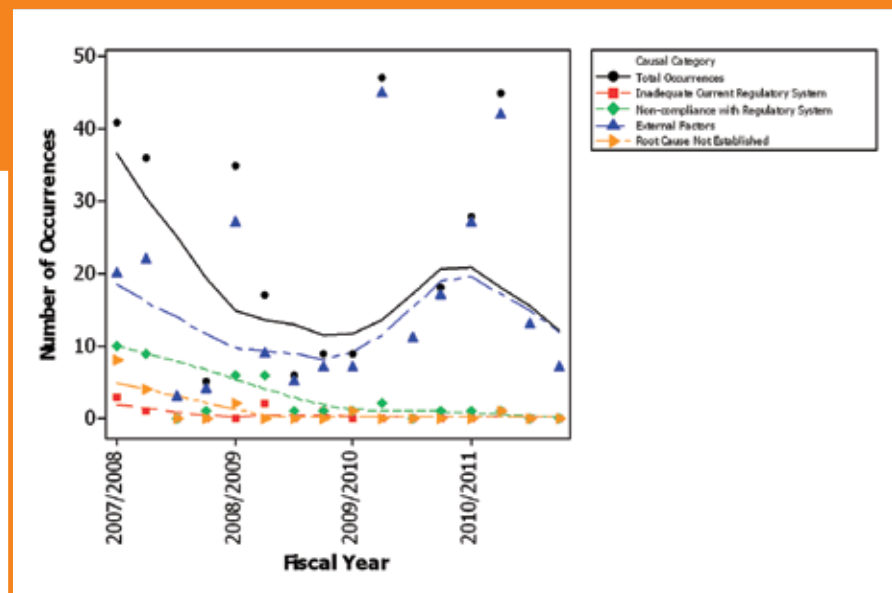


Figure AD-2 charts the number of amusement devices fatalities and serious injuries over the last seven fiscal years. As illustrated, there have been no fatalities on amusement devices within TSSA's jurisdiction during this period. A statistical analysis of this data indicates that the number of serious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

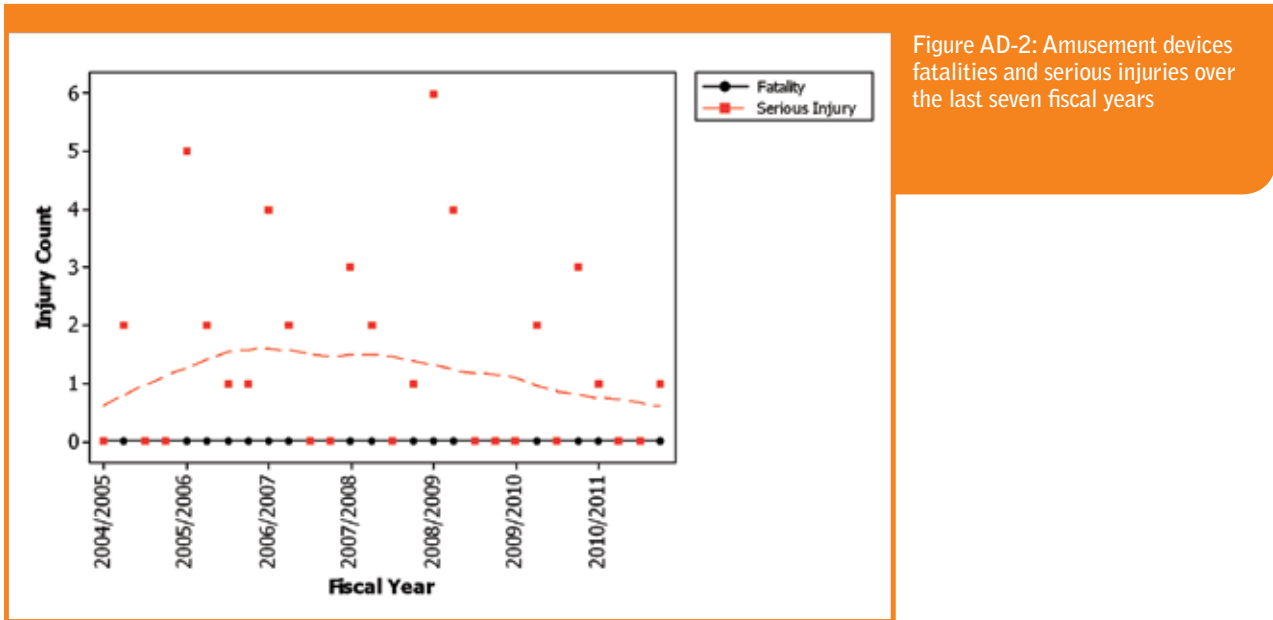
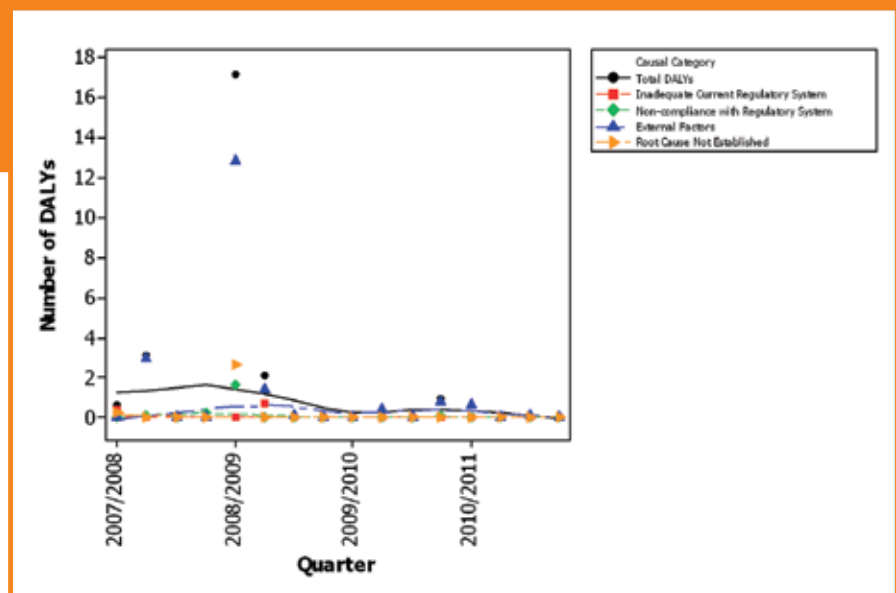


Figure AD-3 illustrates the distribution of health impacts as measured by DALYs for inspected occurrences over the last four fiscal years. A statistical analysis of the data indicates that the overall health impacts, as measured by the total number of DALYs, do not demonstrate a significant trend over the period. This analysis also reveals that the health impacts associated with non-compliance with the regulatory system exhibit a decreasing trend over the measured time at a rate of 0.0006 DALYs per quarter. All other causal categories do not show a significant trend.

Figure AD-3: The health impacts, as measured in DALYs, from occurrences on amusement devices and their causal categorization over the last four fiscal years.

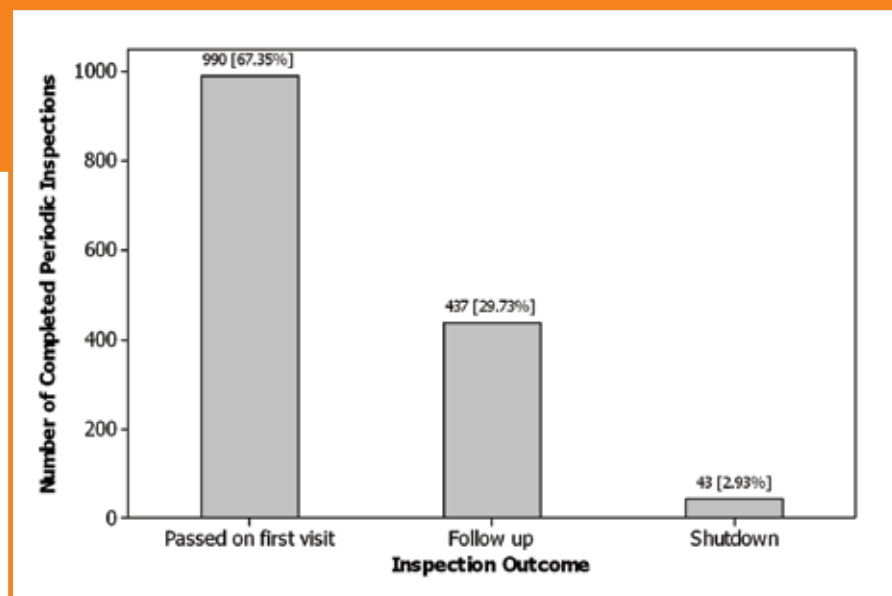


Compliance Analysis

Periodic Inspections

There were 1,470 periodic inspections conducted in fiscal year 2010/2011. Each of these inspections results in an outcome as determined by a TSSA inspector, shown in Figure AD-4. Of all periodic inspections completed in fiscal year 2010/2011, 67.35% were compliant with regulations on the first visit.

Figure AD-4: Outcomes from amusement devices periodic inspections completed in fiscal year 2010/2011.



TSSA inspectors issued a total of 1,477 inspection orders during the course of these periodic inspections. This yields an average number of inspection orders issued per inspection of 1.00.

Compliance Related Trends

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

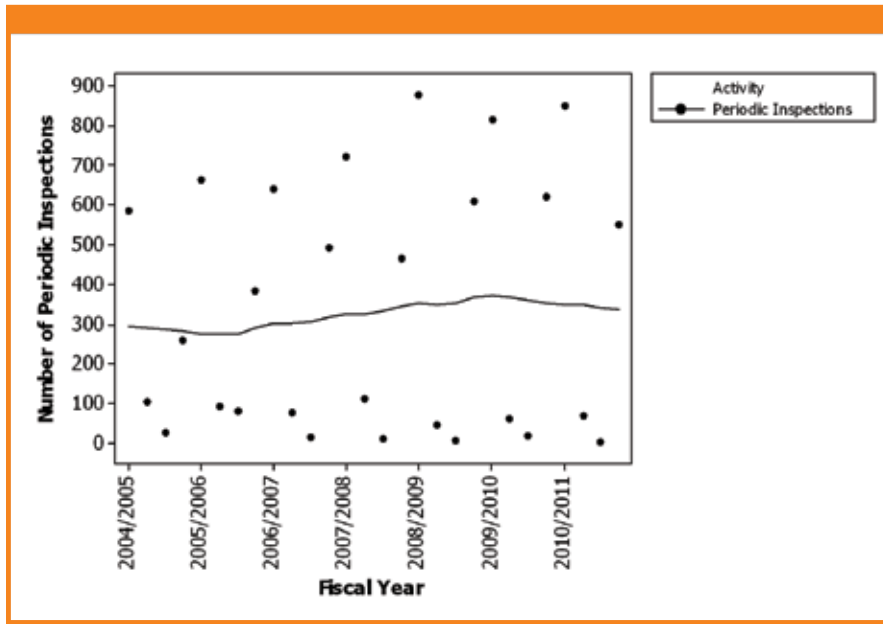


Figure AD-5: Amusement devices periodic inspections completed over the last seven fiscal years.

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

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

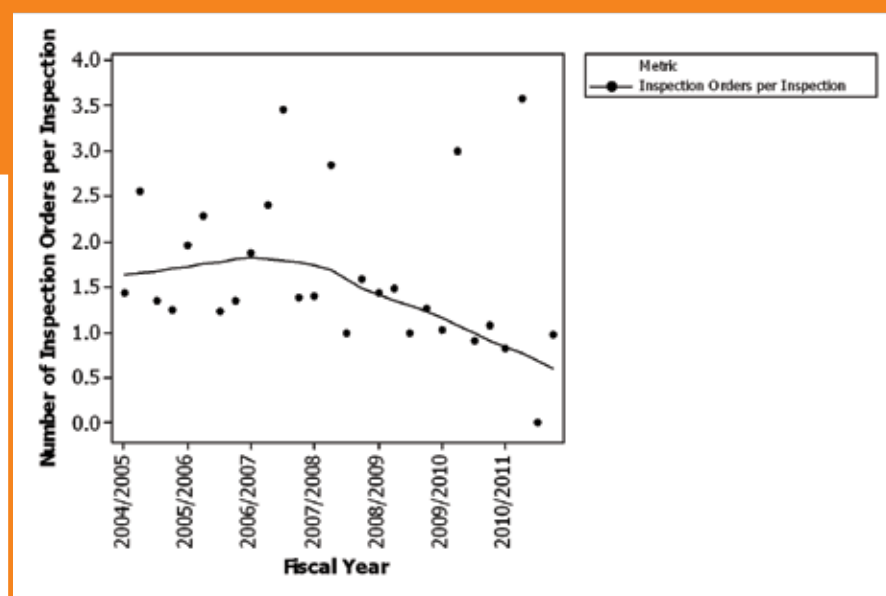
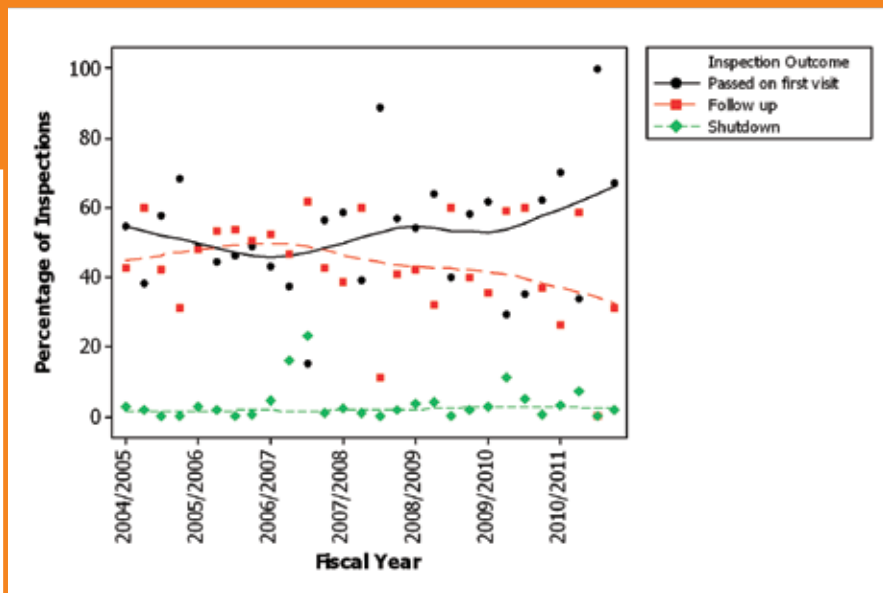


Figure AD-7 charts the outcomes from the periodic inspections over the last seven fiscal years. A statistical analysis of this data indicates that there is a decreasing trend in the percentage of 'Follow-up' inspection outcomes over the period at a rate of 0.49% per quarter. This analysis also reveals that the percentage of 'Shutdown' inspection outcomes is seasonal. This outcome and the percentage of 'Passed on first visit' inspection outcomes do not exhibit significant trends.

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



Other Safety and Risk Analysis Results

The prediction intervals, which represent the expected ranges of the indicator and are defined by the fifth and ninety-fifth percentiles of the trend data, for the compliance outcomes on amusement devices are indicated in Table AD-3.

Table AD-3: Prediction intervals for compliance outcomes from amusement devices for fiscal year 2011/2012.

Table AD-3: Prediction intervals for compliance outcomes from amusement devices for fiscal year 2011/2012.			
Activity	Indicator	Lower Prediction Bound	Upper Prediction Bound
Periodic Inspections	Percentage Passed on First Visit	21.74%	95.00%
	Percentage Follow-up	5.00%	60.85%
	Percentage Shutdown	0.00%	19.89%
	Number of Orders per Inspection	0.37	3.52

The prediction intervals generated from the trend data for the safety outcomes from amusement devices are indicated in Table AD-4.

Table AD-4: Prediction intervals for safety outcomes from amusement devices for fiscal year 2011/2012.			
Activity	Indicator	Lower Prediction Bound	Upper Prediction Bound
Occurrences	Number of Fatalities	0	0
	Number of Serious Injuries	0	6

Public Safety Decisions

TSSA Actions

Improving Compliance

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

Managing Safety Issues

Analysis continues to identify "Failure to follow user instructions" as the dominant root and contributing cause of occurrences. In response to this, TSSA established a safety outreach partnership with the Fire Marshal's Public Fire Safety Council and the Toronto Blue Jays to raise awareness with young target audiences, distributing approximately 130,000 special safety-edition baseball collector card decks, through local distribution by fire departments and during a Fire Safety Day during a Blue Jays game at the Rogers Centre, highlighting various fire, go-kart and waterslide safety tips to children across the province. In addition, TSSA, working with industry and other regulators, completed a risk assessment on aging amusement devices. The need for an assessment of aging rides was highlighted by a tragic incident involving a ride at the Calgary Stampede in July, 2010. The specific outcome of the risk assessment is reflected in recommendations to review the current design of log books, and enhance welding and non-destructive testing requirements.

Regulatory Improvements

TSSA continues to lead the work on the harmonization of amusement device standards that are being undertaken by the American Society for Testing and Materials (ASTM) F24 and CSA Z267 Amusement Devices Safety Codes. The key benefit of this process is harmonized safety requirements across North America, Europe and Australia, leading to more consistent regulatory requirements, making compliance easier for operators.

The occurrence identified in Table AD-2, where an individual slipped down the stairs of a fun house during rainy conditions and sustained a minor injury, falls under the inadequate current regulatory system category. The device was subsequently found to be compliant with current regulatory requirements, including codes and standards. This type of occurrence does not currently represent a significant safety concern; however, occurrences of this type will be monitored and if a significant trend arises, potential regulatory changes, including design requirements, will be assessed.

Elevators

TSSA regulates over 48,000 operating elevators in Ontario to ensure all devices conform to the *Technical Standards and Safety Act, 2000* and applicable regulations, codes and standards. TSSA reviews and registers elevating devices, issues licences, conducts inspections and performs incident investigations. These devices include elevators (passenger, freight, hand powered, observation, sidewalk, temporary elevators, and limited use limited application elevators), dumbwaiters, material and freight platform lifts (type A and B), lifts for persons with physical disabilities, manlifts, construction hoists, incline lifts, stage lifts, and parking garage lifts.

Public Safety Analysis

Occurrence Analysis

Table ED-1 summarizes the occurrences on elevators reported to TSSA in accordance with the reporting guidelines provided to 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 inspections do not involve a device-related failure. These are attributed to human factors that are outside of the control or influence of TSSA and have been treated accordingly in the health impact analysis.

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

Occurrence Detail	Number of Occurrences May 1, 2010 – April 30, 2011
Number of Incidents	128
Number of Near-Misses	96
Occurrences Within TSSA Jurisdiction	224
▪ Completed Causal Analysis	37
▪ Unable to Establish Root Cause	2
▪ In Progress	14
▪ Not Requiring Formal Inspection	171
Total Occurrences	224
Occurrences Outside TSSA Jurisdiction	0
Number of Fatalities ¹⁴	1
Number of Serious Injuries	7
Number of Minor Injuries	108

¹⁴ The fatality listed in Table ED-1 is not included in the causal or trend analysis since the occurrence inspection is ongoing. The results of the inspection will be included in the next edition of this report.

The fatality listed in Table ED-1 occurred on a passenger elevator as a result of complications that arose from injuries sustained when the victim tripped and fell while entering the elevator, which was not level with the floor. The elevator involved is a two speed elevator. Although the elevator was about 12 mm (3/8") off level, it was compliant with the regulations as it met the requirements of the code under which it was installed. This was an unfortunate incident; and, current risk reduction groups dealing with elevator machine brake operation are looking at all aspects of machine brake operation. The seven serious injuries occurred on the following devices: one on a freight platform lift-type B, two on freight elevators and four on passenger elevators. The occurrence on the freight platform and one of the passenger elevators were due to external factors. The rest were due to non-compliance with the regulatory system. The full causal categorization for the fiscal year is presented in Table ED-2. The categorization below is made on occurrences whose inspection has been completed or those that did not require a formal inspection.

Table ED-2: Causal categorization for occurrences on elevators

Causal Category	Number of Occurrences	Percentage of Occurrences	Health Impacts (DALYs)	Percentage of Total Health Impacts
1. Inadequate Current Regulatory System	1	0.48%	0.0000	0.00%
2. Non-compliance with Regulatory System	19	9.05%	0.3126	27.80%
3. External Factors	186	88.57%	0.8120	72.20%
4. Root cause not established	4	1.90%	0.0000	0.00%

For more details about TSSA's response to occurrences in the inadequate current regulatory system causal category, please see the Public Safety Decisions section below.

Occurrence Related Trends

Figure ED-1 shows the number of occurrences to which TSSA has responded over the last four fiscal years and the associated causal categorization of these occurrences. A statistical analysis of this data indicates that the number of occurrences on elevators does not demonstrate a significant trend over the period. This analysis also reveals that over the measured time there are decreasing trends in the number of occurrences due to non-compliance with the regulatory system and without an established root cause, at the rates of 1 and 0.225 occurrences per quarter, respectively. There is an increasing trend in the number of occurrences due to external factors, at a rate of 1.92 occurrences per quarter. The other causal category does not show a significant trend. The primary contributor to the occurrences due to external factors continues to be "Failure to follow user instructions."

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

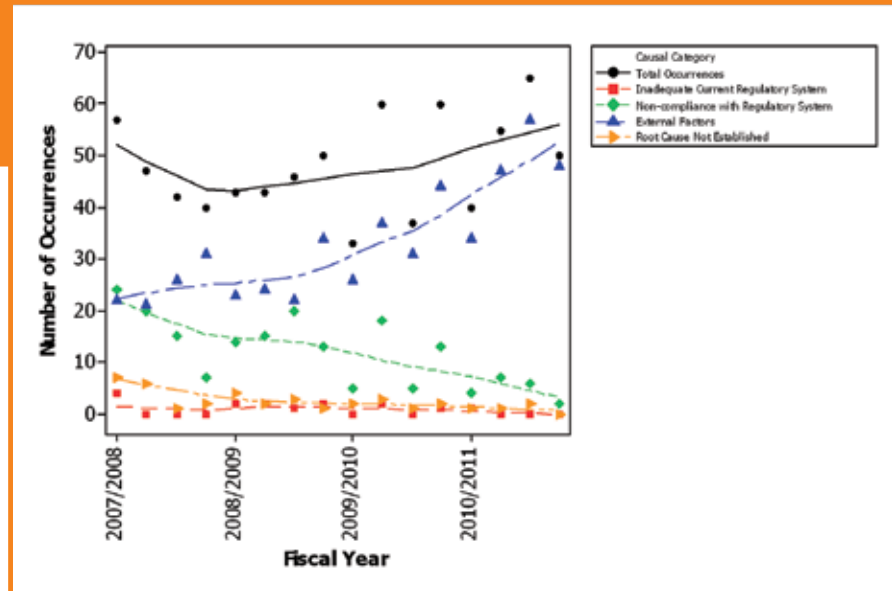


Figure ED-2 charts the number of fatalities and serious injuries on elevators over the last seven fiscal years. As illustrated, there have been no fatalities on elevators within TSSA's jurisdiction during this period¹⁵. A statistical analysis of this data indicates that the number of serious injuries demonstrates a decreasing trend over the measured period at a rate of 0.09 injuries per quarter.

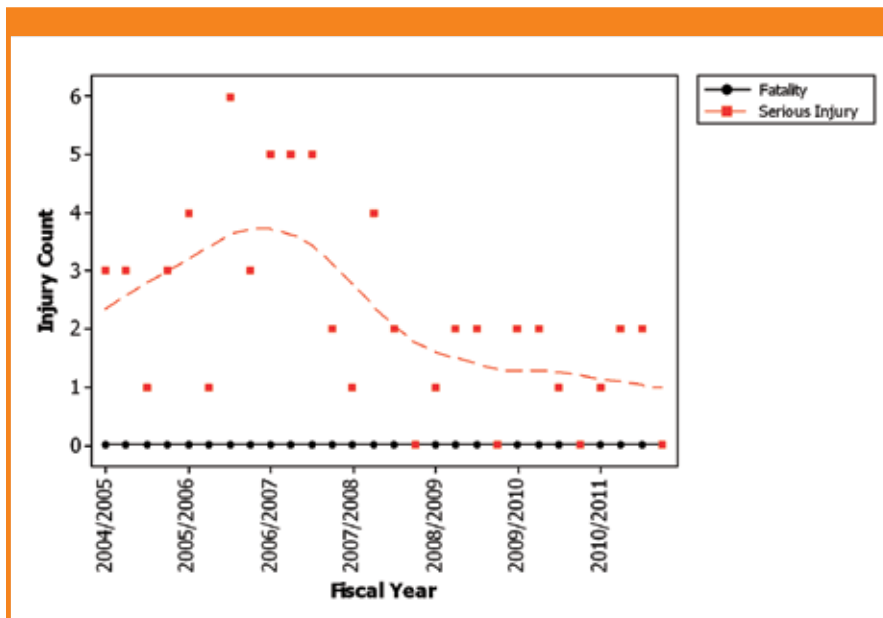


Figure ED-2: Fatalities and serious injuries involving elevators over the last seven fiscal years.

¹⁵ This does not include the fatality listed in Table ED-1. The results of the inspection will be included in the next edition of this report.

Figure ED-3 illustrates the distribution of health impacts, as measured by DALYs, for inspected occurrences over the last four fiscal years. A statistical analysis of the data indicates that the overall health impacts, as measured by the total number of DALYs, is seasonal and does not demonstrate a significant trend over the period. This analysis also reveals that the health impacts as represented by the number of DALYs associated with occurrences without an established root cause exhibits a decreasing trend over the measured time at a rate of 0.0002 DALYs per quarter. All other causal categories do not show a significant trend.

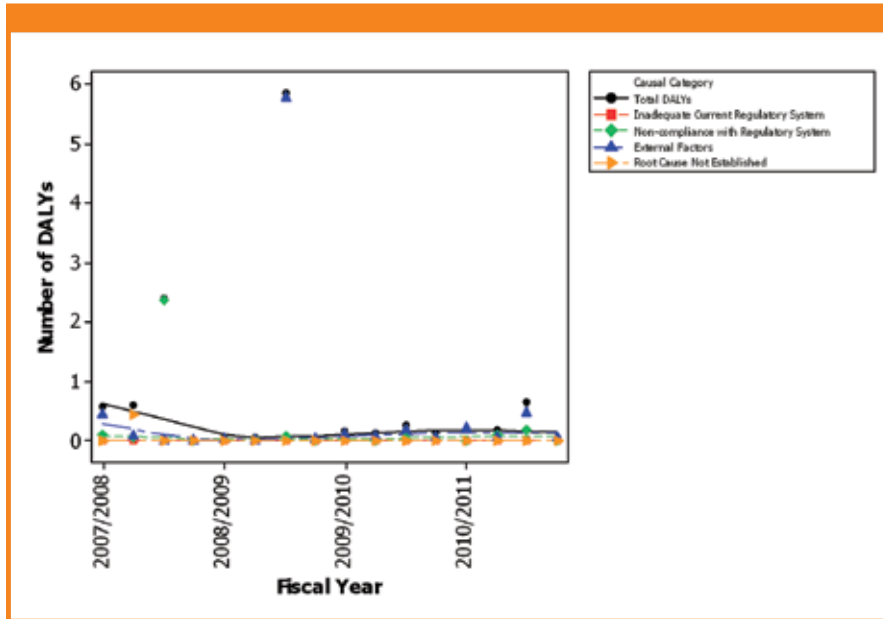


Figure ED-3: The health impacts, as measured by DALYs, from occurrences on elevators and their causal categorization over the last four fiscal years.

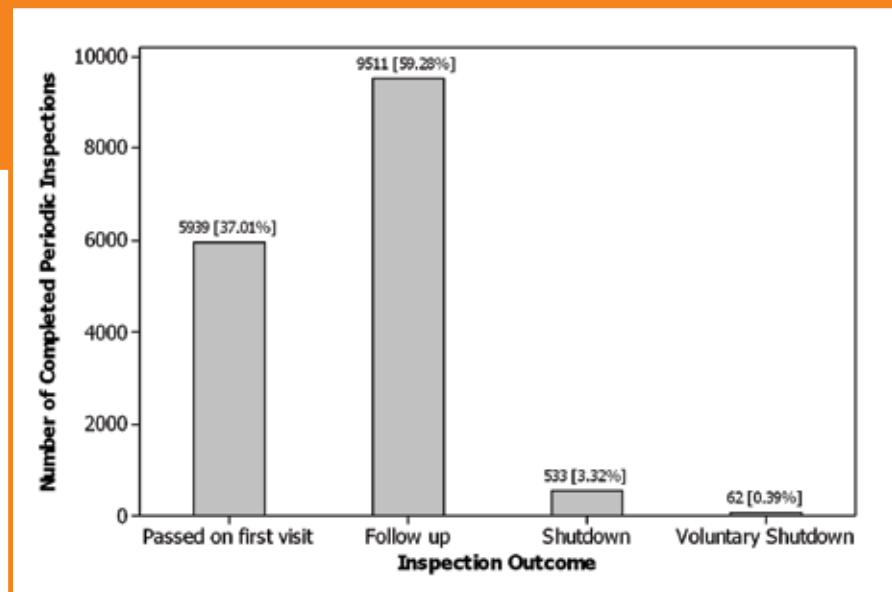


Compliance Analysis

Periodic Inspections

There were 16,045 periodic inspections conducted in fiscal year 2010/2011. Each of these inspections results in an outcome as determined by a TSSA inspector, shown in Figure ED-4. Of all periodic inspections completed in fiscal year 2010/2011, 37.01% were compliant with regulations on the first visit.

Figure ED-4: Outcomes from elevator periodic inspections completed in fiscal year 2010/2011.



TSSA inspectors issued a total of 32,387 inspection orders during the course of these periodic inspections. This yields an average number of inspection orders issued per inspection of 2.02.

Compliance Related Trends

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

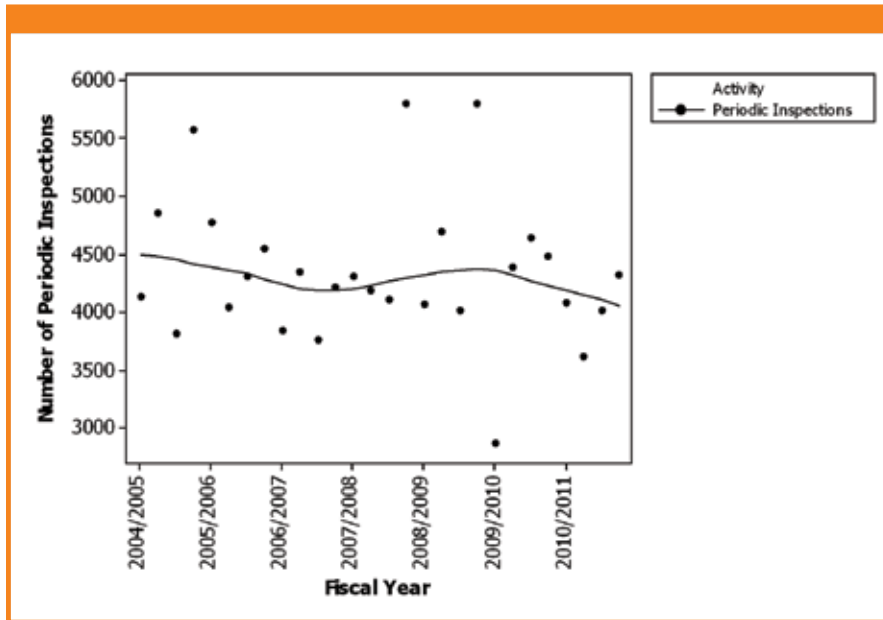


Figure ED-5: Periodic inspections completed on elevators over the last seven fiscal years.

Figure ED-6 provides the average number of inspection orders per inspection for the last seven fiscal years. A statistical analysis of this data indicates that the average number of inspection orders per inspection demonstrates a decreasing trend over the period at a rate of 0.01 orders per inspection per quarter.

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

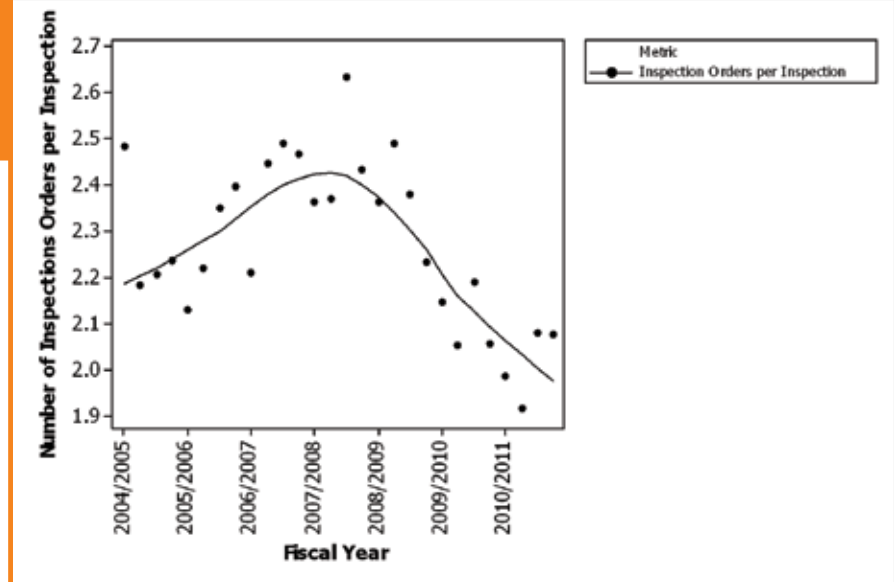
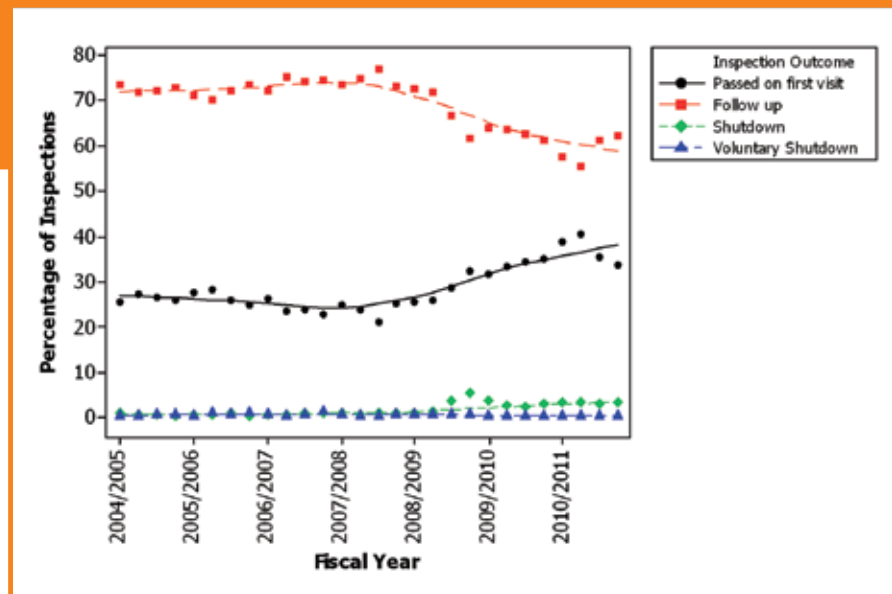


Figure ED-7 charts the outcomes from the periodic inspections over the last seven fiscal years. A statistical analysis of this data indicates that over the period there are increasing trends in the percentage of 'Passed on first visit' and 'Shutdown' inspection outcomes over the last seven fiscal years at rates of 0.40% and 0.11% per quarter respectively. This analysis also reveals that over the measured time there are decreasing trends in the percentage of 'Follow-up' and 'Voluntary Shutdown' inspection outcomes at rates of 0.50% and 0.01% per quarter respectively.

Director's order 218/07 was issued and came into full effect in the fourth quarter of fiscal year 2007/2008. A statistical analysis of both regions separated by that quarter indicates that the outcomes demonstrate statistically significant behaviour. The 'Passed on first visit' inspection outcome went from a decreasing trend at 0.35% per quarter to an increasing trend at 1.32% per quarter. The 'Follow-up' inspection outcome changed from an increasing trend at 0.27% per quarter to a decreasing trend at 1.19% per quarter.

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



Statistical analysis indicates that TSSA's decision to address increasing trends in non-compliance in the elevating devices sector with respect to conducting annual examinations and tests is having a positive effect. TSSA's enforcement policies over the three-year period seem to indicate a gradual increase in the pass rate of TSSA periodic inspections suggesting an improvement in compliance. TSSA, in an effort to accelerate the rate of compliance, has introduced additional penalties for non-compliant devices.

Other Safety and Risk Analysis Results

The prediction intervals, which represent the expected ranges of the indicator and are defined by the fifth and ninety-fifth percentiles of the trend data, for the compliance outcomes from elevators are indicated in Table ED-3.

Table ED-3: Prediction intervals for compliance outcomes from elevators for fiscal year 2011/2012.			
Activity	Indicator	Lower Prediction Bound	Upper Prediction Bound
Periodic Inspections	Percentage Passed on First Visit	22.06%	39.80%
	Percentage Follow-up	56.38%	76.31%
	Percentage Shutdown	0.50%	4.64%
	Percentage Voluntary Shutdown	0.26%	1.20%
	Number of Orders per Inspection	1.95	2.57

Prediction intervals for elevators, escalators and moving walks combined have also been calculated for the compliance outcomes as shown in Table ED-4.

Table ED-4: Prediction intervals for compliance outcomes from elevators, escalators and moving walks for fiscal year 2011/2012.			
Activity	Indicator	Lower Prediction Bound	Upper Prediction Bound
Periodic Inspections	Percentage Passed on First Visit	21.79%	39.48%
	Percentage Follow-up	56.71%	76.41%
	Percentage Shutdown	0.52%	4.68%
	Percentage Voluntary Shutdown	0.25%	1.26%
	Number of Orders per Inspection	1.95	2.59

The prediction intervals generated from the trend data for the safety outcomes from elevators, escalators and moving walks combined are indicated in Table ED-5.

Table ED-5: Prediction intervals for safety outcomes from elevators, escalators and moving walks for fiscal year 2011/2012.			
Activity	Indicator	Lower Prediction Bound	Upper Prediction Bound
Occurrences	Number of Fatalities	0	1
	Number of Serious Injuries	0	9

Public Safety Decisions

TSSA Actions

Improving Compliance

Through the introduction of a number of key enforcement initiatives, including elevator shutdowns and three times fees, compliance levels rose 10.4% as indicated by the percentage of inspections compliant with regulations on first visit for fiscal year 2010/2011 over the fiscal year 2009/2010. Furthermore, the number of orders per periodic inspection was lower for each quarter in fiscal year 2010/2011 than in the one previous, indicating improved industry compliance. This indicates that Director's Order 218/07 and 218/07-r1, which address enforcement procedures along with other enforcement activities, is producing the desired outcome of improved compliance. Improved compliance will continue to be an area of focus over the coming years.

Managing Safety Issues

TSSA delivered presentations to owners/professional associations and issued communications to elevating device owners reminding them of their legal responsibilities with regard to elevator maintenance and oversight of their maintenance contractors.

TSSA issued Director's Order 248/11 requiring the addition of a pressure sensor on all existing lifts for persons with physical disabilities where the hydraulic cylinder is above the top of the hydraulic oil storage tank. The required action will raise the level of safety for existing elevating devices to be consistent with newer devices.

Working with the MOL and industry, TSSA completed a review of car top fall hazards and issued Director's Order 245/10 mandating car top guard rails on all existing elevators by December 2013. Actions taken were as a result of an elevator mechanic's fall from a car top and to reduce the risk of fall from heights for all industry personnel from elevator car tops.

As a member of the National Association of Elevator Safety Authorities Canadian Region (NAESA), TSSA partnered with NAESA members and provided leadership in the organization of the annual training workshop for its inspectors and engineers, alongside inspectors from other provinces and industry members. Participation in the workshops provides the necessary education credits to qualify TSSA inspectors and engineers to write the annual exam required to renew their qualified elevator inspector certification.

Regulatory Improvements

A major undertaking was the consolidation of director's orders, code adoption document amendments and other bulletins into a new consolidated code adoption document Amendment, including an unofficial consolidated code adoption document. This allows users of the consolidated code adoption document to save time and avoid confusion by viewing up-to-date regulatory requirements in one place.

The occurrence identified in Table ED-2 as inadequacies in the current regulatory system, where an individual was struck by an elevator door without any health impacts, was reviewed and the device was subsequently found to be compliant with current regulatory requirements, including codes and standards. This type of occurrence does not currently represent a significant safety concern; however, occurrences of this type will be monitored and if a significant trend arises, potential regulatory changes, including design requirements, will be assessed.

Escalators and Moving Walks

TSSA regulates over 1,850 escalators and moving walks in Ontario to ensure all devices conform to the *Technical Standards and Safety Act, 2000* and applicable regulations, codes and standards. TSSA reviews and registers escalators and moving walks, issues licences, conducts inspections and performs incident investigations.

Public Safety Analysis

Occurrence Analysis

Table EM-1 summarizes the escalator and moving walk occurrences reported to TSSA for fiscal year 2010/2011 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 523 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 inspections do not involve a device-related failure. These are attributed to human factors that are outside of the control or influence of TSSA and have been treated accordingly in the health impact analysis.

Table EM-1: Activity breakdown for escalator and moving walk occurrences.	
Occurrence Detail	Number of Occurrences May 1, 2010 – April 30, 2011
Number of Incidents	408
Number of Near-Misses	129
Occurrences Within TSSA Jurisdiction	537
▪ Completed Causal Analysis	6
▪ Unable to Establish Root Cause	0
▪ In Progress	8
▪ Not Requiring Formal Inspection	523
Total Occurrences	537
Occurrences Outside TSSA Jurisdiction	0
Number of Fatalities	0
Number of Serious Injuries	4
Number of Minor Injuries	378

All of the serious injuries occurred on escalators, and were due to factors external to the regulatory system. The full causal categorization for fiscal year is presented in Table EM-2. The categorization below is made on occurrences whose inspection has been completed or those that did not require a formal inspection.

Table EM-2: Causal categorization for occurrences on escalators and moving walks.

Causal Category	Number of Occurrences	Percentage of Occurrences	Health Impacts (DALYs)	Percentage of Total Health Impacts
1. Inadequate Current Regulatory System	0	0.00%	0.0000	0.00%
2. Non-compliance with Regulatory System	2	0.38%	0.0000	0.00%
3. External Factors	526	99.43%	1.3292	100.00%
4. Root cause not established	1	0.19%	0.0000	0.00%

Occurrence Related Trends

Figure EM-1 shows the number of occurrences to which TSSA has responded over the last four fiscal years and the associated causal categorization of these occurrences. A statistical analysis of this data indicates that the number of occurrences on escalators and moving walks is seasonal and does not demonstrate a significant trend over the period. This analysis also reveals that over the measured time there are decreasing trends in the number of occurrences due to inadequate current regulatory system, non-compliance with the regulatory system and with a root cause not established. The decreasing trend in the non-compliance with the regulatory system is at the rate of 0.56 occurrences per quarter. The most recent behaviour for the other two categories is flat and the trend is due to the occurrences at the first few quarters in the covered period. The other causal category does not show a significant trend. The primary contributor to the occurrences due to external factors continues to be "Failure to follow user instructions."

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

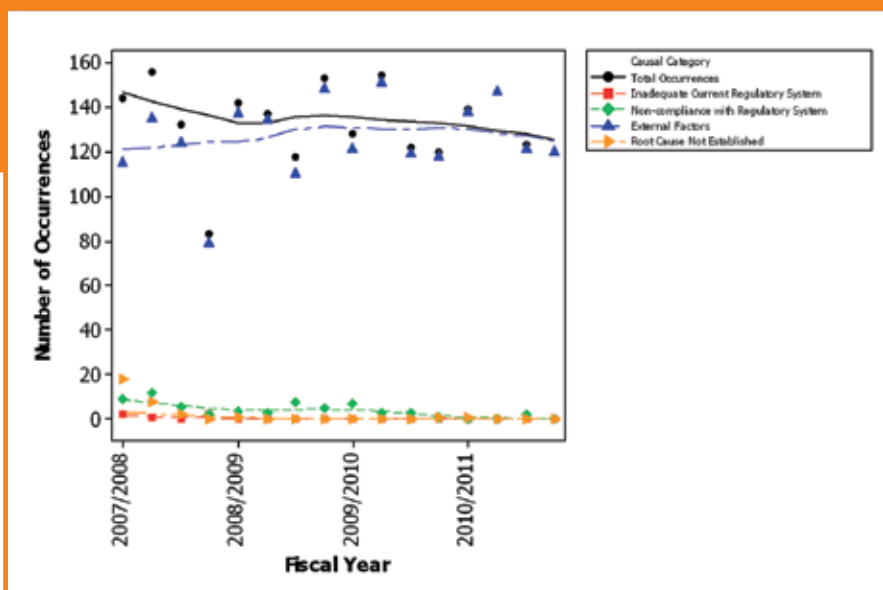


Figure EM-2 charts the number of fatalities and serious injuries on escalators and moving walks over the last seven fiscal years. As illustrated, there has been one fatality, where an individual was sliding down the handrail of an escalator and fell backwards off the escalator, on escalators and moving walks within TSSA's jurisdiction during this period. A statistical analysis of this data indicates that the number of serious injuries does not demonstrate significant trend over the measured time.

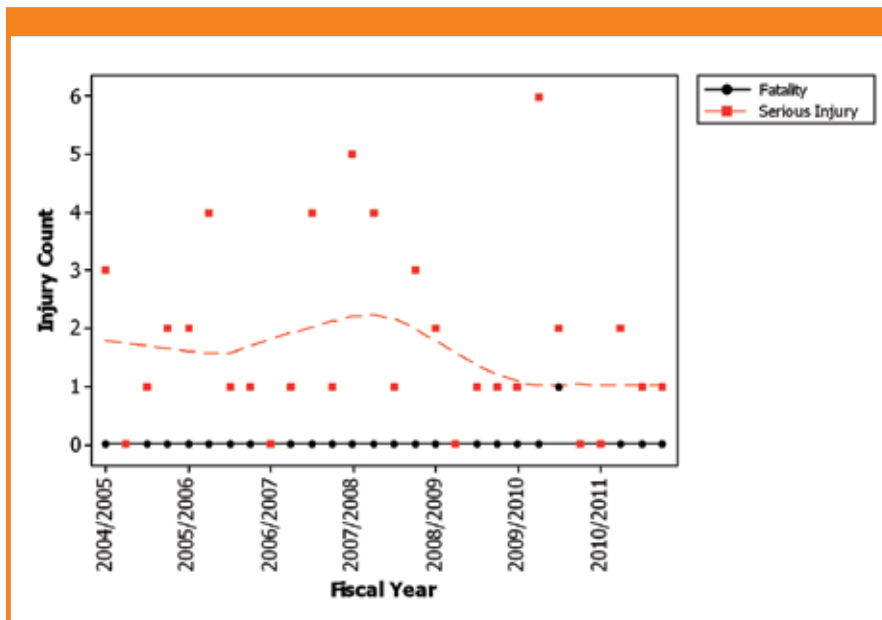
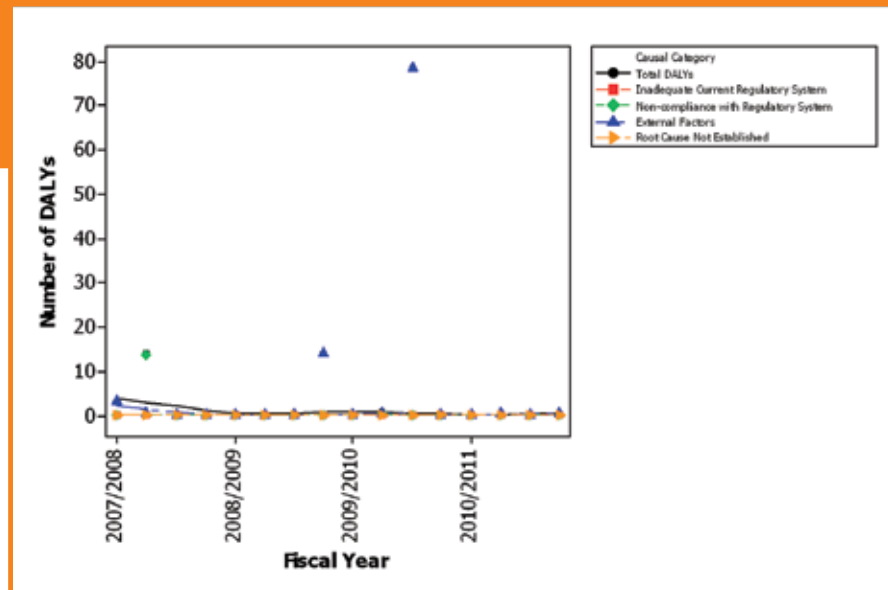


Figure EM-2: Fatalities and serious injuries on escalators and moving walks over the last seven fiscal years.

Figure EM-3 illustrates the distribution of health impacts, as measured by DALYs, for inspected occurrences over the last four fiscal years. A statistical analysis of the data indicates that overall health impacts, as measured by the total number of DALYs, do not demonstrate a significant trend over the period. This analysis also reveals that over the measured time there are decreasing trends in the health impacts as represented by the number of DALYs associated with occurrences due to an inadequate current regulatory system, non-compliance with the regulatory system and without an established root cause. The decreasing trend in the health impacts, as measured by DALYs, due to non-compliance with the regulatory system has a rate of 0.0014 DALYs per quarter. The most recent behaviour for the other two categories is flat and the trends are due to the DALYs in occurrences in the first few quarters in the covered period. The other causal category does not show a significant trend.



Figure EM-3: The health impacts, measured by DALYs, from occurrences on escalators and moving walks and their causal categorization over the last four fiscal years.



Compliance Analysis

Periodic Inspections

There were 631 periodic inspections conducted in fiscal year 2010/2011. Each of these inspections results in an outcome as determined by a TSSA inspector, shown in Figure EM-4. Of all periodic inspections completed in fiscal year 2010/2011, 26.47% were compliant with regulations on the first visit.

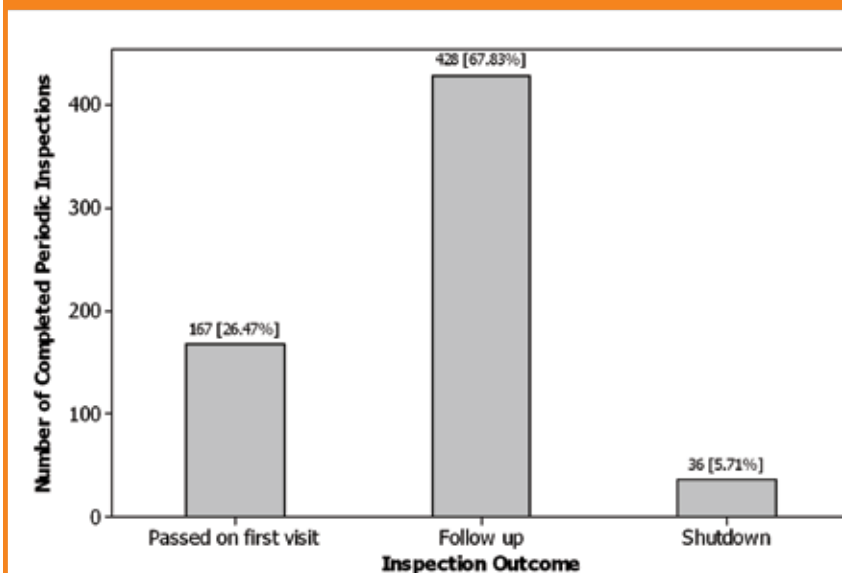


Figure EM-4: Outcomes from periodic inspections completed on escalators and moving walks in fiscal year 2010/2011.

TSSA inspectors issued a total of 1,364 inspection orders during the course of these periodic inspections. This yields an average number of inspection orders issued per inspection of 2.16.

Compliance Related Trends

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

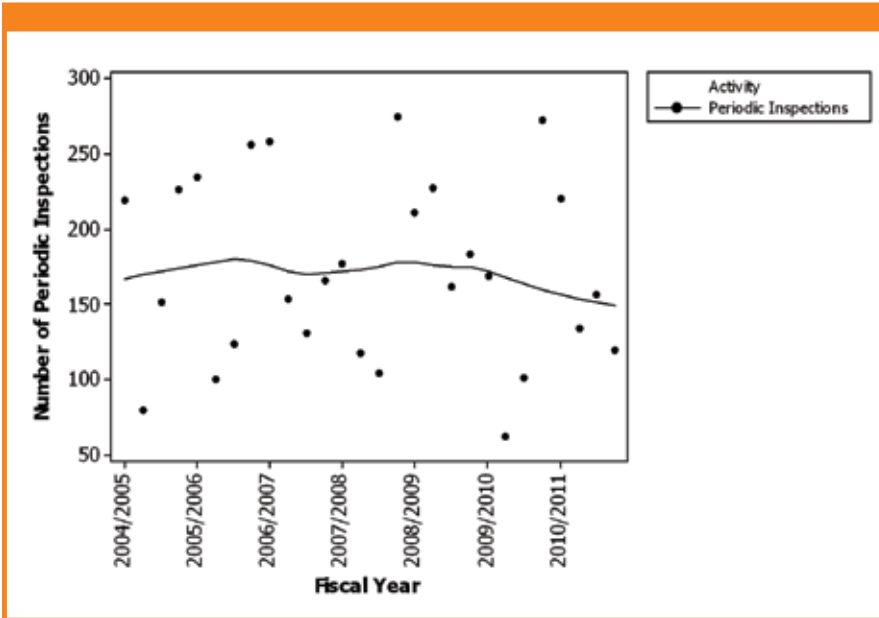


Figure EM-5: Periodic inspections completed on escalators and moving walks over the last seven fiscal years.

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

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

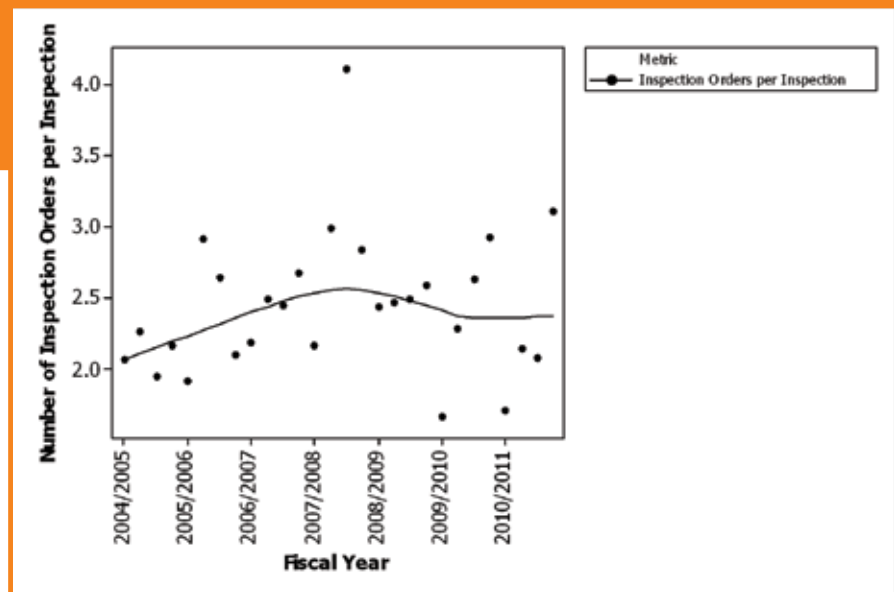
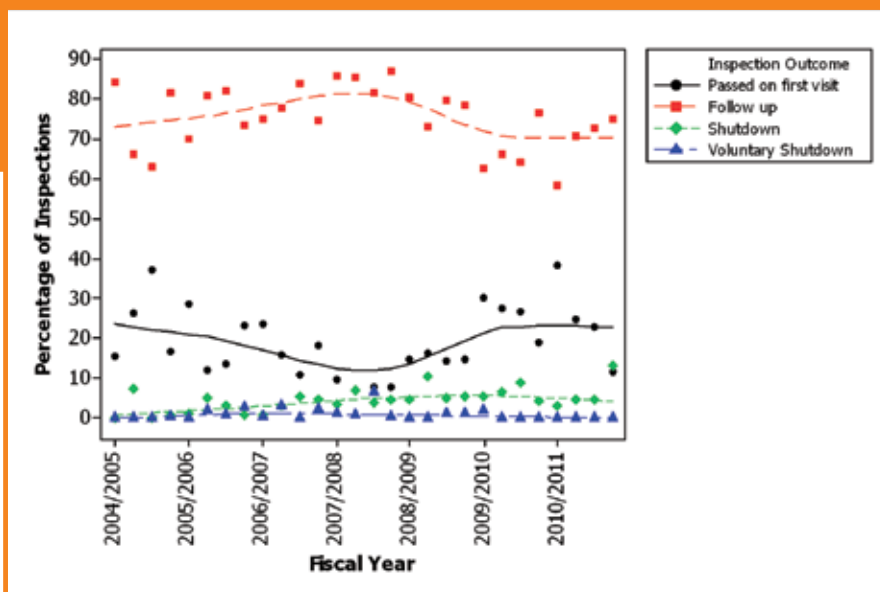


Figure EM-7 charts the outcomes from the periodic inspections over the last seven fiscal years. A statistical analysis of this data indicates that there is an increasing trend in the percentage of 'Shutdown' inspection outcomes over the period at rate 0.21% per quarter. This analysis also reveals that there are no significant trends in any other inspection outcome.

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



Other Safety and Risk Analysis Results

The prediction intervals, which represent the expected ranges of the indicator and are defined by the fifth and ninety-fifth percentiles of the trend data, for the compliance outcomes from escalators and moving walks are indicated in Table EM-3.

Table EM-3: Prediction intervals for compliance outcomes from escalators and moving walks for fiscal year 2011/2012.

Activity	Indicator	Lower Prediction Bound	Upper Prediction Bound
Periodic Inspections	Percentage Passed on First Visit	7.17%	37.69%
	Percentage Follow-up	60.47%	86.64%
	Percentage Shutdown	0.00%	12.09%
	Percentage Voluntary Shutdown	0.00%	5.17%
	Number of Orders per Inspection	1.68	3.67

Public Safety Decisions

TSSA Actions

Improving Compliance

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

Managing Safety Issues

TSSA will be completing a risk assessment of safety issues with escalator brakes and issuing Director's Order 247/10 requiring a check of the escalator brake as part of the daily start-up procedure. The additional requirement will ensure that the escalator brake is functioning properly and stopping the escalator within a prescribed distance. This director's order was the result of recommendations from the escalator brake risk reduction group.

Regulatory Improvements

The consolidated code adoption document referred to under elevators above, also applies to escalators and moving walks.

Ski Lifts

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

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

Public Safety Analysis

Occurrence Analysis

Table SL-1 summarizes the ski lift occurrences reported to TSSA for the fiscal year 2010/2011 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 inspections do not involve a device-related failure. These are attributed to human factors that are outside of the control or influence of TSSA and have been treated accordingly in the health impact analysis.

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

Occurrence Detail	Number of Occurrences May 1, 2010 – April 30, 2011
Number of Incidents	81
Number of Near-Misses	13
Occurrences Within TSSA Jurisdiction	94
▪ Completed Causal Analysis	2
▪ Unable to Establish Root Cause	0
▪ In Progress	4
▪ Not Requiring Formal Inspection	88
Total Occurrences	94
Occurrences Outside TSSA Jurisdiction	0
Number of Fatalities	0
Number of Serious Injuries	1
Number of Minor Injuries	77

The serious injury was a result of an individual who was struck by the chair while unloading at the top of the lift line and was due to external factors. The full causal categorization for fiscal year is presented in Table SL-2. The categorization below is made on occurrences whose inspection has been completed or those that did not require a formal inspection.

Table SL-2: Causal categorization for occurrences on ski lifts.

Causal Category	Number of Occurrences	Percentage of Occurrences	Health Impacts (DALYs)	Percentage of Total Health Impacts
1. Inadequate Current Regulatory System	0	0.00%	0.0000	0.00%
2. Non-compliance with Regulatory System	1	1.11%	0.0008	0.09%
3. External Factors	89	98.89%	0.8733	99.91%
4. Root cause not established	0	0.00%	0.0000	0.00%

Occurrence Related Trends

Figure SL-1 shows the number of occurrences to which TSSA has responded over the last four fiscal years and the associated causal categorization of these occurrences. A statistical analysis of this data indicates that the number of occurrences on ski lifts is seasonal and does not demonstrate a significant trend over the period. This analysis also reveals that there is a decreasing trend in the number of occurrences due to non-compliance with the regulatory system over the measured time. This trend is seasonal, and the rate is not well defined for the number of quarters in the analysis. The other causal categories do not show a significant trend. The primary contributor to the occurrences due to external factors continues to be "Failure to follow user instructions."

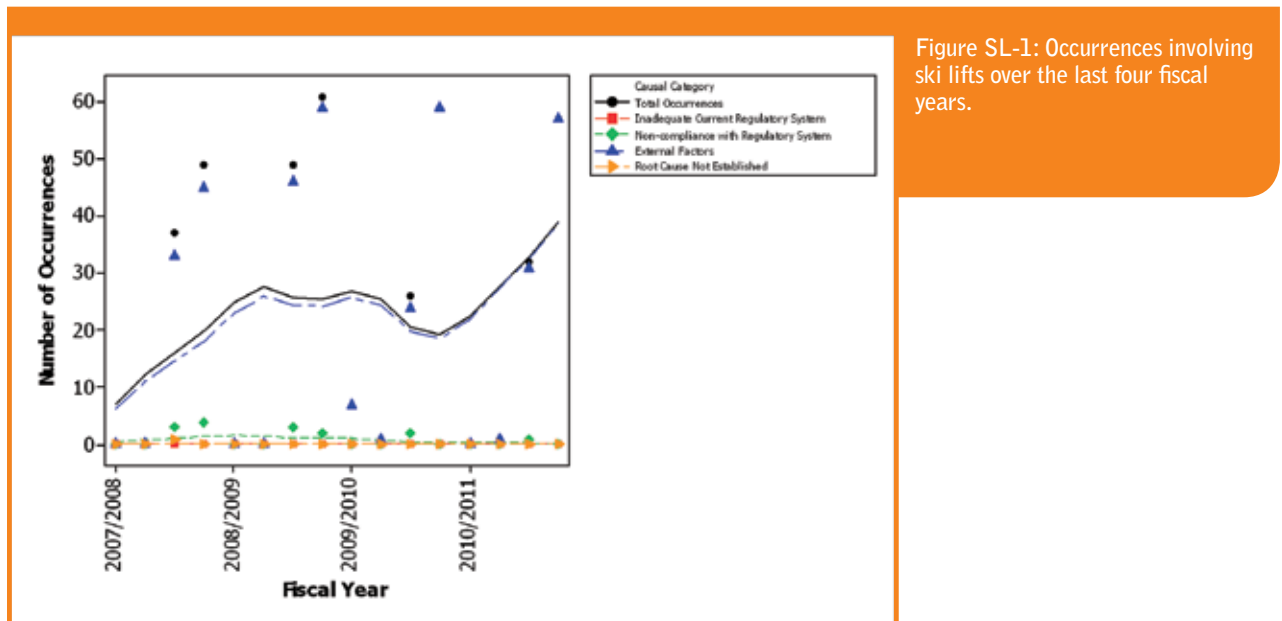


Figure SL-2 charts the number of fatalities and serious injuries on ski lifts over the last seven fiscal years. As illustrated, there have been no fatalities on ski lifts within TSSA's jurisdiction during this period. A statistical analysis of this data indicates that the number of serious injuries is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

Figure SL-2: Fatalities and serious injuries on ski lifts over the last seven fiscal years.

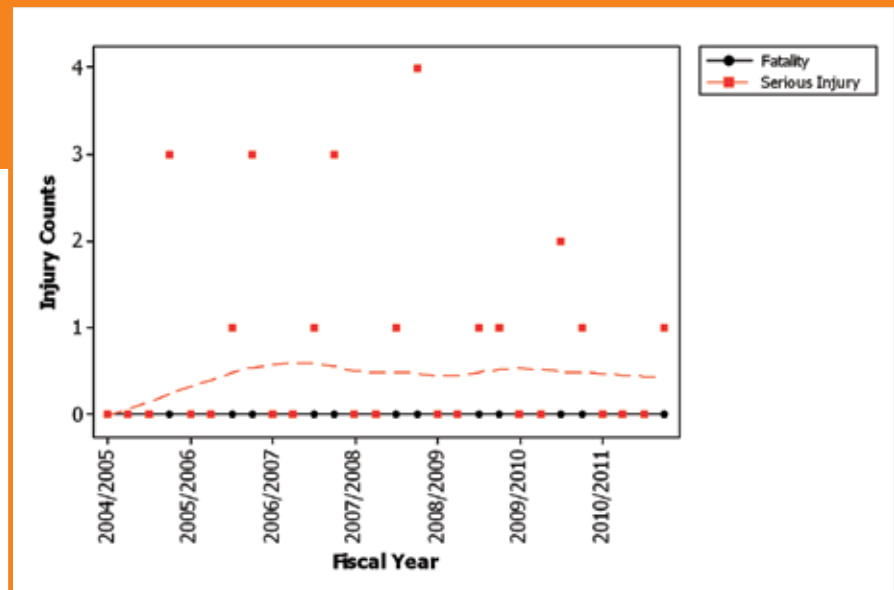
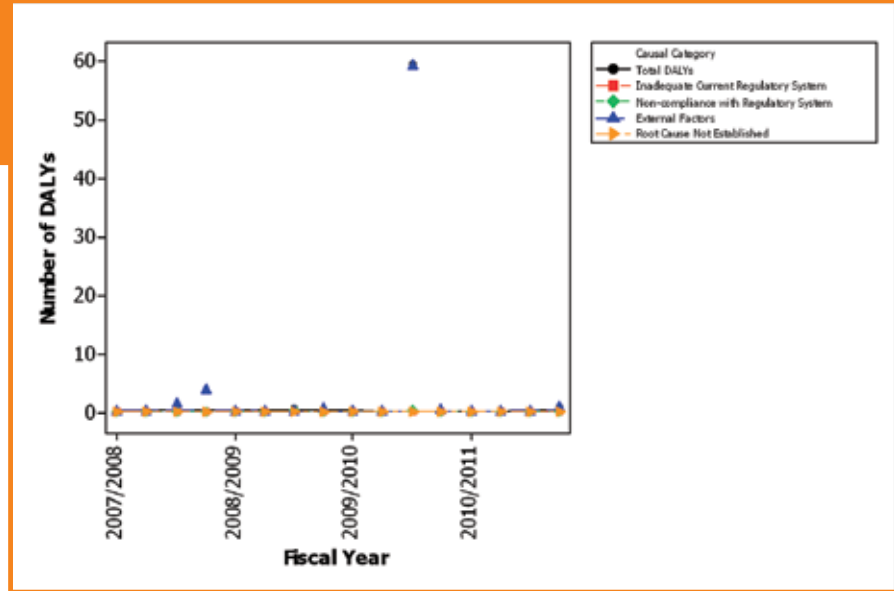


Figure SL-3 illustrates the distribution of health impacts, as measured by DALYs, for inspected occurrences over the last four fiscal years. A statistical analysis of the data indicates that the overall health impacts, as measured by the total number of DALYs, is seasonal and does not demonstrate a significant trend over the period. This analysis also reveals that all other causal categories are seasonal and do not exhibit significant trends.

Figure SL-3: The health impacts, as measured by DALYs, from occurrences on ski lifts and their causal categorization over the last four fiscal years.



Compliance Analysis

Periodic Inspections

There were 164 periodic inspections informed by the risk model and conducted in fiscal year 2010/2011. Each of these inspections results in an outcome as determined by a TSSA inspector, shown in Figure SL-4. Of all periodic inspections completed in fiscal year 2010/2011, 37.80% were compliant with regulations on the first visit.

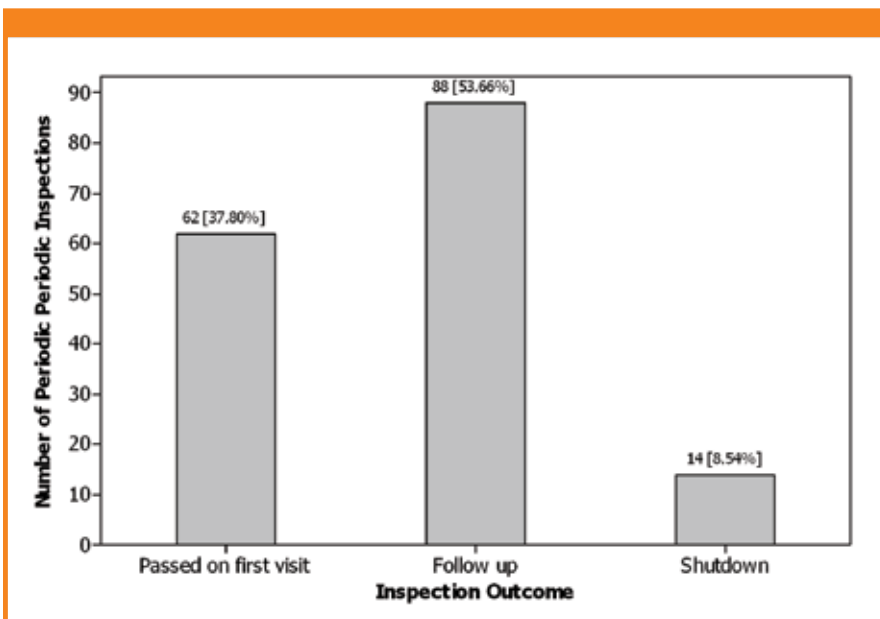


Figure SL-4: Outcomes from periodic inspections completed on ski lifts in fiscal year 2010/2011.

TSSA inspectors issued a total of 282 inspection orders during the course of these periodic inspections. This yields an average number of inspection orders issued per inspection of 1.72.

Compliance Related Trends

Figure SL-5 charts the number of periodic inspections over the last seven fiscal years. A statistical analysis of this data indicates that the number of periodic inspections is seasonal and does not demonstrate a significant trend over the period.

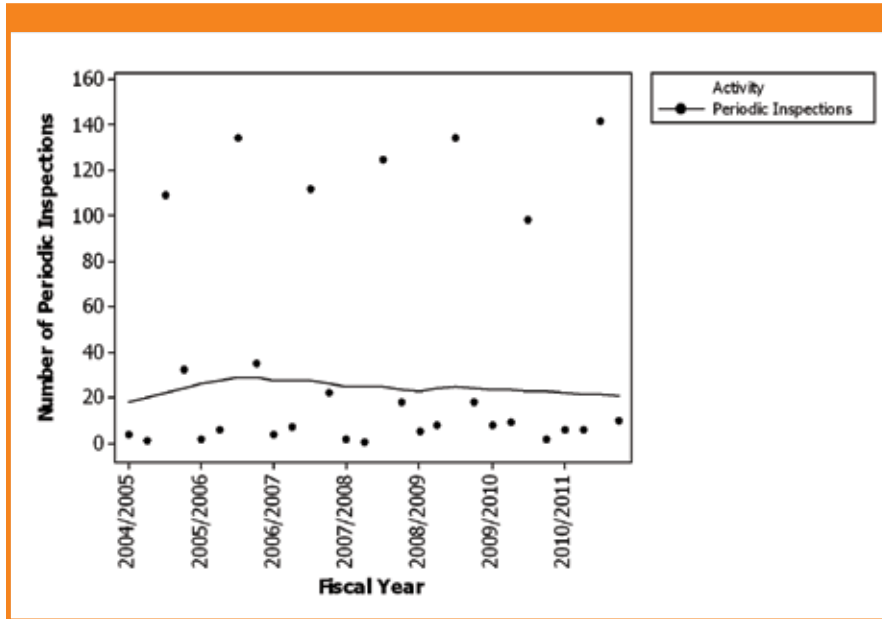


Figure SL-5: Periodic inspections completed on ski lifts over the last seven fiscal years.

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

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

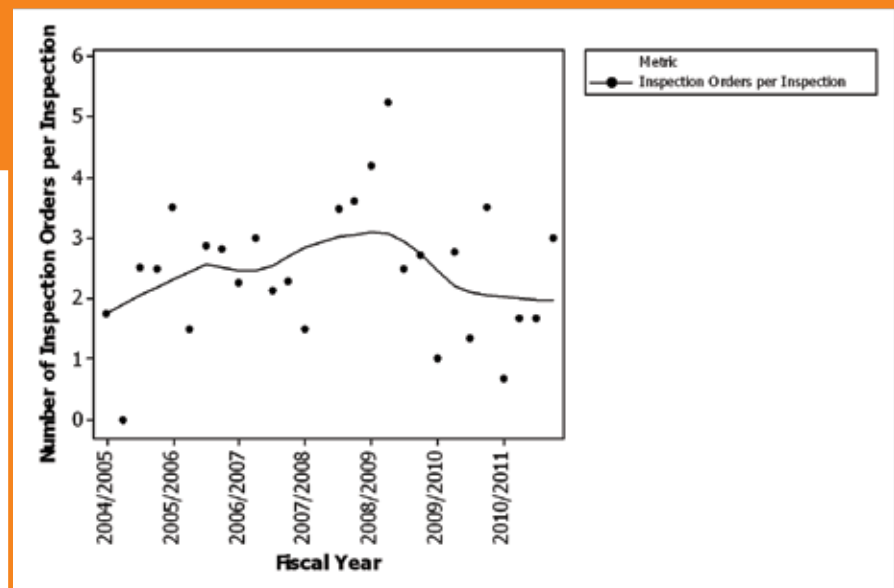
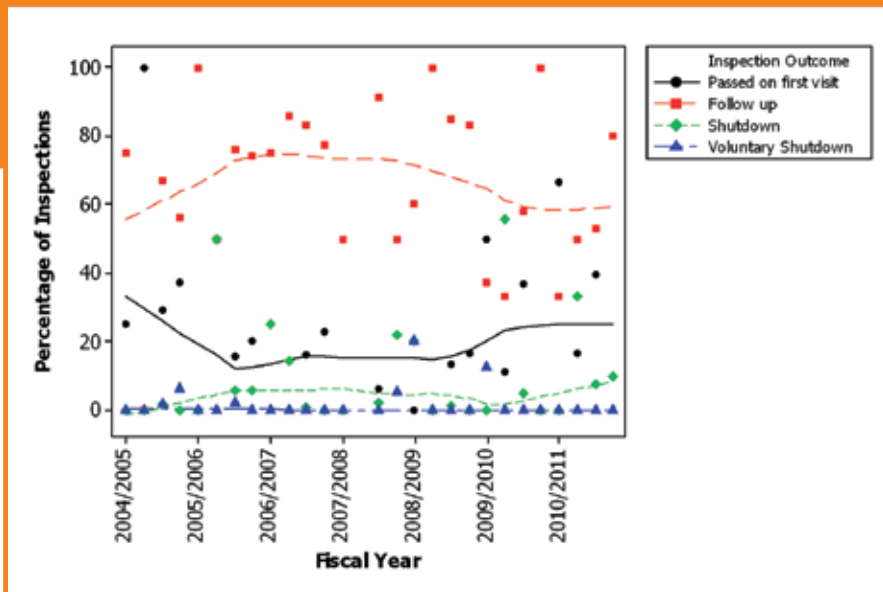


Figure SL-7 charts the outcomes from the periodic inspections over the last seven fiscal years. A statistical analysis of this data indicates that none of the inspection outcomes demonstrate significant trends over the period.

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



Other Safety and Risk Analysis Results

Due to the seasonality of inspections, prediction intervals for compliance outcomes on ski lifts are not able to be calculated at this time. A minimum of ten years of data is required to produce statistically significant intervals.

The prediction intervals, which represent the expected ranges of the indicator and are defined by the fifth and ninety-fifth percentiles of the trend data, for the safety outcomes from ski lifts are indicated in Table SL-3.

Table SL-3: Prediction intervals for safety outcomes from ski lifts for fiscal year 2011/2012.

Activity	Indicator	Lower Prediction Bound	Upper Prediction Bound
Occurrences	Number of Fatalities	0	0
	Number of Serious Injuries	0	4

Public Safety Decisions

TSSA Actions

Improving Compliance

Based on the results of the inspections, there are presently no significant compliance issues requiring TSSA response.

Managing Safety Issues

TSSA issued code adoption document amendment 246/11, which adopts the latest edition of the CSA Z98 Code for Passenger Ropeways and Passenger Conveyors. This code has significant implications for ski lift control systems design by stating requirements in both prescriptive and performance based language, and also new requirements for some design elements to be supported through risk analysis.

'Failure to follow user instructions' continues to be the dominant root cause category relative to all the other causal categories for occurrences. TSSA continues to deliver its public education campaigns at various ski resorts across the province, as well as partnering with the Canadian Ski Patrol System and the Canadian Ski Instructors Alliance, to further encourage lift and overall ski safety to the over 81,000 members of its key target audience.

Regulatory Improvements

The consolidated code adoption document referred to under elevators above, also applies to ski lifts. This allows users of the consolidated code adoption document to save time and avoid confusion by viewing up-to-date regulatory requirements in one place



Fuels

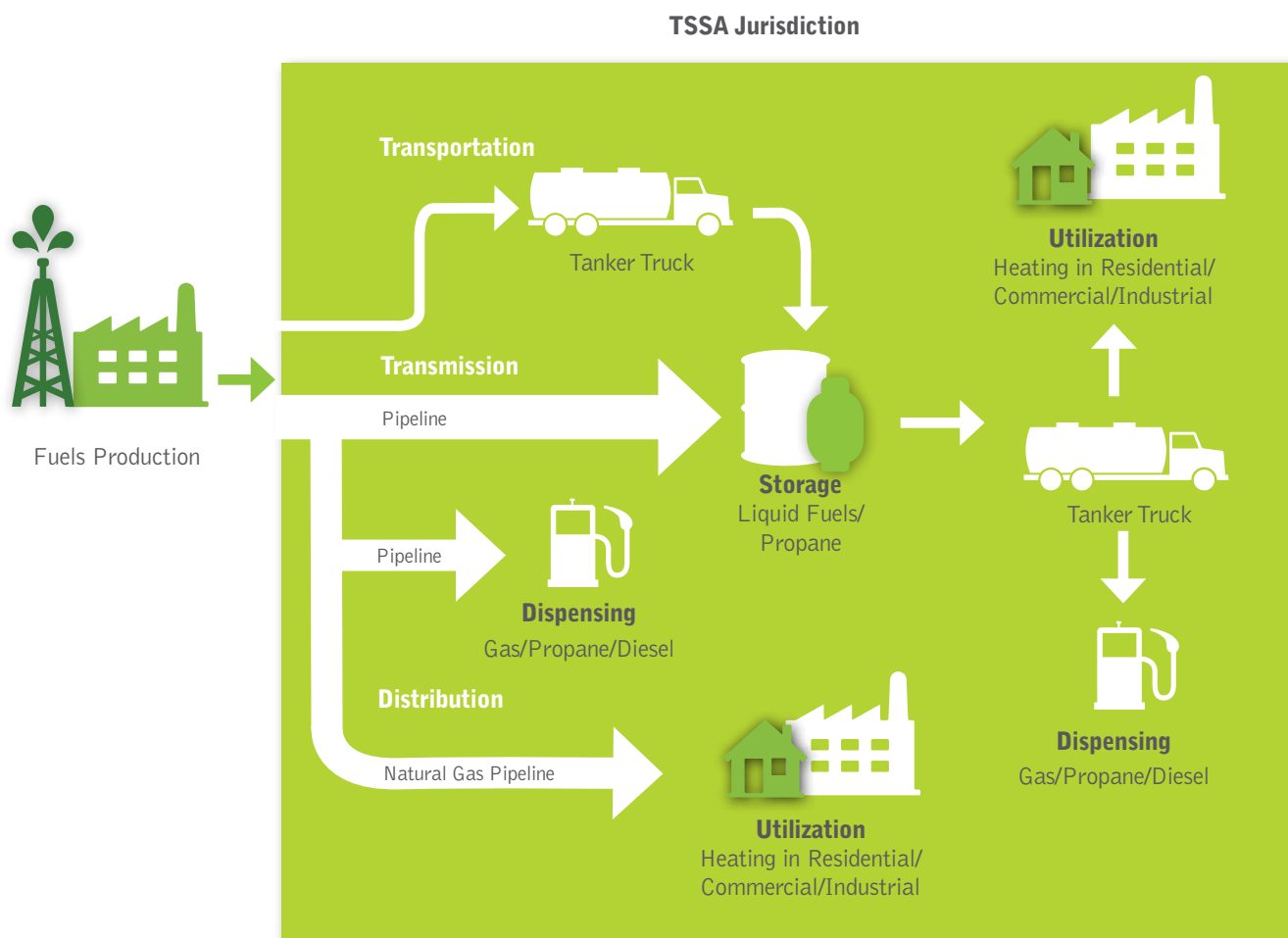
TSSA regulates the transportation, storage, handling and use of fuels as to ensure conformance to the *Technical Standards and Safety Act, 2000*, and applicable regulations, codes and standards. These fuels include natural gas, propane, butane, hydrogen, digester gas, landfill gas, fuel oil, gasoline and diesel. TSSA licenses fuel facilities, registers contractors and certifies tradespersons who install and service equipment.

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

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

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

Figure F-1: The fuels life cycle.



Public Safety Analysis

Occurrence Analysis

TSSA's occurrence information tracking database, the Incident Management Information System (IMIS), categorizes each type of occurrence reported to TSSA. Table F-1 provides a summary of the occurrences by type reported to the TSSA during fiscal year 2010/2011. These occurrences include those that are currently in progress and those with resolved root cause analysis. The health impact associated with each occurrence type is also included in the table below.

Table F-1: Fuels occurrence types and health impacts for fiscal year 2010/2011.			
Occurrence Type	Number of Occurrences	Number of Fatalities	Number of Serious Injuries
Carbon Monoxide (CO) Release	216	1	1
Discovery of a Petroleum Product	92	0	0
Explosion	37	0	0
Fire	162	1	1
Leak	282	0	0
Liquid Petroleum Spill	93	0	0
Other	64	1	0
Pipeline Strike	2,322	0	0
Unknown	3	0	0
Vapour Release	327	0	0
Total Occurrences	3,598	3	2

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

Table F-2: Activity breakdown for pipeline strikes.

Occurrence Detail	Number of Occurrences May 1, 2010 – April 30, 2011
Number of Incidents	2,305
Number of Near-Misses	17
Occurrences Within TSSA Jurisdiction	2,322
▪ Completed Causal Analysis	1,589
▪ Unable to Establish Root Cause	0
▪ In Progress	584
▪ Not Requiring Formal Inspection	149
Total Occurrences	2,322
Occurrences Outside TSSA Jurisdiction	293
Number of Fatalities	0
Number of Serious Injuries	0
Number of Minor Injuries	0

Table F-3 summarizes the fuels occurrences reported to TSSA in accordance with the reporting guidelines provided to stakeholders. These occurrences can be categorized as an incident or a near-miss. The table includes their occurrence inspection status at the end of the fiscal year. Finally, the number of occurrences reported to the TSSA but which are outside of its jurisdiction is also included; these occurrences are not included in any of the analysis or trending.

Table F-3: Activity breakdown for fuels occurrences.

Occurrence Detail	Number of Occurrences May 1, 2010 – April 30, 2011
Number of Incidents	1,203
Number of Near-Misses	73
Occurrences Within TSSA Jurisdiction	1,276
▪ Completed Causal Analysis	862
▪ Unable to Establish Root Cause	2
▪ In Progress	402
▪ Not Requiring Formal Inspection	10
Total Occurrences	1,276
Occurrences Outside TSSA Jurisdiction	460
Number of Fatalities	3
Number of Serious Injuries	2
Number of Minor Injuries	26

Table F-4 shows the fuel types involved in fuels occurrences.

Table F-4: Activity breakdown for fuels occurrences.	
Fuel Type	Number of Occurrences
Butane	0
Diesel	37
Fuel Oil	216
Gasoline	29
Hydrogen	1
Natural Gas	479
Other Hydrocarbon Fuel	3
Propane	51
Used Oil	2
Fuel Type Not Confirmed	458

The full causal categorization for fiscal year is presented in Table F-5. The categorization below is made for fuels occurrences whose inspection has been completed. Please note, all pipeline strikes are assumed to be due to non-compliance with the regulatory system.

Table F-5: Causal categorization for fuels occurrences.				
Causal Category	Number of Occurrences	Percentage of Occurrences	Health Impacts (DALYs)	Percentage of Total Health Impacts
1. Inadequate Current Regulatory System	12	1.39%	0.0000	0.00%
2. Non-compliance with Regulatory System	613	70.95%	18.8956	49.96%
3. External Factors	93	10.76%	0.2161	0.57%
4. Root cause not established	146	16.90%	18.7122	49.47%

TSSA used an in-house developed software tool to conduct an advanced root cause analysis on an incident involving the explosion of a dryer in an apartment building due to a natural gas leak resulting in serious injuries to an Ontarian. The analysis documented a series of events and associated causes, which determined a root cause of lack of training related to installation of equipment. An audit of locations where this equipment is installed was recommended.

Occurrence Related Trends

Figure F-2 shows the number of pipeline strikes to which TSSA has responded over the last four and a half fiscal years. A statistical analysis indicates that this number is seasonal, and does not demonstrate a significant trend over the period. Since the introduction of an enhanced strike inspection documentation process in fiscal year 2010/2011, specific reasons for pipeline strikes can be analyzed and addressed. For the time during which this process has been in place, analysis indicates that 68.68% of strikes are due to improper excavation practices.

Figure F-2: Number of pipeline strikes over the last four and a half fiscal years..

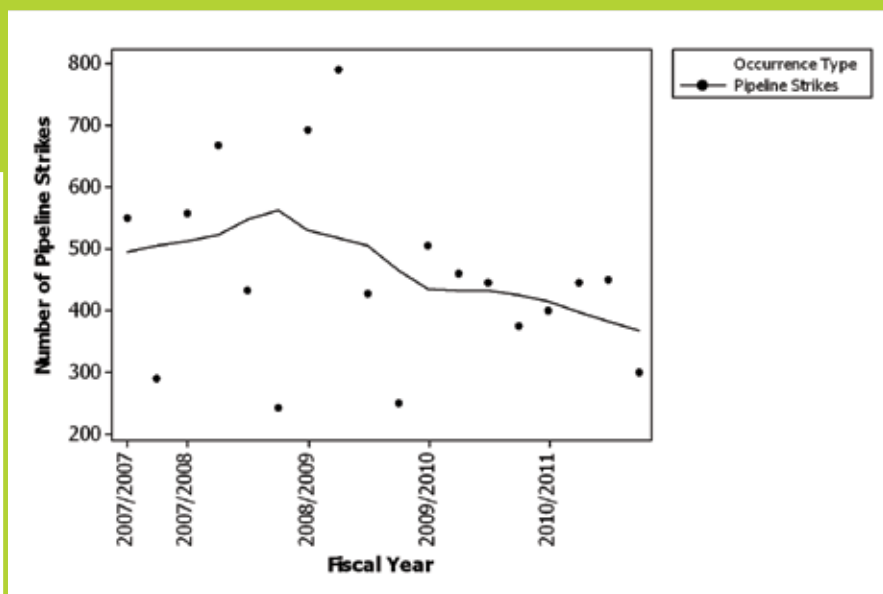


Figure F-3 shows the number of occurrences to which TSSA has responded over the last four and a half fiscal years by occurrence type. A statistical analysis indicates that there are a number of CO releases, fires, and vapour releases which are seasonal. This analysis also reveals an increasing trend in the number of other occurrences over the period at a rate of 0.57 occurrences per quarter. There are decreasing trends over the measured time in the number of explosions and spills per quarter, at rates of 0.36 and 0.92 occurrences per quarter respectively. All other occurrences types do not exhibit a significant trend.

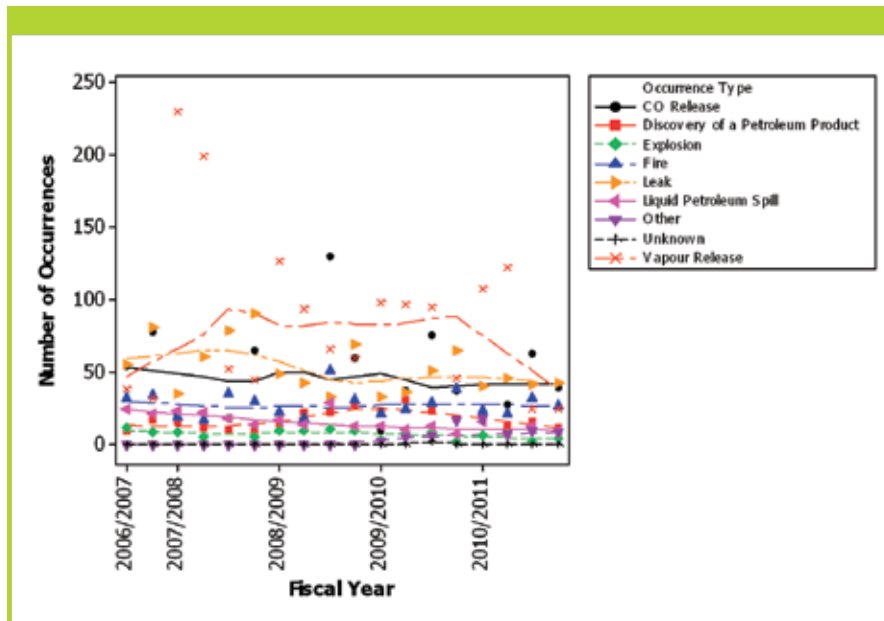


Figure F-3: Occurrences by occurrence type over the last four and a half fiscal years.

In response to a pattern of carbon monoxide incidents resulting from malfunctioning residential natural gas boilers with natural draft venting, TSSA conducted a comprehensive risk assessment study which predicted that at least 5% of over 200,000 such boilers may be operating with unacceptable levels of risk. In response, TSSA issued a Director's Order that effectively bans any future installation of such appliances unless they are isolated from living areas in homes. Additionally, for all existing appliances additional maintenance and risk monitoring requirements have been mandated. TSSA will monitor the effectiveness of these decisions over the course of the next three years and expect that there will be a corresponding decrease in the number of such incidents.

Figure F-4 shows the percentage distribution of occurrences across the fuels life cycle over the last four and a half fiscal years. A statistical analysis of this data indicates that Utilization and Transmission, Distribution, and Transportation are seasonal. This analysis also reveals that over the period there are increasing trends in the percentage of occurrences in the utilization and other life cycle stages, at rates of 0.62% and 0.08% per quarter respectively. All other life cycle stages do not demonstrate significant trends.

Figure F-4: The percentage of occurrences by life cycle stage over the last four and a half fiscal years.

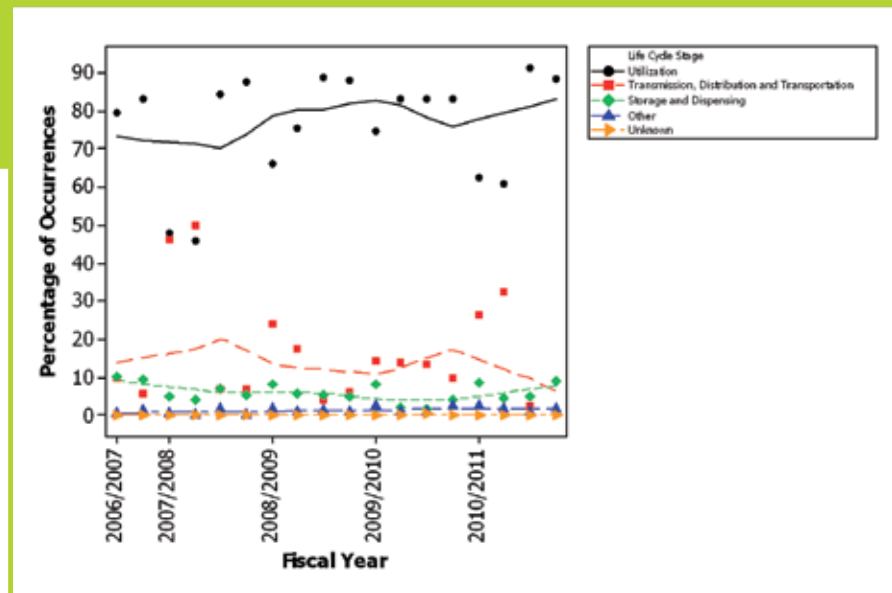


Figure F-5 charts the number of fatalities and serious injuries over the last seven fiscal years. A statistical analysis of this data indicates that the number of fatalities and serious injuries do not demonstrate significant trends over the period. It is important to note that this trend does not take into account the effect of those occurrences that have multiple serious injuries.

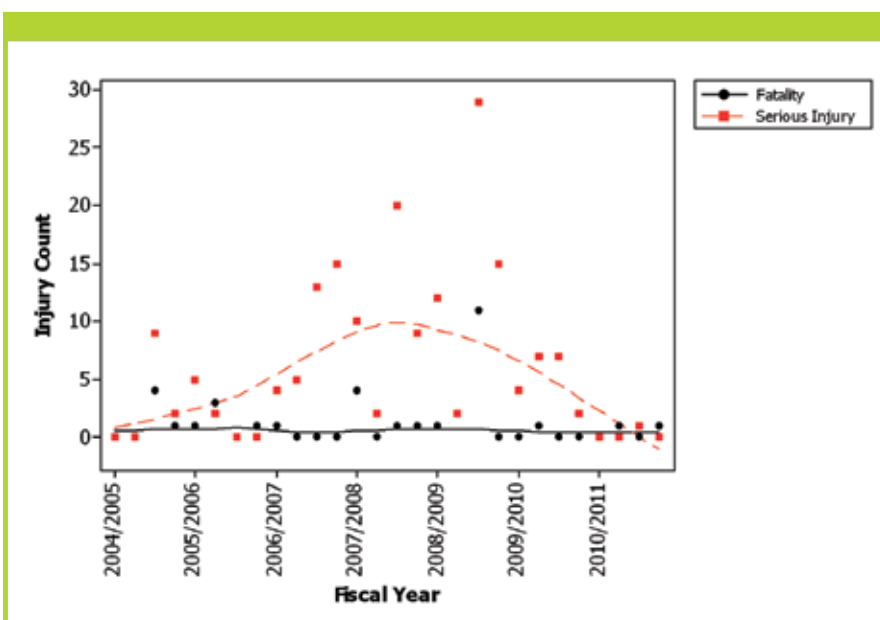


Figure F-5: Fuels fatalities and serious injuries over the last seven fiscal years.

Figure F-6 shows the number of occurrences to which TSSA has responded over the last four and a half fiscal years and the associated causal categorization of these occurrences. A statistical analysis of this data indicates that the total number of occurrences involving fuels demonstrates a decreasing trend over the period at a rate of 4.8 occurrences per quarter. This analysis also reveals that the number of occurrences due to non-compliance with the regulations and external factors exhibit decreasing trends over the measured time at rates of 4.33 and 1.14 occurrences per quarter respectively. The other causal categories do not show significant trends.

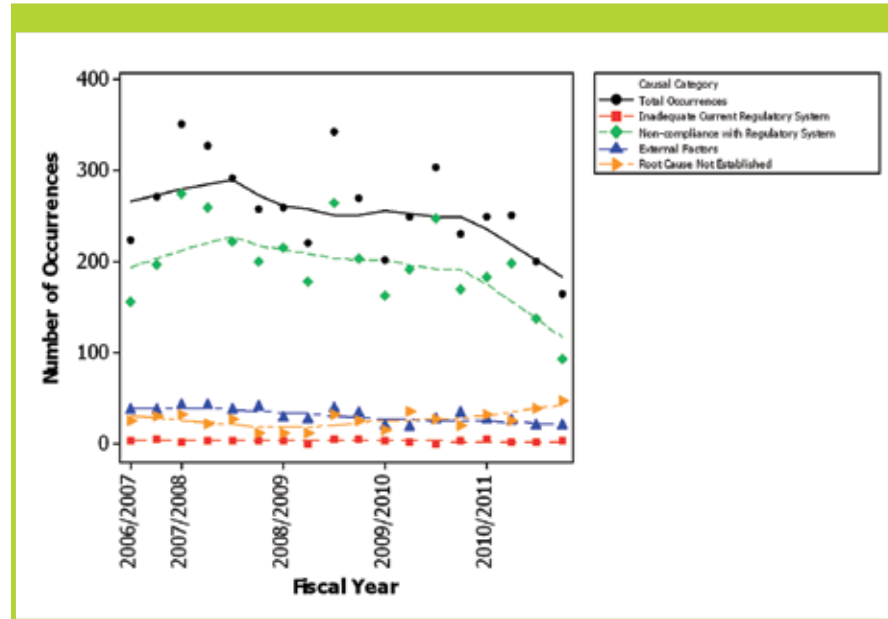
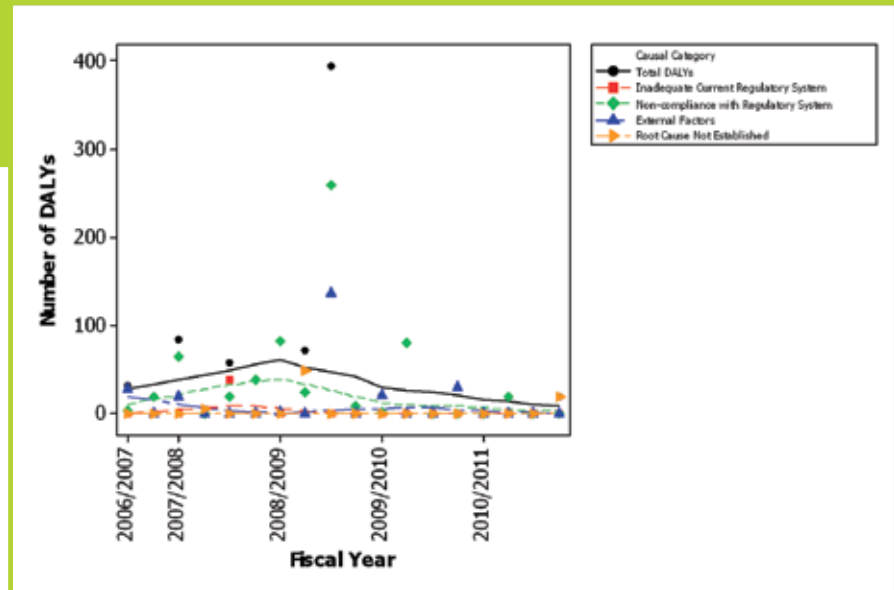


Figure F-6: Occurrences involving fuels and the causal category over the last four and a half fiscal years.



Figure F-7 illustrates the distribution of health impacts, as measured by DALYs, for inspected occurrences over the last four and a half fiscal years. A statistical analysis of the data indicates that the overall health impacts, as measured by the total number of DALYs, do not demonstrate a significant trend over the period. This analysis also reveals that the health impacts represented by the number of DALYs due to non-compliance with the regulatory system exhibits a decreasing trend over the measured time at a rate of 0.6575 DALYs per quarter. The other causal categories do not exhibit significant trends.

Figure F-7: The health impacts, as measured by DALYs, from occurrences involving fuels and their causal categorization over the last four and a half fiscal years.



Compliance Analysis

Periodic Inspections

There were 2,263 periodic inspections conducted in fiscal year 2010/2011. Each of these inspections results in an outcome as determined by a TSSA inspector, shown in Figure F-8. Of all periodic inspections completed in fiscal year 2010/2011, 46.88% were compliant with regulations on the first visit.

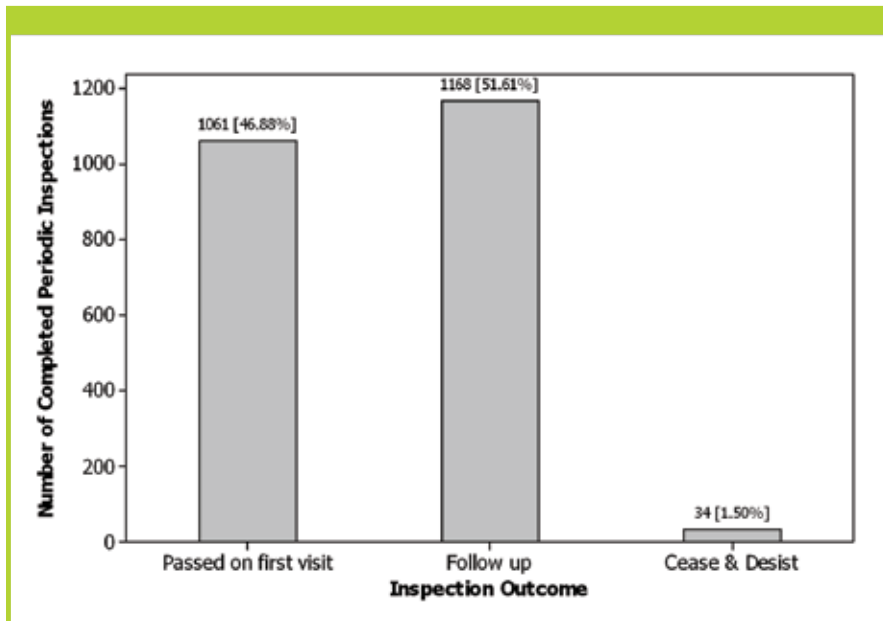


Figure F-8: Outcomes from fuels periodic inspections completed in fiscal year 2010/2011.

TSSA inspectors issued a total of 4,034 inspection orders during the course of these periodic inspections. This yields an average number of inspection orders issued per inspection of 1.78.

Compliance Related Trends

Figure F-9 charts the number of periodic inspections over the last seven fiscal years. A statistical analysis of this data indicates that the number of periodic inspections does not demonstrate a significant trend over the period.

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

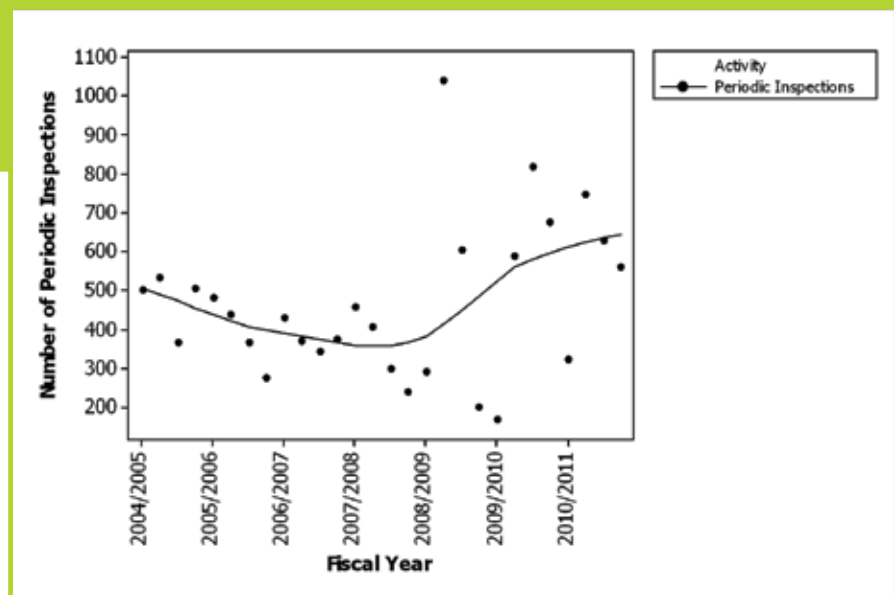


Figure F-10 provides the average number of inspection orders per inspection for the last seven fiscal years. A statistical analysis of this data indicates that the average number of inspection orders per inspection exhibits a decreasing trend over the period at a rate of 0.03 inspection orders per inspection per quarter.

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

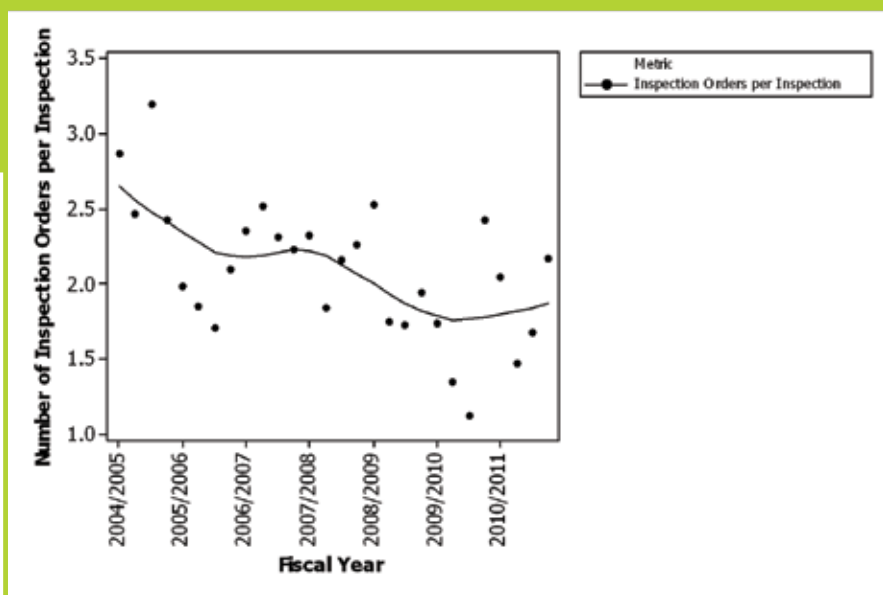


Figure F-11 charts the outcomes from fuels periodic inspections completed over the last seven fiscal years. A statistical analysis of this data indicates that over the period there is an increasing trend in the percentage of 'Passed on first visit' inspection outcomes at a rate of 0.43%. This analysis also reveals that over the measured time there is a decreasing trend in the percentage 'Follow-up' inspection outcomes at a rate of 0.48% per quarter. The 'Cease & Desist' inspection outcome has only been available since the end of the first quarter of fiscal year 2010/2011 thus it does not have enough information to conduct a proper statistical trend test. It will be monitored over the next two fiscal years.

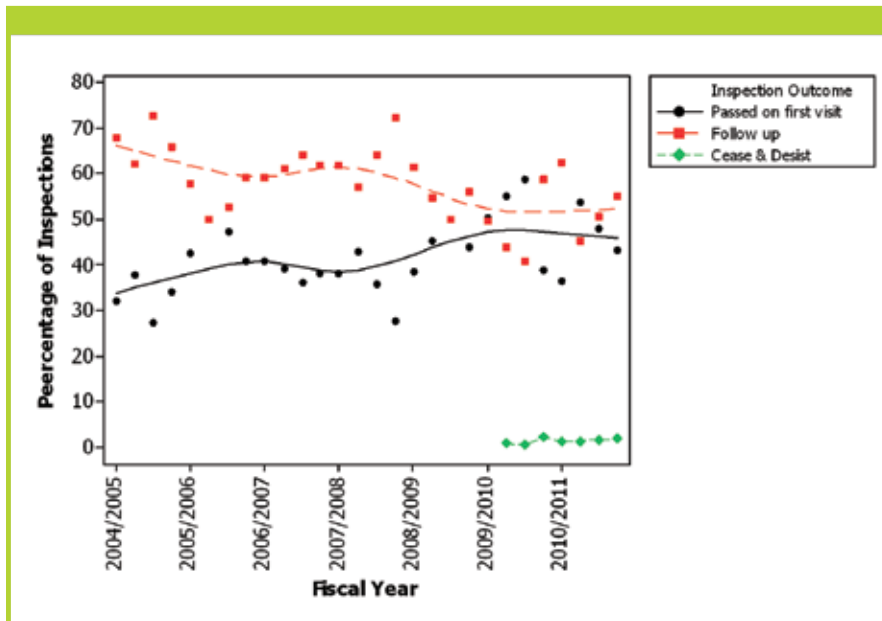


Figure F-11: Fuels periodic inspection outcomes by percentage over the last seven fiscal years.

Ad Hoc Inspections

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

There were 3,392 ad hoc inspections conducted in fiscal year 2010/2011. Each of these inspections results in an outcome as determined by a TSSA inspector; shown in Figure F-12. Of all ad hoc inspections completed in fiscal year 2010/2011, 33.55% were compliant with regulations on the first visit.

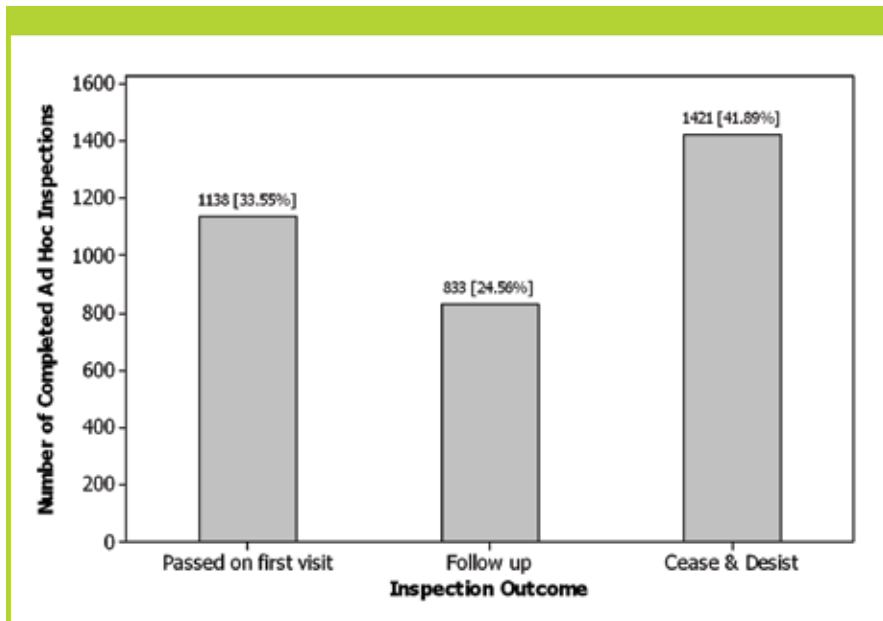


Figure F-12: Outcomes from fuels ad hoc inspections completed in fiscal year 2010/2011.

TSSA inspectors issued a total of 6,791 inspection orders during the course of these ad hoc inspections. This yields an average number of inspection orders issued per inspection of 2.00.



Compliance Related Trends

Figure F-13 charts the number of ad hoc inspections over the last seven fiscal years. A statistical analysis of this data indicates that the number of ad hoc inspections exhibits a decreasing trend over the period at a rate of 6.77 inspections per quarter.

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

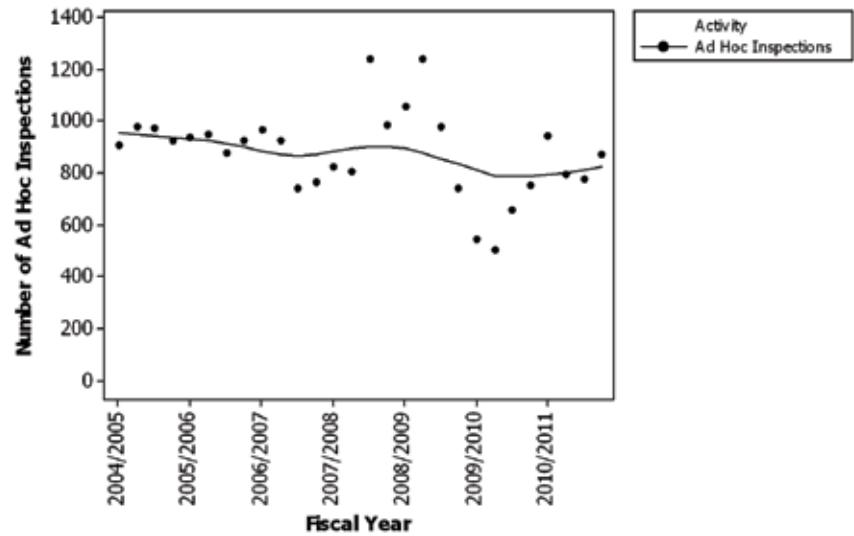


Figure F-14 provides the average number of inspection orders per inspection for the last seven fiscal years. A statistical analysis of this data indicates that the average number of inspection orders per inspection demonstrates an increasing trend over the period at a rate of 0.02 inspection orders per inspection per quarter.

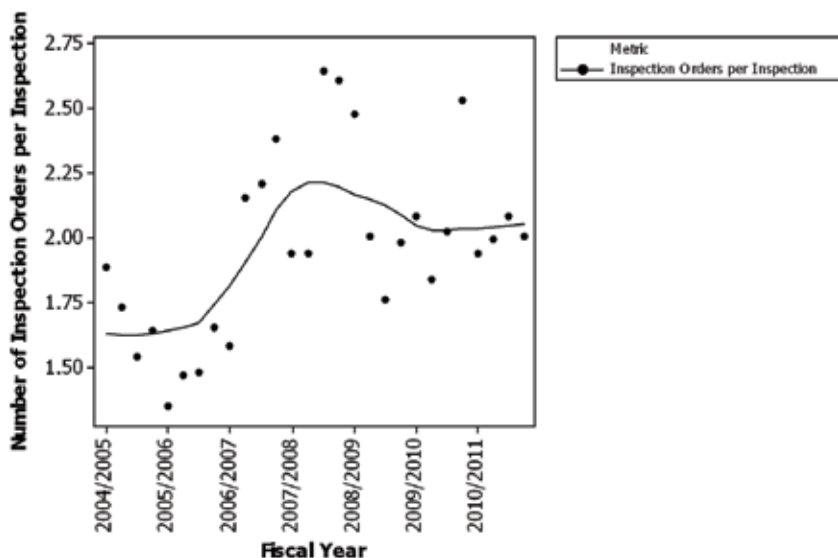


Figure F-14: The number of inspection orders per fuels ad hoc inspections over the last seven fiscal years.

Figure F-15 charts the outcomes from fuels ad hoc inspections completed over the last seven fiscal years. A statistical analysis of this data indicates that there is an increasing trend in the percentage of 'Cease & Desist' inspection outcomes over the period at a rate of 1.65% per quarter. This analysis also reveals a decreasing trend in the percentage of 'Follow-up' inspection outcomes over the measured time at a rate of 1.56%. The other inspection outcome does not demonstrate a significant trend.

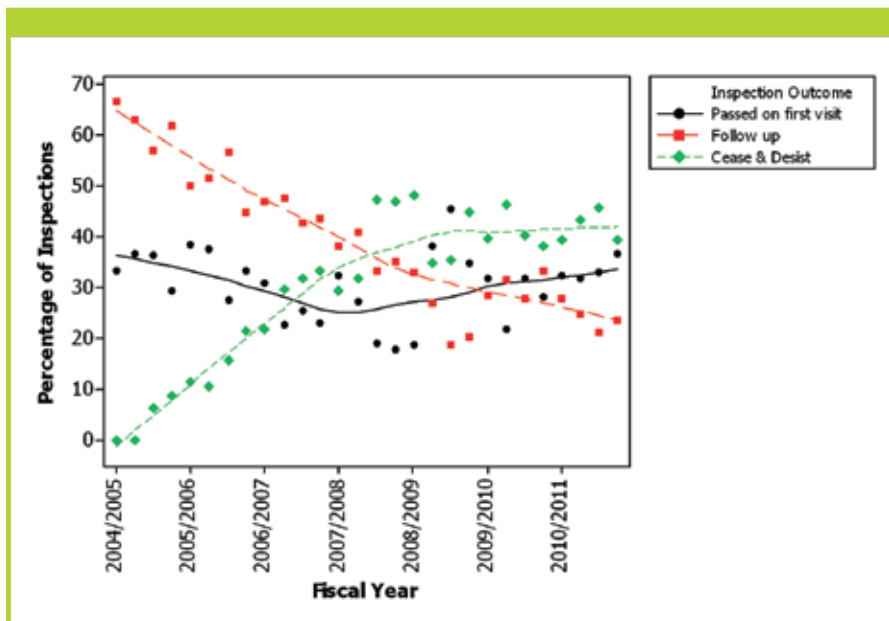
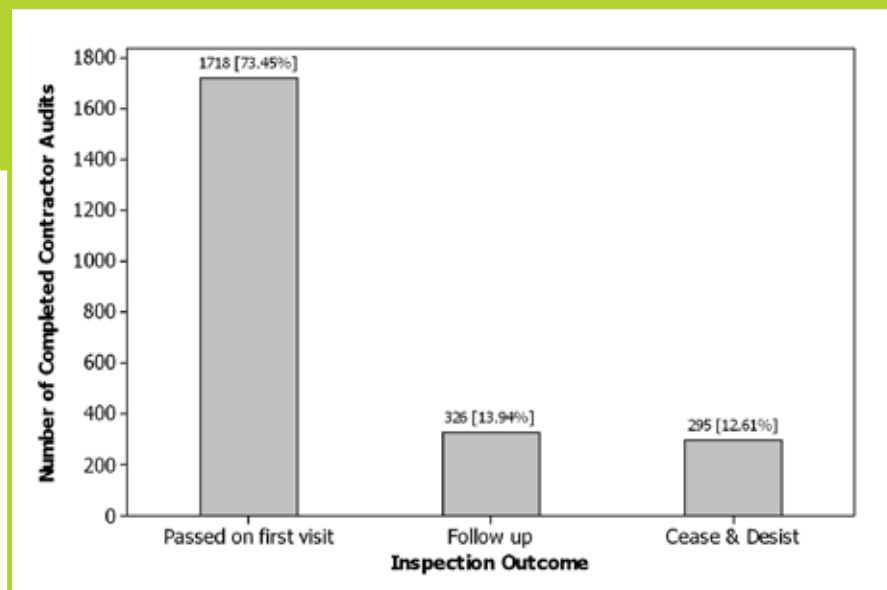


Figure F-15: Fuels ad hoc inspection outcomes by percentage over the last seven fiscal years.

Contractor Audits

There were 2,339 contractor audits conducted in fiscal year 2010/2011. Each of these audits results in an outcome as determined by a TSSA inspector, shown in Figure F-16. Of all contractor audits completed in fiscal year 2010/2011, 73.45% were compliant with regulations on the first visit.

Figure F-16: Outcomes from fuels contractor audits completed in fiscal year 2010/2011.



TSSA inspectors issued a total of 3,508 inspection orders during the course of these periodic inspections. This yields an average number of inspection orders issued per inspection of 1.50.

Compliance Related Trends

Figure F-17 charts the number of contractor audits over the last seven fiscal years. A statistical analysis of this data indicates that the number of contractor audits does not demonstrate a significant trend over the period.

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

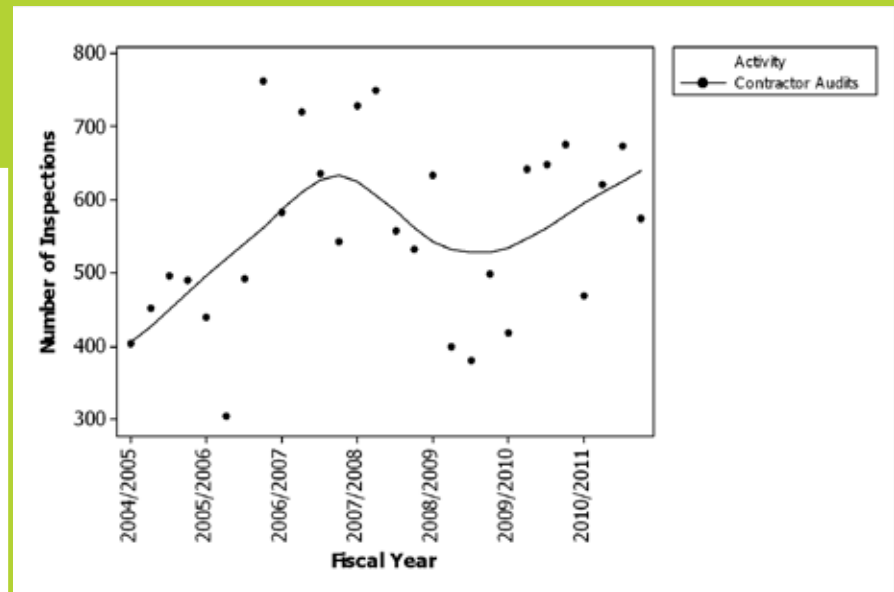


Figure F-18 provides the average number of inspection orders per audit for the last seven fiscal years. A statistical analysis of this data indicates that the average number of inspection orders per audit demonstrates an increasing trend over the period at a rate of 0.03 inspection orders per audit.

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

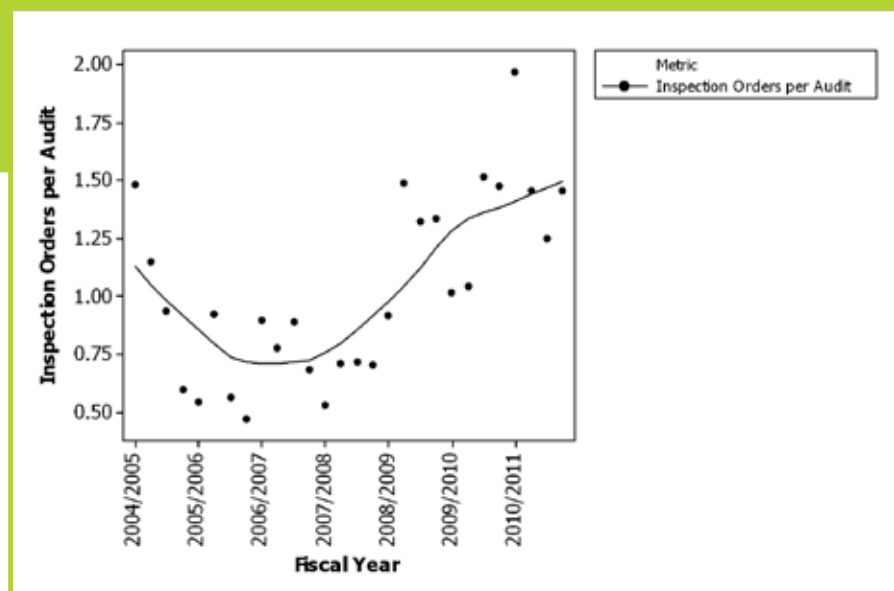


Figure F-19 charts the outcomes from fuels contractor audits completed over the last seven fiscal years. A statistical analysis of this data indicates that there is an increasing trend in the percentage of 'Cease & Desist' inspection outcomes over the period at a rate of 0.54% per quarter. This analysis also reveals that there is a decreasing trend in the percentage of 'Follow-up' inspection outcomes over the measured time at a rate of 0.72% per quarter. The 'Passed on first visit' inspection outcome did not demonstrate a significant trend.

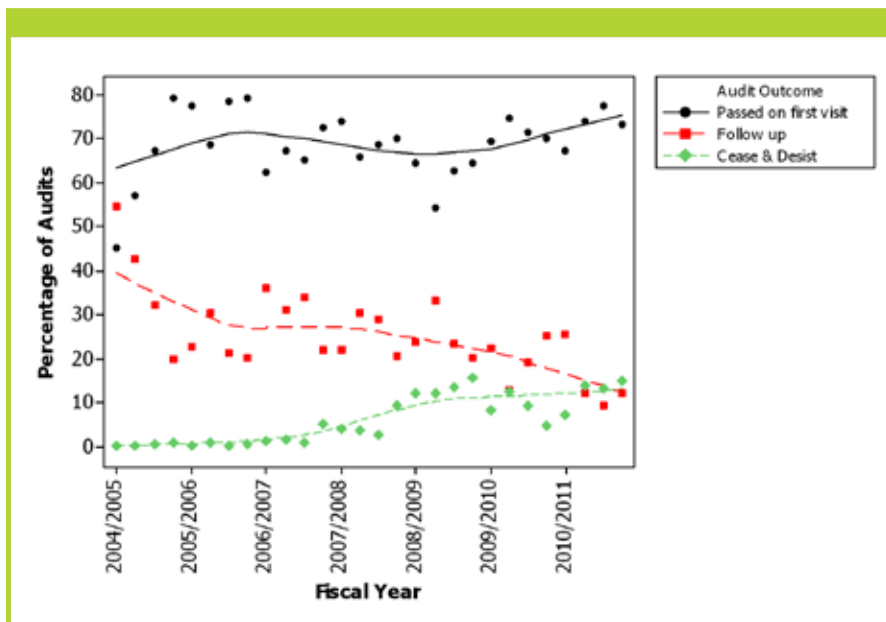


Figure F-19: Fuels contractor audit outcomes by percentage over the last seven fiscal years.

Other Safety and Risk Analysis Results

The prediction intervals, which represent the expected ranges of the indicator and are defined by the fifth and ninety-fifth percentiles of the trend data, for the compliance outcomes on fuels are indicated in Table F-6.

Table F-6: Prediction intervals for compliance outcomes on fuels for fiscal year 2011/2012.

Activity	Indicator	Lower Prediction Bound	Upper Prediction Bound
Periodic Inspections	Percentage Passed on First Visit	27.32%	55.18%
	Percentage Follow-up	40.71%	72.27%
	Percentage Cease & Desist	0.00%	1.79%
	Number of Orders per Inspection	1.12	2.87
Ad Hoc Inspections	Percentage Passed on First Visit	18.39%	42.39%
	Percentage Follow-up	19.46%	65.10%
	Percentage Cease & Desist	0.00%	47.75%
	Number of Orders per Inspection	1.40	2.63
Contractor Audits	Percentage Passed on First Visit	45.05%	79.27%
	Percentage Follow-up	9.35%	42.83%
	Percentage Cease & Desist	0.00%	14.81%
	Number of Orders per Inspection	0.47	1.52

The prediction intervals generated from the trend data for the safety outcomes from fuels are indicated in Table F-7.

Table F-7: Prediction intervals for safety outcomes from fuels for fiscal year 2011/2012.			
Activity	Indicator	Lower Prediction Bound	Upper Prediction Bound
Occurrences	Number of Fatalities	0	8
	Number of Serious Injuries	0	25

Public Safety Decisions

TSSA Actions

TSSA will assess two potential safety issues, fuel oil tank failures and pipeline failures due to the aging technology and infrastructure initiative. Actions will be identified from these assessments as required.

The fuel oil tank failure assessment will be completed by the end of the fourth quarter of fiscal year 2011/2012.

Analysis of the pipeline integrity management program for transmission and distribution companies is an ongoing initiative.

Improving Compliance

To enhance compliance, the Fuels Safety Program will form a task group in fiscal year 2011/2012 that will consider initiatives to improve the compliance with regulations for periodic inspections. Enhancements to the contractor audit program, including the contractor audit program booklet and pre-registration inspection, are gaining momentum and continue to receive positive feedback as an effective tool to assist contractors in understanding their role and responsibilities.

Managing Safety Issues

TSSA will continue its current activities of safety presentations and dig safe day audits to help reduce pipeline damages. Dig safe days are an inspection activity whereby the inspection team blitzes excavation sites to gauge the level of compliance and provide safety awareness information, where necessary. Additionally, TSSA will continue its support of ORCGA initiatives, like the introduction of one call legislation, to further reduce pipeline damages and enhance public safety.

ORCGA is an organization promoting efficient and effective damage prevention for Ontario's vital underground infrastructure. ORCGA is a growing organization with over 380 groups as active members and sponsors, and represents a wide cross-section of stakeholders.

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 labelled. 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.

The introduction of the new information system in July 2009 was designed to allow for the collection of compliance outcomes enabling trend analysis. The information system also allows for a deeper level of analysis of inspection orders. On the basis of the information collected in this system, TSSA may apply its risk-informed decision making framework and better inform inspection priorities.

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

The introduction of the new information system in July 2009 was designed to allow for the collection of compliance outcomes enabling trend analysis. The information system also allows for a deeper level of analysis of inspection orders. On the basis of the information collected in this system, TSSA may apply its risk-informed decision making framework and better inform inspection priorities.



Public Safety Analysis

Inspection Analysis

The number of inspections completed in fiscal year 2010/2011 is presented in Table USA-1. The table also includes the total number of inspection orders issued in those inspections.

Table USA-1: Activity measures for upholstered and stuffed articles inspections for fiscal year 2010/2011.				
Activity	Number of Inspections	Number of Follow-ups	Number of Inspection Orders	Number of Inspection Orders Per Inspection
Home Hobby/Craft Operator Ad hoc Inspection	25	0	0	0.00
Importer/Distributor Ad hoc Inspection	185	80	2,045	11.05
Major Retailer Ad hoc Inspection	153	0	4,412	28.84
Manufacturer Ad hoc Inspection	135	42	358	2.65
Printer Ad hoc Inspection	3	0	0	0.00
Renovator Ad hoc Inspection	136	22	28	0.21
Retailer Ad hoc Inspection	399	274	4,838	12.13
Supplier Ad hoc Inspection	8	0	0	0.00
Trade Show Ad hoc Inspection	2	0	0	0.00
Complaint	7	0	201	28.71
Other Inspection	2	0	116	58.00
Home Hobby/Craft Operator Periodic Inspection	2	0	0	0.00
Importer/Distributor Periodic Inspection	18	7	216	12.00
Manufacturer Periodic Inspection	7	3	3	0.43
Renovator Periodic Inspection	14	1	3	0.21
Retailer Periodic Inspection	99	17	121	1.22
Supplier Periodic Inspection	2	0	0	0.00
Domestic Manufacturer Registration Inspection	1	0	0	0.00
Domestic Renovator Registration Inspection	1	0	0	0.00
Total	1,199	636	12,341	10.29

Table USA-2 breaks down the top infraction types by volume.

Table USA-2: Number of Inspection Orders by Infraction from inspections conducted for fiscal year 2010/2011.

Infraction Type	Number of Inspection Orders	Number of Inspection Orders Per Inspection
Manufacturer Not Registered in Ontario	3,882	3.24
No Provincial Label	3,546	2.96
No Contents Declared	1,530	1.28
Expired Registration	506	0.42
Non-approved Label Format	416	0.35
Incorrect Content Declaration	285	0.24
Country of Origin Conflicts with Registration Address	115	0.10
Unclean/unsafe Filling Material	33	0.03
Other	2,028	2.51
Total Number of Inspection Orders Issued	12,341	10.30

Public Safety Decisions

Seasonal inspections are the primary source of finding articles that are non-compliant with the regulation. An important additional avenue of finding non-compliant articles is through the self-monitoring of customers, who lodge complaints when a competitor does not follow the regulation.

To address non-compliance with articles that do not have their manufacturer registered or a provincial label affixed, TSSA educates customers on the requirements of the regulation. Several retailers and importer/distributors have in turn passed on these requirements to their vendors, helping to reduce non-compliance. TSSA also communicates to retailers the requirement to affix a second-hand label at the point of sale to all returned articles, which is an important area of compliance.

TSSA will continue to monitor the furniture and mattress industry to ensure that contaminated products are not being sold. Whenever a product is discovered to be contaminated, orders are issued to ensure that it is destroyed. It is expected that over time TSSA's proactive response will decrease the amount of such products in the market.

The majority of articles manufactured and falling under this regulation are imported. TSSA continues to proactively inspect at retailers and importers/distributors.

Appendix A -Statistical Methods

The statistical analysis of time series of data in this report includes:

- graphical data analysis;
- construction of prediction intervals;
- trend tests; and
- slope estimates.

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 scatter plots 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. Scatter plots have the limitation that the presentation of a large number of data points can become rather clustered and unintelligible.

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 a centre line to the data; the direction and slope of this line varies locally in response to the data itself. The analysis in this report uses a method known as Locally Weighted Scatter plot Smoothing (LOWESS) to fit lines to the data. This method is more robust to outliers than the method of ordinary least squares regression, and does not require residuals to satisfy the assumptions of normality and constant variance. Additionally, unlike the regression method, the shape of a smooth is not specified *a priori*, but rather 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 16®.

A prediction interval is an estimate of an interval into which a new observation will fall, with a certain probability, given what has already been observed. In this report, the prediction interval covers between the 5 and 95 percentiles of the measured data. Observations for those indicators lying outside the prediction intervals are made with a 95% confidence level. Prediction intervals allow indicators to be checked on a quarterly basis, verifying if they fit the behaviour of historical observations.

Trend tests allow for statistical hypotheses testing. This has two advantages over graphical data analysis:

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

The current study uses the Mann-Kendall test in the determination of whether the probability distribution from which response values arise has changed over time. The Mann-Kendall test is a non-parametric test, and does not require any assumption of normality or canonical distributions in the data. This test is robust to outliers and allows missing data to be present in the analysis. To better discern the trend in the response variable, efforts have been made to remove the effects of other exogenous variables in this report (such as the number of inspections conducted).

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 16® software. If evidence is found for seasonality then the Seasonal Mann-Kendall trend test is used instead of the Mann-Kendall test.

The assertions of any of these tests are made with 95% confidence.

An estimate of the slope is constructed using Sen's method. This method calculates the slope for each pair of points in the data, and utilizes the median of these calculated slopes as the estimate. When the data is seasonal, only points from the same season are used in the pair-wise slope calculation. This slope gives an estimate of the rate of change of the data, assuming that it responds linearly with time.

Appendix B -Causal Analysis Categories

There are three causal analysis categories into which occurrences with a root cause can be categorized. The description of each category and the associated mapping of root cause information are listed below. Occurrences that do not have an established root cause after inspection are contained in a fourth category, root cause not established.

Inadequate Current Regulatory System

Occurrences in this causal category indicate potential areas in need of regulatory change or improvement. They are consistent with the regulatory gap and impact analysis currently used by Ministry of Consumer Services to effectively improve the regulatory system without imposing unnecessary additional regulatory burden.

Table C-1: Causes contained in the Inadequate Current Regulatory System category.

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.
Management	Factors related to the levels of responsibility that are accountable for specific activities, programs and systems of operation.	▪ Gaps in the regulatory management system.

Non-compliance with Regulatory System

Occurrences in this causal category most appropriately reflect TSSA's effectiveness in administering the safety system and obtaining compliance. They allow TSSA to allocate enforcement resources to areas of greatest risk.

Table C-2: Causes contained in the Non-compliance with Regulatory System category.

Category	Definition	Sub-Categories
Design	Factors related to the engineering outline and physical make-up of a device for its intended purpose.	▪ 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.
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. ▪ Failure to follow maintenance procedures. ▪ Failure to follow operating procedures. ▪ Failure to follow installation procedures. ▪ Inappropriate plant operator attendance. ▪ Incomplete or inadequate internal communication. ▪ Incomplete or inadequate external communication.
Maintenance Procedures	Factors related to repair and upkeep activities required for the preservation of a device during its useful life cycle.	▪ 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.
Procedures	Factors related to guidelines that outline how specific activities should be executed.	▪ Defective or inadequate operating procedures. ▪ Lack of operating procedures. ▪ Lack of or inadequate safety procedures. ▪ Defective or inadequate installation procedures. ▪ Lack of installation procedures.
Training	Factors related to documented programs that prepare employees for the proper execution of specific work activities as required.	▪ Lack of training programs. ▪ Defective or inadequate training programs.

External Factors

Occurrences in this causal category indicate occurrences that are outside the control or influence of TSSA. This category prevents inappropriately misrepresenting occurrence cause to TSSA's performance with respect to compliance or the effectiveness of provincial regulations, and allows for the identification of other mitigation measures.

Table C-3: Causes contained in the External Factors category.

Category	Definition	Sub-Categories
External Factors	Factors representing occurrences beyond human control or TSSA regulatory control.	- Weather or other environment conditions. - Utilities disruption or failure. - External incidents. - Sabotage, terrorism, vandalism or theft. - Non-compliance with non-TSSA regulations.
Human Factors	Factors related to actions or inactions of humans in the execution of activities in the operation of equipment or in the general work environment.	- Special conditions. - Failure to follow user instructions. - Deliberate intent or sabotage.

Appendix C - Disability-Adjusted Life Year (DALY) Metric

A DALY of 1.0 is the loss of one year of healthy life of a single person due to an injury. For comparison purposes, DALYs are expressed per million of population. For example, a DALY of 28.1 per million for a fiscal year means that 28.1 years of useful life were lost per one million people in Ontario for that year due to injuries arising from all the sectors TSSA regulates.

The disability-adjusted life year is a universal health impact metric introduced by the World Health Organization as a single measure to quantify the burden of diseases and injuries. The DALY can be thought of as equivalent years of “healthy” life lost by virtue of being in states of poor health or disability and/or due to premature fatality. The number of DALYs for a fatality is calculated based on the standard life expectancy at age of death in years and is based on age and sex (e.g., fatality of a male child aged 5 would translate to 70 DALYs as the average life expectancy is 75 years). The number of DALYs for an injury is calculated by multiplying the average duration of the injury by a weight factor that reflects the severity of the injury on a scale from 0 (being in perfect health) to 1 (being dead).

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

- quality of life;
- quantity of life; and
- social magnitude.

The quality of life is measured by duration of injury and life expectancy of a victim. The quantity of life lost is expressed through disability weights, and the social magnitude is characterized by the number of people affected. As discussed earlier, DALYs can be expressed per million of population.

The DALY can be calculated by the following equation: $\text{DALY} = (\text{Short-term Weight} * \text{Short-term Duration}) + (\text{Fraction Long-term}) * (\text{Long-term Weight} * \text{Long-term Duration})$.

There are four injury types categorized in the TSSA database: i) fatality, ii) serious injury, iii) minor injury, and iv) no injury. The serious and minor injuries are further characterized by 28 specific types of injury descriptions. In the above equation, disability weights, fraction long-term, and short-term durations, associated with the various injury descriptions, have been adopted and/or modified from the Australian Burden of Disease and Injury Study. The long-term durations were adopted from the global burden of disease study by age and gender using the following age groups (cohorts): 0–4, 5–14, 15–24, 25–34, 35–44, 45–54, 55–64, 65–74, 75 and older.

A hypothetical example is presented to better understand the DALYs calculations. Assume a male victim sustains a spinal injury at the age of 30 years due to the malfunctioning of a regulated technology. The equivalent healthy years lost due to the spinal injury can be calculated as 34.87 by using the above equation. In this calculation the short-term weight of 0.725 and duration of 0 years are used respectively. For fraction long-term and long-term duration parameters the values of 1 and 0.725 were used, respectively, in calculating the injury burden. The cohort life expectancy of 48.1 years, for the age group of 25 to 34 years, is used in the above calculation.

One further advantage of the DALY metric for safety performance reporting is that it allows the root cause of incidents to be established and divided into the three categories listed in Appendix B.

Appendix D - Glossary of Terms

Cease and Desist	Applies to an activity or a person and is an order to cease an activity that is in non-compliance or could create an unsafe condition.
Complete	An inspection that has been executed with no outstanding non-compliances (hazards) found.
Conditional Pass	A device is allowed to remain in operation with low hazards or minor non-compliances identified from inspection.
Disability-Adjusted Life Year (DALY)	A DALY of 1.0 is the loss of one year of healthy life of a single person due to an injury. Please see appendix C for a full description.
Follow-up	An inspection with this outcome has revealed non-compliances that must be corrected and verified by an inspector.
Hazard Rank	The assignment of the likelihood of a failure and its associated consequence(s) as judged by the inspector when a non-compliance is found, using a pre-determined hazard ranking tool.
Incident Management Information System (IMIS)	A public safety decision-support information tool that enables TSSA to document the receipt, dispatch, investigation and analysis of reported occurrences and forms a component of the Incident Management System (IMS).
Incident Management System	A structured framework that translates the legislated regulatory responsibilities of TSSA, specifically as it pertains to incident investigations into a management system. This management system contains policies, procedures, roles and responsibilities and associated processes that enable the receipt, investigation and analysis of reported occurrences.
Incident Occurrence	An occurrence involving a system/device/component under TSSA's jurisdiction, whereby a hazard is exposed resulting in a consequence to people or property.
Inspection	An official examination of a device, system or procedure aimed at forming a safety assessment of the device, system or procedure.
Inspection Order	Referenced in Section 21 of the Technical Standards and Safety Act, an inspection order is the direction issued by an inspector to address any contravention to the provision of the Act, the regulations including codes, or a Minister's order.
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.
Passed on First Visit	An inspection that has been executed with no outstanding non-compliances (hazards) found after the inspection is complete.
Prediction Interval	A prediction interval is an estimate of an interval into which a new observation will fall, with a certain probability, given what has already been observed. In this report, the prediction interval covers between the 5 and 95 percentiles of the measured data. Observations for those indicators lying outside the prediction intervals are made with a 95% confidence level.
Root Cause	The most basic reason (underlying cause) for an occurrence that can be reasonably identified.
Seasonal	A time series of data is seasonal when it contains cyclical sub-periods that display distinct behaviour.
Serious Injury	The consequence of an incident occurrence wherein there was observed health impact that was estimated to be serious based on the nature of the injury and its associated severity using a methodology developed by the WHO.
Shutdown	Inspections that identify non-compliances that must be rectified and verified by an inspector before the device can be operated.
Voluntary Compliance	An allowance provided by the inspector for a person to comply with Legal Orders at a point in the future and self declare the compliance in writing without the need for a follow-up inspection by an inspector to verify the compliance.
Voluntary Shutdown	Non-compliances were found which would have warranted a failed inspection, a shut down or conditional pass but the owner has voluntarily decided to shut the device down.



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