

REPORT OF THE

**P R O P A N E S A F E T Y**

**R E V I E W**

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**EXPERT PANEL**

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## ***Ontario Propane Safety Review***

November 7, 2008

The Honourable Harinder S. Takhar  
Minister of Small Business and Consumer Services  
1306 - 99 Wellesley St W,  
1st Floor, Whitney Block  
Toronto ON M7A 1W2

Dear Minister Takhar:

We are pleased to present to you our report on our safety review of the storage, handling, location and transport of propane in Ontario.

We would like to acknowledge the valuable contributions of many individuals, organizations and communities to this report. The advice and suggestions they provided through the engagement process were very helpful in guiding us through our deliberations.

We would particularly like to thank the staff members from across the Ontario Public Service who provided dedicated support during this period.

Minister, we are confident that the course of action contained in this report will further improve the safety of Ontarians and we will follow the results with great interest.

Respectfully,

A handwritten signature in black ink, appearing to read "M Birk". The signature is fluid and cursive.

Dr. Michael Birk

A handwritten signature in black ink, appearing to read "Susana Katz". The signature is more stylized and blocky than the one to its left.

Susana Katz

## EXECUTIVE SUMMARY

This report sets out the findings and recommendations of the Propane Safety Review, an independent panel which was appointed in August 2008 by the Minister of Small Business and Consumer Services.

The focus was on the regulatory system for propane safety from an over-all perspective. The review did not involve investigating the events of August 10, 2008, when an explosion occurred at a facility in northwest Toronto at which propane was stored, nor did it touch on findings of fault. Other parties are investigating that incident.

The building blocks for propane safety are in place in Ontario and have served people well over the years, but improvement is always possible. The following recommendations provide guidance on how to achieve this. The body of this report sets out more detailed findings and analysis to present a basis for the recommendations.

### RISK-BASED REGULATION

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1. Technical Standards and Safety Authority (TSSA) should continue to build on its existing risk-based enforcement model by introducing a more rigorous, statistical approach for propane safety.
2. TSSA should inspect facilities annually until it has gathered the required data, and has developed and is applying a comprehensive risk-based approach to regulation.

### STORAGE AND INVENTORY

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3. For the purposes of licensing a facility, the total capacity should include both fixed and transient storage, with the second element defined as the combined capacity of the maximum number of stored cylinders and tanks, and of tanker trucks and/or rail tank cars that might stay at the facility at any given time for longer than it takes them to complete a transfer.
4. A limit should be set on maximum transient storage at a facility.
5. The facility operator should be required to designate the parking spaces for transient tanker truck storage at a facility.

### RISK AND SAFETY MANAGEMENT PLANS

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6. Every facility at which transfer of propane takes place should have a risk and safety management plan as a condition of licensing.
7. Certification by a professional engineer should be required for all risk and safety management plans for facilities of more than 30,000 USWG in total capacity.
8. When reviewing an operator's risk and safety management plan, TSSA should verify that it includes all relevant requirements.

9. TSSA should continue to invest in the technology needed to improve the quality and value of data on the location of propane facilities and those handling other volatile fuels, with a specific goal of allowing these facilities and related defined hazard distances to be mapped using geographical information system (GIS) technology.
10. TSSA should make available to municipalities and planning boards the locations of facilities and the defined hazard distance around each, either as maps or, if the community prefers, GIS data.
11. TSSA should make publicly available sections of the risk and safety management plan dealing with emergency response for facilities of more than 30,000 USWG in total capacity.
12. As a condition of licencing, the operator should be required to review the risk and safety management plan on the same cycle as TSSA's inspection cycle. This review should assess whether development within the defined hazard distance has increased the risks relating to the facility and the plan should be upgraded as required.
13. When a licence is first issued for a facility, the licence approval should state specifically that if development around the facility changes so as to increase risk, it is the responsibility of the operator to reassess and, if necessary, upgrade special mitigation measures.
14. The Province should amend planning rules to require municipalities and local appeal bodies to notify facility operators of applications for official plan amendments, plans of subdivision, rezoning and minor variances where the facility's defined hazard distance extends into the area under consideration for change.

#### **OTHER NEW REQUIREMENTS FOR PROPONENTS**

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15. An application to TSSA for a new or expanded facility should not be considered complete until the fire service has received and approved all components of the risk and safety management plan that address fire safety, protection and emergency considerations.
16. Before commissioning a new or expanded facility, the proponent should be required to contact the local fire service for a walk-through with the aim of familiarization.
17. An application to TSSA for a new facility or an expansion should not be considered complete until the proponent receives and includes the comments of the relevant local planning authority.

#### **TRAINING AND CERTIFICATION**

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18. Training requirements should be extended to include at least one officer, director or partner of every propane operator and licence holder.
19. Certificate holders should have to produce proof of their training on demand.
20. Certificate holders should receive site-specific training when starting work and after changing employers or facilities, and should be re-certified after being away from the job for a significant period of time.
21. Every person who works at a facility should be trained in the facility's emergency procedures.

22. The training curriculum for certificate holders should cover the consequences of incorrect handling, storage or transport of propane, including the impact of major fires and explosions. It should also cover emergency procedures.
23. TSSA should set a three-year review schedule for training providers and as part of this process the training provider should review the curriculum, update it if necessary and submit it to TSSA.
24. Trainers should be required to have hands-on, practical experience as well as theoretical knowledge of the subject areas they teach.
25. The Office of the Fire Marshal should enhance its training for fire department personnel in the areas of prevention, mitigation and suppression of propane explosions and fires.
26. Propane facility inspectors should be trained in all aspects of propane safety, including how to recognize and respond to imminent hazards.

### **PUBLIC EDUCATION**

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27. TSSA, Office of the Fire Marshal, industry and others with an interest in the industry's safety should work together on a public safety and awareness program.

### **INFORMATION-SHARING**

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28. As part of the code adoption process or if considering changes to other regulatory instruments, TSSA should consult with the Office of the Fire Marshal and Ontario municipalities.
29. There should be formal agreements in place so that such authorities as the Province's Office of the Fire Marshal, Office of the Chief Coroner for Ontario, Ministry of Labour, and TSSA share information, findings and any recommendations with all parties with an interest in propane safety.
30. TSSA and provincial, municipal and other investigative authorities should create a cross-jurisdictional incident database, aggregating information on causes of incidents, lessons learned, and recommended preventative steps.

### **INSURANCE**

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31. Propane operators should be required to carry insurance as a condition of licensing.

### **IMMINENT HAZARD**

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32. Where there is an imminent hazard to safety, and the facility operator will not or cannot act to correct it, TSSA inspectors should have the full and clear authority to ensure that the installation is made safe and to charge back the costs to the operator.

## **FIRE SAFETY**

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33. Operators should be required to keep records to demonstrate on-going maintenance and operational testing of fire safety equipment and systems.
34. Fire services should have clear authority to enter licensed propane facilities for familiarization purposes and/or to verify proper maintenance of fire protection equipment.

## **OTHER RECOMMENDATIONS**

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35. In light of these recommendations, TSSA should review its current code adoption document, directors' orders and branch standards, with a view to updating these as necessary.
36. The Ministry should consider approaches similar to those recommended here for propane for all liquid and gaseous fuels in use in the province to ensure that they also are covered by a best-practices regulatory framework.
37. The Ministry should review the progress of adoption and implementation of these recommendations within 18 months and report to the public, including the members of the Propane Safety Review.
38. Once recommendations have been implemented, the Ministry and TSSA should review their impacts on a periodic basis with a view to making any further changes, if necessary, to improve propane safety and should inform the public, including the members of the Propane Safety Review.
39. The Minister should ask Transport Canada to examine the potential benefits to public safety of thermal protection requirements for highway tank trucks similar to those for railway tank cars and regulations for safe parking of tank trucks, including such factors as setback and security.
40. The Minister should ask the Canadian Standards Association to review and update the relevant sections of the propane installation code (B149.2 and B149.5) with a focus on setback distances, categories of installation, emergency response plans, maintenance, and special fire protection and to ensure the code aligns with international best practices.

## **NOTE**

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The terms "defined hazard distance" and "certificate holder" in the above recommendations have specific meanings in this report that can be found on page 25 and page 16 respectively.



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\* Many of the written submissions were made in response to a public discussion paper that was posted on the Propane Safety Review's website at [www.propanesafetyreview.ca](http://www.propanesafetyreview.ca)

## INTRODUCTION

In August of this year, the Minister of Small Business and Consumer Services appointed an independent safety review panel to examine the regulatory framework relating to propane in the province. This report sets out the findings of that review.

Before discussing what we found, we must first stress that our focus was on the regulatory system for propane safety from an over-all perspective, not on finding or suggesting how to remedy a specific problem. We looked at all the building blocks of the system, the connections within it and the strength of the entire framework. We considered propane-related legislation and regulations in Ontario, including how propane is stored, handled, located and transported. We examined the links between propane safety and other public safety systems at the provincial, municipal and federal levels. We also widened our view to consider the practices used elsewhere in Canada, the United States and around the world.

Our review did not involve investigating the events of August 10, 2008, when an explosion occurred at a facility in northwest Toronto at which propane was stored. Our work did not touch on findings of fault. Other parties are investigating that incident.

Our goal in looking at the regulatory framework as a whole was to develop a set of recommendations that would improve propane safety in Ontario. In doing so, we hope that we have provided a basis for moving the propane safety system to a higher level.

Our perspective was shaped by our backgrounds. We are both professional engineers but with different – and, in light of the goal of the review, complementary – fields of expertise.

Dr. Michael Birk is a professor of mechanical and materials engineering at Queen's University in Kingston whose fields of interest include the safety of compressed and pressure liquefied gases, particularly when they or the vessels holding them are exposed to fire. He has particular expertise in “boiling liquid expanding vapour explosions” (BLEVEs).

Susana Katz is a former director and chief inspector for gas safety for the government of British Columbia. She has managerial and technical experience in both government and private industry. In addition to in-depth regulatory experience, she is also knowledgeable in such fields as management of safety programs, quality assurance, standards development, equipment design and manufacturing, metallurgy, urban rail transport problems, welding, and destructive and non-destructive testing. Appendix A provides more details from our terms of reference, while Appendix B provides more complete biographies.

In carrying out our work, we invited members of the public and other parties with an interest in propane safety to provide their views. Over the 45 days of our review we met with a wide range of people and organizations with an interest in the review. They included officials of federal, provincial and municipal governments, community leaders, the Technical Standards and Safety Authority (TSSA), the provincial Office of the Fire Marshal, fire services and emergency planning officials, and propane industry associations and companies. A special thanks goes to TSSA, whose staff met with us three times and responded promptly to our many requests for additional information.

A complete list of those with whom we met is included as Appendix C. Written submissions are listed in Appendix D. We sincerely thank all those members of the public, government and industry who took the time to provide us with their views and advice.

To help provide a better picture of current regulatory approaches, Deloitte, a consulting firm, was engaged to gather information on the practices elsewhere and identify best practices across jurisdictions. Their report is summarized in Chapter II.

A team drawn from staff of the Ministry of Small Business and Consumer Services, to whose Minister this report was submitted, and other provincial ministries provided us with logistical, administrative and research support. We thank the provincial team for their dedicated and professional assistance.

The balance of this report covers:

- In Chapter I, background on propane, the Ontario propane industry, and the regulatory framework for safety;
- In Chapter II, a summary of the research into practices in other jurisdictions;
- In Chapter III, our analysis;
- In Chapter IV, our recommendations and thoughts about implementation and timing; and
- In Chapter V, our conclusion.

Before turning to more detailed research and findings, we want to make clear the key element of all public safety frameworks: the primary responsibility for safety must always lie with the operator. No regulator can be on site every hour of every day. Regulation must rely on workers and companies understanding the critical need for safety. Fortunately, it appears to us that most participants in the propane industry in Ontario recognize that without strict attention to safety, their industry cannot operate.

We must never forget, however, that attaining perfect safety is a huge challenge. Equipment fails. People make mistakes. Organizations or individuals are tempted to cut corners. To help the industry ensure a high level of safety, therefore, the propane safety system provides requirements and guidance in many areas: the design and installation of facilities, training and certification of

workers, and inspection and enforcement. Together, these functions aim to create a “multi-barrier” approach to safety – a system with back-ups and extra layers, so that small problems do not escalate into major incidents.

Having looked at that system, we conclude that the building blocks for propane safety are in place in Ontario and have served the people of this province well over the years. But improvement is always possible. Our recommendations address possible ways to achieve this. We believe that adopting this guidance will lead to even greater confidence in propane safety in Ontario.

## I BACKGROUND

### PROPANE AND ITS RISKS

People and businesses across Ontario consume roughly 650 million kilograms of propane every year. Most homeowners are familiar with it as a fuel for barbecues, with a typical cylinder holding 8 kilograms, but it is also used in a wide range of other applications, including fuelling vehicles, providing heat for construction sites, farms, rural homes and campers, and as a raw material in the petrochemical industry.

A by-product of natural gas processing and crude oil refining, propane is an odourless, colourless gas at room temperature. When it is sold to the public, a trace of another chemical is added to give it a distinctive smell. Commercial propane may also include small amounts of other compounds such as butane.

Because the same weight of propane takes up more volume as a gas than a liquid, propane is normally transported and stored under pressure, which transforms it to a liquid. In this state, propane is often called a pressure-liquefied gas. To be used safely, it must be taken out of its container as either a gas or liquid and its pressure must be reduced using a pressure regulator. This may also involve piping, tubing, valves and other fittings. The design, construction, maintenance of these parts requires skilled engineers and technicians. The people who operate propane transport, loading and unloading equipment must also be trained.

The change from liquid to vapour form requires energy, which causes the propane to drop in temperature. If that happens as the result of a leak from a pressurized container, the cold propane can flash-freeze water vapour in the air to create a white cloud. A white cloud near a propane tank can indicate some kind of a leak.

Even though propane is a familiar product, it must be treated with caution. Once liquid propane escapes its container, it expands by roughly 270 times in volume. It is heavier than air, so leaked gas will tend to sink into any low-lying or enclosed area rather than dissipating into the air. It can be fatal to people in an enclosed space because it is an asphyxiant. Mixed with air in concentrations between about 2 and 10% by volume, it is flammable.

Hazards associated with propane include explosion, fire, and projectiles (which can be associated with explosions). These are rare, but they do occur and can have serious consequences. Explosions produce overpressure and blast wind damage. Fireballs can engulf objects in flame or cause damage by intense heat. Projectiles from large tanks can do severe damage.

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#### A note on units of measurement

Various authorities and organizations use different measures for propane production and consumption. These include measures of weight and of volume.

We have used kilograms or tonnes, both measures of weight, when discussing propane's use in general. One tonne is 1,000 kg.

When discussing the size of vessels, where propane is held as a liquid under pressure, we give the volume in U.S. water gallons (USWG). This measure is often used in the industry. One USWG is equivalent to 3.78 litres.

When converting between measures of weight and volume, we have assumed that 1 USWG of liquid propane weighs 1.9 kilograms.

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Chapter III outlines ways in which risk can be reduced. For more information on hazards, see Appendix E.

Propane is safe when properly stored, transported, handled and used, but because of its physical characteristics all of these activities involve risk to public safety. In this, it is similar to many other products we use on a daily basis. Like them, it is subject to a public safety system.

The ideal regulatory system would provide an incident-free, completely safe environment. Research and the experience in the field show, however, that this is unattainable. Risk can be reduced significantly, but it is impossible to eliminate completely the potential for a failure in one or more of the factors that lead to incidents.

Incidents of all types are commonly attributable to:

- Whether key business **processes** are in place, adequately defined, and effective;
- Whether needed **equipment or technology** is available and accessible, and of suitable quality; and
- Whether **people** working at a site are available, knowledgeable, and accountable for outcomes.

Since risk cannot be eliminated, the focus of public safety is to manage it. To understand how a system manages risk, it is necessary to define risk in more detail. This report uses a specific definition, one that is widely used in industry and government: over-all risk takes into account both the likelihood of an incident happening and the impact of it.

Managing risk always involves reducing both elements. A good example is safety improvements in cars: some changes, like more prominent brake lights, reduce the chances of an accident; others, like seatbelts and airbags, aim to reduce the harm done if one happens.

A well designed safety system needs to be based on a multi-barrier approach, so that errors are less likely to occur and small incidents are less likely to escalate into major ones. A multi-barrier system starts with standards and codes for equipment and facilities; and training and certification requirements for people who handle propane and install, service, maintain and operate facilities, as set out in regulations.

The act gives the regulator the authority to supervise and enforce the system. The safety regulatory system for propane and similar substances is organized into elements that help to create a multi-barrier approach to reducing risk:

- Responsibility for safe management, operation and activities lies with the operator;
- The safety regulatory system sets out the codes and standards that specify the types and quality of equipment to be used and how they must be installed and operated. Establishing a system of codes and standards is the first building block in creating a safe industrial environment. It reduces the risk of an incident by ensuring high quality in equipment and processes. This activity relies on both the internal expertise of the regulator and outside parties, such as national public safety bodies. Codes, standards, rules and regulations can also address minimizing the damage if an incident occurs.
- Another element is ensuring workers in the industry are properly qualified. All participants in the system must be professionally, technically, or vocationally trained to ensure that the codes are met and their contribution to safety realized. This activity can involve setting out the education and training requirements for specific workers and certifying them, as well as licensing and certifying tradespeople and contractors who work in the industry.
- A further role is inspecting to ensure the prescribed codes and standards are followed and workers are qualified, and to uncover any inadequacies. This involves reviewing proposed activities, such as a facility expansion, and carrying out inspections before providing an authorization or licence. It also includes ongoing monitoring, both on and off-site. The ideal is that operators willingly carry out activities in a manner that helps to ensure public safety. In some cases, however, regulators must enforce compliance to legislation, regulations and codes. Inspection supports the enforcement process.

Creating and maintaining an appropriate level of safety requires the investment of resources, both financial and human. The costs of regulatory activities are driven by a range of factors, including how great a risk an activity poses, the degree of safety the public expects, conditions within the industry, and regulatory approaches. Regulation that is seen as too costly can lead to a lower level of compliance. It is important for any regulatory system to fulfill its purpose in an efficient and cost-effective manner.

### **THE PROPANE INDUSTRY IN ONTARIO**

Although propane is similar to natural gas in its uses, the way the two fuels are distributed is very different, and this has led to two very different industry structures for the two commodities. Natural gas is transported across the country and into homes by underground pipeline. Over the years, the large investments required to build these pipelines, and the natural customer areas a pipeline creates, have greatly reduced the number of natural gas pipeline operators in Ontario. The pricing and service areas of these companies are regulated by the Ontario Energy Board.

Propane is delivered to customers through a transportation and retailing system with far more participants. Unless it is a by-product of one of Ontario's oil refineries, propane arrives in Ontario through a pipeline or by rail. Depending on the balance of supply and demand at the time, it may be stored in a huge underground cavern until it moves into the distribution chain. Delivered by rail or tanker truck, its next stop is likely to be an intermediate storage facility, called a bulk plant. From there, it moves to another, smaller storage tank closer to where it will be used.

More than 300,000 businesses and households in Ontario, many in rural areas, use propane as a fuel on a permanent basis and this typically delivered by truck. In urban areas, the last stop before consumption is often a filler station that provides propane to barbecue cylinders and vehicle fuel tanks. About 80% of filler stations are less than 2,000 USWG in capacity. In recent years, cylinder exchange facilities – cages containing filled barbecue tanks – where consumers swap empty tanks for full ones have become increasingly common.

This makes for a large and varied distribution network. In all, roughly 5,800 storage facilities are licensed for propane storage in Ontario. These range in size from small cylinder exchanges, of which there are about 2,700, to a handful of very large installations of more than 100,000 USWG.

This chart shows that only about 200 of the facilities in Ontario are greater in size than 5,000 USWG:

Fixed storage at facility (USWG)	Number of facilities
5,000 to 30,000	134
30,000 to 100,000	42
More than 100,000	7

While exact figures are difficult to determine, it is estimated that about 5,000 people are employed in the propane industry in Ontario at the retail level alone. There are many companies in the industry, varying widely in size from a few employees to hundreds. The industry was estimated to have created \$312 million in direct economic activity in Ontario in 2006. Its contribution to government through taxes was an estimated \$43 million that year.

## THE CURRENT REGULATORY FRAMEWORK

The Ministry of Small Business and Consumer Services (MSBCS) has oversight for propane storage and handling in Ontario through its responsibility for the *Technical Standards and Safety Act, 2000*.

Two important regulations under this act pertain to propane:

- The Propane Storage and Handling Regulation (Ontario Reg. 211/01) prescribes safety requirements for the storage and handling of propane, and sets out licensing requirements for operators. It also incorporates, by reference, the standards contained in the Propane Storage and Handling Code of the Canadian Standards Association (CSA). The CSA, a national organization accredited by the Standards Council of Canada, is involved in developing safety standards for a wide range of products and processes. The code (known to the industry as CSA B.149.2-05) sets out detailed specifications for propane equipment, safety measures at propane facilities, and how far facilities must be from adjoining property.
- The Fuel Industry Certificates Regulation (Ontario Reg. 215/01) prescribes requirements for various types of certifications and licences for people who handle various gases, including propane, and work on equipment used in the related industries.

The Ministry delegates the responsibility for day-to-day enforcement of the act and regulations to a body called the Technical Standards and Safety Authority (TSSA). This is done under the authority of the *Safety and Consumer Statutes Administration Act*. Under that act, the Ministry retains authority for the *Technical Standards and Safety Act* and regulations, sets public safety standards and policy, and oversees delivery.

TSSA, which began operation in 1997, is a designated administrative authority as defined under Ontario's *Safety and Consumer Statutes Administration Act*. The act also requires it to be a not-for-profit corporation. TSSA is responsible for administering, on the Province's behalf, regulations that apply to a number of industries. This type of arrangement, which is used by a number of jurisdictions, is commonly referred to as a delegation of authority. An agreement governs the relationship between TSSA and the Ministry, which is responsible for overseeing it.

Before the creation of TSSA, its functions were carried out by the Province through the former Ministry of Consumer and Commercial Relations. One of the major differences with the current model is that regulatory activity is now funded essentially by the propane industry, through licence fees and other charges levied by TSSA. This means that ultimately, the propane consumer pays the regulatory costs.

Another difference is that although accountability for propane safety continues to lie with the Minister of Small Business and Consumer Services, administration of the act and regulations has been delegated to an organization outside government. The 13-member board of TSSA comprises industry and independent representatives, including three appointed by government. On specific industry matters it seeks guidance from advisory councils made up of representatives from the industry and regulatory community. These include the Propane Advisory Council, through which TSSA can consult with industry on its safety strategies, and receive input and advice to help guide its decision-making and operations; and its Consumers Advisory Council, which provides input concerning the public's perspective on safety associated with TSSA's business procedures and regulatory activities.

As well as administering the *Technical Safety and Standards Act* and related regulations, TSSA sets out additional requirements in carrying out its mandate.

### ACTIVITIES OF TSSA

TSSA regulates propane through two of its programs. One, Fuels Safety, deals with the safe transportation, storage, handling and use of fuels, including propane. The other, Boilers and Pressure Vessels, regulates the tanks used to store propane and other gases, including how they are manufactured and installed.

TSSA's propane-related functions include regulating fuel suppliers, storage facilities, tank trucks, contractors, and equipment or appliances that use propane. It carries out inspections when licensed facilities start up and periodically afterward.

In Ontario, propane facilities (including retail outlets, filling plants, cylinder handling facilities and container refill centres) must be licensed. Applications are submitted to TSSA. All applicants must provide:

- basic facility information (such as the location and the name of a contact person); and,
- a letter from the relevant municipality indicating that the facility will not contravene the municipality's zoning by-laws.

The applicant must also provide a site plan showing the distances between tanks and cylinder storage areas, between tanks/cylinder storage areas and nearby buildings, and between tanks/cylinder storage areas and property lines. TSSA reviews this information for compliance. TSSA also inspects each facility before granting a licence. Licensed facilities are audited periodically, generally an average of once every three years. TSSA has a number of specialized full-time inspectors and engineers who monitor the industry's compliance, enforce the act and regulations and investigate incidents and complaints.

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#### A note on terminology

In this report, the term "certificate holder" refers to anyone required under the Fuel Industry Certificates Regulation to hold a certificate. These include propane plant and truck operators.

The more general term "operator," on the other hand, refers to those who own or manage a propane company.

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Every person handling propane at a facility must be certified as a propane plant operator (PPO). This certification process has three levels; at each successive level, an operator is authorized to carry out different activities. A similar certification regime applies to propane truck operators (PTOs). Training is delivered and these certificates are issued not by TSSA itself but by third parties which it authorizes. TSSA certifies other workers in the industry.

### **OTHER REGULATORY AUTHORITIES**

Although TSSA has the largest role in propane safety in Ontario, other regulatory bodies, some federal, may also be involved.

**Transport Canada** The Transport of Dangerous Goods Directorate within this federal department governs the transport of propane and other hazardous substances in Canada. Under a memorandum of understanding, Ontario's Ministry of Transportation may inspect trucks on the roads carrying dangerous goods. The federal directorate may also carry out its own inspections. Every truck transporting propane must carry an Emergency Response Assist Plan (ERAP), which is required to take into consideration the risks (such as population density) relating to specific routes.

**Environment Canada** Regulations made under the federal *Canadian Environmental Protection Act* require operators of facilities storing or using more than 4.5 tonnes of propane (roughly equivalent to 2,400 USWG) to notify Environment Canada and prepare an environmental emergency plan, which must be tested and updated annually. The plan and test results must be kept on-site.

**Municipalities** Ontario municipalities determine the uses of land within their boundaries through such instruments as zoning bylaws and official plans. They also consider applications for building permits and subdivisions of land, which normally must conform to allowed land use. Through the Ministry of Municipal Affairs and Housing, the Province has general oversight of land-use planning and the building code, but enforcement is at the local level. Propane facilities are generally considered as commercial or industrial uses for planning and zoning purposes. Propane vessels do not fall under the definition of a building, nor are they considered "designated structures" for building code purposes.

**Other authorities** Several other organizations and authorities have roles that can touch on propane safety. The Ministry of Labour is responsible for monitoring compliance with the *Hazardous Products Act*, the *Occupational Health and Safety Act* and the Ontario Workplace Hazardous Materials Information System (WHMIS) regulation, all of which relate to hazards and conditions in a workplace. The Ministry may also carry out inspections and ask tradespeople for proof of their qualifications. The *Fire Protection and Prevention Act* allows firefighters to enter a facility if there is a fire. The Office of the Fire Marshal, through its authority under the *Fire Protection and Prevention Act*, administers the Ontario Fire Code, provides advice and assistance to municipalities

and fire-departments, and investigates the cause of fires among other duties. Coroners are authorized to investigate deaths that may have resulted from any of a wide range of suspected causes, including misadventure, negligence or misconduct.

## II REVIEW OF OTHER JURISDICTIONS

As noted in the Introduction, Deloitte was retained to carry out a review of practices in other jurisdictions for this project. Deloitte researched, compiled and reviewed relevant propane regulatory frameworks from the following jurisdictions:

- Alberta, British Columbia, and Quebec;
- Selected U.S. states;
- The European Union (and member states, including the United Kingdom and the Netherlands);
- Australia (with a focus on the states of New South Wales and Victoria); and
- Japan.

Ontario measured favorably when compared with other provinces. For example, Ontario's setback distances exceed those found in the rest of Canada and follow common technical standards found in CSA's Propane Safety Code. The review shows, however, that there are other jurisdictions ahead of Ontario and Canada in several areas that touch on propane safety.

In leading jurisdictions, the report notes, the regulation of propane storage and handling, and hazardous materials sites more generally, reflects the following key characteristics:

- Focus on emergency prevention and preparedness: Preventative measures, such as regulatory review and audit of safety and operational plans, are emphasized, alongside plans that require identifying hazards, including mitigation where needed, and specifying emergency response procedures;
- Information-sharing: Information on hazardous facilities, as well as incident reporting and investigation, is shared with other regulators, local emergency responders, key stakeholders (such as hospitals and schools), to enable a coordinated approach to emergency prevention and response;
- Data analysis: Data collected by regulators on hazardous facilities is used in a systematic way (for example, in risk maps) to analyze relevant risks and aid decision-making; and
- Integrating regulatory resources: Where appropriate, government agencies work together in order to make decisions impacting on hazardous materials sites. For example, a hazardous materials regulator advises local planning authorities on zoning decisions or building approvals.

These key characteristics reflect the best practices observed in the review, which are summarized by general theme below. These practices are drawn for the most part from several documents that we believe set out good approaches to public safety where propane is concerned.

These documents include:

- The Seveso II Directive (Council Directive 96/82/EC), which applies to industrial establishments within European Union member states where dangerous substances are present in greater than threshold amounts. Seveso II contains guidelines on the management of hazardous industrial sites, as well as land use planning guidelines for the siting of hazardous industrial facilities.
- The Control of Major Accident Hazards (COMAH) regulations in the United Kingdom, which were made under the authority of the *Health and Safety at Work Act* and are the means by which Seveso II was adopted.
- The risk management planning requirements for propane operators from the U.S. Environmental Protection Agency (EPA) under the authority of the *Clean Air Act*.

Various codes and standards of the National Fire Protection Association (NFPA) in the U.S., particularly in the area of special fire protection.

### **BEST PRACTICES IN LEGISLATIVE DESIGN**

1. Specific legislation and/or regulation covering the siting of hazardous materials facilities and emergency planning requirements. This was noted in Europe, Australia, and the United States.
2. Co-operation between state/federal regulators and local governments who have jurisdiction over planning and land use. Many of the European jurisdictions reviewed, particular the U.K., have successfully integrated the regulation of hazardous materials sites with local planning.
  - In the U.K., statutory agencies with relevant expertise advise local planning departments on hazardous facility siting issues.
  - In the Netherlands, integration takes the form of information-sharing between a federal-level competent authority, local governments, and institutions such as hospitals and schools.
  - Integration between local and state/federal regulatory bodies is also apparent in the United States, where the federal regulatory regime requires various risk analyses and emergency plans to be delivered to local emergency planning agencies.
3. Delegation of regulatory authority, in certain areas, directly to local governments. For example, British Columbia has permitted the delegation of regulation of part of propane and natural gas to municipal governments.

4. Creation of arm's-length regulatory agencies to oversee and enforce safety codes and/or hazardous materials regulations.

#### **BEST PRACTICES IN TRAINING, CERTIFICATION, AND LICENSING**

1. Certification and licensing requirements for both propane facilities and employees who handle propane.
2. A minimum liability insurance requirement for large propane storage or filling facilities. (Quebec, and U.S. jurisdictions such as North Carolina and Florida).
3. Relatively short renewal periods for facility licenses (between 1-5 years).
4. Physical inspection of facilities before license issue.

#### **BEST PRACTICES IN DISTANCE AND ZONING**

1. A risk-based approach to zoning decisions which takes into account quantitative data on surrounding population and accident scenarios, supported by national-level authorities. (As seen in the Netherlands and the U.K.)
2. Development of risk maps to aid local authorities in the decision-making process. (As seen in the Netherlands and the U.K.)
3. Enunciation of broad principles to guide zoning decision-making at local government level. (As seen in Seveso II)
4. Decision-making processes that consider not only current land use, but also likely future uses of surrounding land. (As seen in New South Wales)

#### **BEST PRACTICES IN EMERGENCY MANAGEMENT PLANNING**

1. Requiring operators of large facilities to prepare emergency response plans including risk analysis, response methodology, training and personnel, and communications.
  - All jurisdictions do this, to varying extents.
2. Requiring operators of large facilities to document preventative measures, such as risk assessments, operating procedure manuals, safety management reports, or fire protection strategy.
  - This is done in the U.S., Europe, and Australia.
3. Requiring applicable emergency management and/or "preventative" reports to be submitted to local emergency response authorities, or in some cases prepared in consultation with local emergency responders.
  - This is done in the U.S. and Europe; in the Australian state of Victoria comments of local first responders are specifically sought.

4. Efforts to encourage co-operation and information sharing with local emergency responders.
  - For example, in U.S. legislation there is a requirement that local emergency responders be contacted for discussion or walk-through of facility.
5. Imposing varying levels of emergency management planning obligations depending on level of risk associated with facility.
  - U.S. system of Program 1 or Program 3 emergency plans;
  - Australian system of “Major Hazard Facility” designation.

#### **BEST PRACTICES IN REPORTING OBLIGATIONS AND INFORMATION SHARING**

1. Regular reporting and information-submission requirements, which are shared not just with the regulator but also with emergency-response authorities at state and local level. (U.S.)
2. Reporting and information-submission shared with relevant local institutions (schools, hospitals). (EU)
3. “Domino effect” synthesis of information gathered by regulator in order to understand community-level risks arising from closely located facilities. (EU)
4. Cross-jurisdictional accident database, aggregating information on causes of accidents, lessons learned, and recommended preventative steps. (EU)

#### **BEST PRACTICES IN INSPECTION, OFFENCES, AND ENFORCEMENT**

1. Regular intervals for inspections, which are clearly articulated in legislative or regulatory guidance documents.
2. Documentation of inspection results is made accessible to other government agencies, key stakeholders such as emergency responders, and the public.

### III FINDINGS

We believe that the Ontario propane safety system includes all the necessary building blocks and has served the people of this province well, but as we have noted any system can be made stronger. Based on the interjurisdictional review, the submissions we received and our discussions, we identified a number of areas where we felt improvement was possible. The recommendations we provide in the following chapter explain how to make this happen.

#### **UPDATED REGULATORY APPROACHES**

The Deloitte report noted many best practices that take relative risks into account. We agree that this is a good basis for an effective public safety system, and believe it should shape the approach to regulation.

In a statistical, risk-based framework, more of a regulator's resources are allocated to pinpointing and reducing the largest sources of risk. When properly designed, this kind of framework uses resources more effectively. It allows the regulator to understand in greater depth where the largest risks lie and to focus more attention on them. For example, this may allow the regulator to spend more time identifying non-compliant operators. Conversely, the better an operator's compliance and risk prevention policies are, the less regulatory resources need to be invested. A risk-based approach also enables quicker response to changing conditions that may increase risk. Over all, it can help the propane industry to become a safer industry.

At present, TSSA uses its own system, called risk-informed decision-making (RIDM), which has been applied to some of the sectors it regulates, but not yet to propane. We feel that there is an opportunity for TSSA to refine and improve its risk-based statistical methodology in applying it to propane.

Regulatory approaches have changed in recent years. There is a tendency to move away from highly prescriptive rules to looking at whether the operator is achieving the desired results, although some leading jurisdictions remain highly prescriptive. This reflects an understanding that with many technologies available, there are many ways to reach the same outcome.

Both of these approaches – risk-based regulation and a focus on results instead of detailed prescription – make new demands on regulators. To allocate more resources to the biggest risks, the regulator must have very detailed information about the industry – incident histories, transient storage at a facility at any given time, what kind of emergency planning is in place, and many other factors. Its knowledge must also, to an extent, go beyond the industry. When development encroaches on a “defined hazard distance” around a facility, for example, that facility becomes riskier even though it has not changed in size itself. Other hazardous materials close by can

increase risk through the potential for a domino effect. All of this can put a very large burden on the regulator to collect and make sense of huge amounts of data.

Similarly, moving to a results-based regulatory framework calls for increased knowledge about existing and new safety solutions on the part of both industry participants and the regulator.

To be successful, these new approaches generally require a shift in culture, as well as investments in systems, personnel and training.

### **RISK AND SAFETY MANAGEMENT PLANNING**

Best practices elsewhere link risk management and emergency planning requirements to facility and vessel size. We believe this should be done in Ontario through requiring a risk and safety management plan for each facility at which transfer of propane takes place. These plans should take into account land use within a defined hazard distance of the largest vessel on site, as well as total facility capacity, and should include special mitigation measures where necessary.

A well-conceived risk and safety management plan contains at a minimum the following elements:

- Hazard analysis: an analysis of the “worst-case” situation that could occur at the facility, as well as of a less serious but more likely incident.
- Risk assessment: what damage could be caused to nearby people and/or property by a serious incident involving the largest vessel at the facility.
- Risk mitigation: measures to eliminate to the extent possible the risks to people and property.
- Emergency response and preparedness: procedures to be followed in the event of an incident, to be practised at least once a year, and appropriate parts to be communicated to the public.

### **EMERGENCY RESPONSE AND PREPAREDNESS**

Being prepared for an emergency and knowing how to respond are important facets of a risk and safety management plan. Typical requirements for an emergency response plan include:

- Names or positions of persons authorized to set emergency procedures in motion and the person in charge of and coordinating the on-site action;
- Name or position of the person with responsibility for liaising with the authority responsible for the external emergency plan;
- A description of the safety equipment and the resources available;
- Arrangements for limiting the risks to persons on site;
- How external authorities will be notified both initially and as more detailed information becomes available;

- Arrangements for training staff in the duties they will be expected to perform, and where necessary coordinating this with off-site emergency services; and
- Arrangements for providing assistance with off-site mitigation action.

The above requirements are summarized from the European Union Seveso II framework described in Chapter II. Other jurisdictions set similar requirements. Where external fire services are concerned, additional elements might include:

- Documents, including diagrams, showing the location and operation of emergency systems;
- Ensuring equipment and facilities for fire safety and other hazards are properly maintained;
- Alternative measures in the event of shutdown of fire protection equipment and emergency systems; and
- The capacity of the local emergency response system.

TSSA does not require emergency plans for propane facilities as part of its standard regulatory framework. Environment Canada does require environmental emergency plans for facilities holding more than 4.5 tonnes (about 2,400 USWG in volume), a threshold that would cover many propane facilities in Ontario. Since Environment Canada's mandate is protection of the environment and related health issues, its focus is somewhat different from the general public safety of operations.

Likely because several dozen substances are covered, the regulation itself does not set out detailed requirements for assessing or managing the risks each one might present. We found, however, that it provides sources of guidance that are suitable for public safety planning, such as NFPA and U.S. EPA documents.

Where response to an emergency is concerned, the regulation sets out specific requirements, including the names and contact information of those who would carry out the plan, their training, and details of emergency response equipment and public notification in case of an emergency.

Environment Canada provides a sample template for facilities between 4.5 and 9 tonnes in size (roughly 2,400 to 4,800 USWG), but requires larger facilities to develop custom plans.

Environment Canada in general neither reviews nor approves plans when they are drawn up. Facilities are required to notify the department that it has prepared a plan, not to provide the plan itself. A quality assurance inspection at a site may subsequently assess the content of the plan, but not directly for the purposes of enforcement. It appears that enforcement activities are limited to ensuring during site visits that a plan exists and has been tested.

We have recommended in-depth requirements for risk and safety management plans that are specifically oriented to public safety, as a condition of TSSA licensing, and that vary with the capacity of the operation. We discuss requirements and our rationale for these in further detail in our recommendations. In some instances, a plan developed for Environment Canada purposes might fulfill the planning requirement.

### **MITIGATION IN BUILT-UP AREAS**

The current setback distances dictated by the regulatory framework – that is, the distances required between a tank and another tank, roads or buildings – are intended to ensure that sites are well ventilated and that workers and emergency responders can get to tanks quickly. Setbacks also reduce the risk of escaped propane getting into neighbouring buildings, help protect tanks from damage in case of nearby fires and increase the distance to possible ignition sources.

If the source of a hazard is kept far enough from people and facilities, the impacts of fire, explosion and projectiles can be reduced to tolerable levels. Tests, analyses, and experience help to determine the relationship between the effects of an incident and the quantity of hazardous material involved in the incident. Appendix E discusses a measure used by the U.S. Environmental Protection Agency (EPA) that is based on such a relationship. From knowledge of the tolerance levels of people and structures, safe distances are determined. These distances are based entirely on the estimated damage that could result from an incident, without considering probabilities or frequency of occurrence. When this report discusses a “defined hazard distance,” it means a measure such as the U.S. EPA 1-psi overpressure distance (see Appendix E) that gives operators guidance about when and how to manage risks to nearby population.

The current setback distances in Ontario reflect national standards and additional TSSA requirements. For vessels under 10,000 USWG in capacity, the national CSA standards apply. Those over 10,000 USWG must comply with the distance requirements outlined in NFPA 58, which are greater than the CSA distances. In addition, TSSA’s branch standard No. 9 sets minimum distances from an aboveground vessel to a residence or school, and places general restrictions on locating vessels in heavily populated or congested areas.

We found that current setback distances mandated in Ontario provide some level of safety to the public. However, the current distances do not consider the potential impact of a catastrophic failure of a large pressure vessel – a rare event, but one that can result in widespread damage.

Fortunately, setback distances are not the only safety measure for the people near a facility. There are many measures and practices other than setback distance that lower the risk to surroundings.

In this report, we refer to these as “mitigation measures.” Some of these are already required under the propane safety framework; those that are not are called “special mitigation measures.”

Special mitigation measures include tank mounding or burying, water spray or water deluge systems, or thermal insulation. Active fire protection systems, such as water spray or water deluge, are designed to control an escalating fire and keep large vessels cool. Passive systems include burying a tank underground or mounding earth around it to create a physical barrier against fire and explosion. Other passive systems include thermal insulation, for example a paint-like coating that expands when heated, that slow the impact of a fire on a vessel.

All of these systems protect the large vessels from direct fire impingement. If properly installed and maintained, they delay or even prevent the catastrophic failure of vessels. There are many accepted industrial standards for mitigation measures. The liquefied petroleum gas code in the U.K., for instance, shows clear guidelines for such systems. In North America, the NFPA 15 is a commonly-used code for water spray systems. In Canada, water protection is an area where the use of specific measures is important because of extended areas and long periods of freezing. Other codes are available for burying, mounding and protective firewalls.

When facilities are close to populated areas, best practices suggest the implementation of these types of special mitigation measures. We discuss in our recommendations how propane facilities should incorporate special mitigation measures, when and if necessary.

### **EVACUATION DISTANCE**

Emergency response procedures usually set out an evacuation area. A measure such as the 1-psi overpressure distance does not define absolute limits beyond which the population is safe. Exploding tanks, or pieces of them, can be projected farther distances. For that reason, evacuation distances should be based on the largest vessel at a facility, and are about 2.5 times the 1-psi overpressure distance or even greater.

### **TRANSIENT STORAGE AT A SITE**

In our view, the total capacity of a facility should include permanent vessels (storage tanks), stored cylinders and tanks, and any transient storage vessels (tanker trucks or rail tank cars) that could be at the facility for longer than it takes them to transfer propane.

This requirement arises from our concern that the current regulatory framework does not fully address the kinds of issues that can arise from storing propane at a site in a transient vehicle or other vessel that is not permanently fixed. In particular, transient vehicles pose safety risks at least as great as those of permanent tanks of a similar size. Issues that are not addressed in current rules include the

distance to other temporary storage or permanent tanks, the number of vehicles that can be parked at one time, and the impact on access to the site in the event of an emergency.

Under Transport Canada's rules for the transport of dangerous goods, rail tank cars must be thermally protected, which lengthens the time they can be expected to withstand fire. The total amount of propane carried in a train consisting of many tank cars is much greater than that carried in a single truck. However, sometimes several trucks may be parked at a single facility. Transport Canada has rules governing the transport of dangerous goods in tanker trucks, but there is no requirement for them to have thermal protection.

### **INSURANCE**

Ontario, unlike some other jurisdictions, does not require propane facilities to be insured.

Insurance provides financial compensation for the consequences of an accident or negligence. It also gives both the insurer and insured the incentive to work together to minimize safety risks from a product or process. Often, insurance companies and government agencies will inspect the same installations to similar standards. A poor safety or compliance record can be reflected in a higher cost of doing business, as insurance premiums increase. Lack of compliance can ultimately lead to nullification of insurance coverage and consequent loss of operating licence. Insurance thus becomes an important, although indirect, element of the safety framework.

### **COMMUNICATION AND INFORMATION-SHARING**

Our discussions with a variety of parties suggest that the agencies and entities with an interest in public safety need to communicate more with one another. This effort should include TSSA, municipalities, a number of provincial ministries, Transport Canada, Environment Canada, the Province's Office of the Fire Marshal and local fire services, and occupational health and safety authorities.

It appears that there are no formal memoranda of agreement between TSSA and many of these parties, which means that communication can be random, depending on individual personalities and relationships. More formal requirements prompt greater attention to regular and meaningful communication, and create a shared responsibility and accountability for making this happen.

A second area in which communications could be enhanced is with the public at large, to create better understanding of how to minimize or avoid the dangers of propane.

### **IMMINENT HAZARDS**

An imminent hazard is a situation that appears to involve a high level of risk of an incident. Many public safety inspectors have the

authority to act in response to imminent hazards, by having a qualified person correct the situation should the person in control of the site be unavailable or unwilling to take corrective action. TSSA inspection staff may not have clear authority to act in cases of imminent hazard.

### **EMERGENCY RESPONDERS**

Responding to an emergency at a propane facility calls for specialized and up-to-date knowledge. This is of two types: familiarity with the specific facility, and understanding of how fires at any propane facility can escalate. Firefighters need opportunities to deepen their knowledge in both areas and keep it current.

### **TSSA IN THE REGULATORY CONTEXT**

Although our mandate did not require us to comment on the delegated administrative authority model which created TSSA, representatives appearing in front of the panel did raise it. Some raised concerns, but others felt that safety outcomes are roughly the same as under the previous model, or in some areas better. In general, and looking to the experience both in Ontario and elsewhere, we have confidence in delegation of authority as a means to regulate public safety.

Like any organization, TSSA faces challenges. As noted earlier, the propane industry includes many small companies, some of which need help understanding the complex regulations and codes and standards. We heard that TSSA thus acts in some cases as a mentor or coach, as well as a regulatory authority and service provider. It also provides consulting services to clients that do not fall within its regulatory scope. Balancing all of these roles puts demands on the regulator.

We understand that TSSA is currently engaged in a process to enhance its transparency, corporate culture, and governance practices. We believe this will be a valuable exercise. Regular review of the impact of these factors in such areas as operational effectiveness and public or stakeholder perception is useful for all organizations. It will be particularly important if TSSA is to be effective at developing and applying new approaches to regulation, as we believe it should.

We also believe that TSSA should consider its revenue model, including its fee structure and proposed expansion of its consulting business. As a regulator, TSSA must strive to ensure that its fee structure and other revenue-generating activities neither affect nor appear to affect public safety.

One further suggestion is that when proposing to vary its requirements from those of an existing standard or code, TSSA should make clear to industry participants, other public safety authorities and other stakeholders the reason for the proposed variance.

## IV RECOMMENDATIONS

We set out in this chapter our recommendations to improve propane safety in Ontario. These fall into a number of broad areas, including:

- New regulatory approaches and planning requirements tied to risk assessment and mitigation;
- Improved training, public education and communications; and
- New obligations for operators.

Appendix F shows how the recommendations relate to the elements of our terms of reference.

We carried out our review to the best of our abilities in the time available, and relied on research, advice and input from several parties. We would expect the Ministry, TSSA and others to whom we have addressed recommendations to carry out further analysis where necessary to help ensure that any adoption and implementation would not give rise to unintended negative outcomes.

### **RISK-BASED REGULATION**

#### **1. *TSSA should continue to build on its existing risk-based enforcement model by introducing a more rigorous, statistical approach for propane safety.***

We talked about risk-based regulation in the previous chapter. TSSA should enhance its propane industry database by including such factors as:

- the total capacity and throughput of the facility;
- the number and capacity of all vessels at the site, including stored and transient ones;
- the complexity of the installation;
- the volume and types of any other hazardous materials at the facility;
- the sophistication and level of special protection measures;
- the sensitivity of the surrounding area to the potential risk;
- the location of the facility and potential hazards to the public;
- the risk and safety management plan for the facility;
- the facility's maintenance program;
- relevant details of the operating history of the facility and its operator, such as incidents and observed bad practices;
- the compliance history of owners, operators and facility; and
- the experience and training of workers.

Much of this information would be captured in the risk management and safety plan that would be required under Recommendation 6.

TSSA should develop a formula that gives weighting to different factors to provide a single score for each facility that would indicate its over-all risk rating.

Once enough data are analyzed and patterns become clear, a risk-based approach can lead to better use of regulatory resources.

Facilities with higher risk ratings could receive more frequent and more in-depth attention, while those with a strong record of safety and risk management could be moved to a longer cycle of inspection. This approach would be supplemented by random inspections.

A system like the one we describe is a major investment of time and money, but will yield ongoing benefits in improved public safety and more efficient allocation of resources.

**2. *TSSA should inspect facilities annually until it has gathered the required data, and has developed and is applying a comprehensive risk-based approach to regulation.***

These annual inspections should provide the information needed for the database. In addition to setting out the results of the usual inspection process, inspection reports should note other issues that suggest unsafe practices, such as:

- tank trucks and/or rail tankers parked too close to other vessels;
- little or no traffic control;
- sloppy housekeeping that could lead to a hazardous situation;
- poor security practices; and
- any other activity that the inspector finds worth noting.

### **STORAGE AND INVENTORY**

**3. *For the purposes of licensing a facility, the total capacity should include both fixed and transient storage, with the second element defined as the combined capacity of the maximum number of stored cylinders and tanks, and of tanker trucks and/or rail tank cars that might stay at the facility at any given time for longer than it takes them to complete a transfer.***

**4. *A limit should be set on maximum transient storage at a facility.***

**5. *The facility operator should be required to designate the parking spaces for transient tanker truck storage at a facility.***

We discuss below the additional protection needs relating to transient storage.

### **RISK AND SAFETY MANAGEMENT PLANS**

**6. *Every facility at which transfer of propane takes place should have a risk and safety management plan as condition of licensing.***

We described risk and safety management plans in detail in Chapter III.

We propose staged requirements based on the size of the facility. Size takes into account two aspects: the facility's total capacity as defined by Recommendation 3, and the size of the largest vessel at the facility. Under this recommendation, the total capacity determines the over-all rigour of planning, and the size of the largest vessel determines what special mitigation measures might be needed at the facility.

In recommending the requirements set out here, we looked to best practices elsewhere. As the Deloitte research summarized in Chapter II notes, all leading jurisdictions set risk management and emergency planning requirements that become more complex as the size of a facility (or the largest vessel at a facility) increases.

We have recommended 5,000 USWG and 30,000 USWG as thresholds for increased planning requirements. The first threshold is roughly equivalent to the upper size limit of facilities that can use an Environment Canada template to create a plan. We regard 30,000 USWG as the next threshold at which the size of a facility warrants additional planning requirements.

*Total capacity less than 5,000 USWG*

A basic risk and safety management plan would be required of transfer facilities with total capacity of less than 5,000 USWG, which is roughly 9.5 tonnes. The first three elements of the plan (hazard analysis, risk assessment and risk mitigation) would be deemed to be met by compliance with the propane code. Satisfying the code requirements for construction and installation would provide adequate safety for these installations. However, the proponent would also be required to provide:

- an outline of emergency response and preparedness procedures; and
- basic risk-profile information, including location, total capacity and throughput.

Many transfer facilities of less than 5,000 USWG will fall into the category of facilities that can complete a template provided by Environment Canada through its emergency planning regulation (the template is for facilities between 4.5 and 9 tonnes, which is roughly 2,400 to 4,800 USWG). Providing a copy of the completed template to TSSA could be considered a way of meeting these requirements. This would avoid duplication of effort.

TSSA should collect and use the basic risk-profile information to build a better understanding of the potential risks posed by these smaller facilities. This would be phased in as part of TSSA's enhanced risk-based approach to regulation that we have recommended. Information of this type would ultimately determine, for example, whether some of these smaller facilities might also need to add special mitigation measures.

*Total capacity equal to or greater than 5,000 USWG*

In addition to the basic information required for smaller facilities, facilities with total capacity of equal to or greater than 5,000 USWG will also need to consider nearby land use and population in the risk assessment section of their plan.

This should start with assessing what lies within a defined hazard distance from the facility. One measure of hazard to nearby areas is the "1 psi overpressure distance" from the single largest vessel at a facility. This measure is explained in more detail in Chapter III.

If the land uses within the defined hazard distance include housing, businesses, hospitals, schools, long-term care facilities, parks and similar types of development, then the plan must set out special mitigation measures. Measures of this type are described in Chapter III, and the summary of best practices in Chapter II provides the names of existing codes that include such measures.

If there is no significant development within the defined hazard distance, no additional special mitigation measures need to be installed. At the time that the facility is licensed, however, the operator should be warned that future development of the surrounding areas might require such upgrades or other measures to reduce risk.

The plan should also be required to include an emergency response plan appropriate to the facility's specific circumstances. If a facility has prepared a plan in response to Environment Canada's environmental emergency plan regulation, this could form the basis of the emergency response plan. TSSA might set out additional requirements.

The information in all plans should be compatible with the requirements of the new risk-based approach to regulation set out in Recommendation 1. Specifically, it should be possible to transfer relevant information easily from a plan to TSSA's risk-management database. An electronic process is a particularly effective approach.

As well, relevant sections, including 24-hour emergency contact phone numbers, size of vessels, and any special fire protection equipment, should be available on-line to first responders.

- 7. Certification by a professional engineer should be required for all risk and safety management plans for facilities of more than 30,000 USWG in total capacity.**
- 8. When reviewing an operator's risk and safety management plan, TSSA should verify that it includes all relevant requirements.**

The responsibility for ensuring that the risk and safety management plan meets all requirements and includes suitable special mitigation measures, if any are needed, would lie with the operator.

TSSA should refer operators to resources for developing risk and safety management plans that reflect best practices. These resources could include the documents listed in Chapter II, such as the NFPA, the U.S. EPA risk management plan guidelines, and the United Kingdom's COMAH regulations, as well as others recognized in the field, such as those drawn up by the Major Industrial Accident Council of Canada and the Liquefied Petroleum Gas code in the U.K. These existing standards and industry codes would help determine how to provide special mitigation generally, and also deal with such issues as special fire protection for designated tank truck parking spaces.

- 9. TSSA should continue to invest in the technology needed to improve the quality and value of data on the location of propane facilities and those handling other volatile fuels, with a specific goal of allowing these facilities and related defined hazard distances to be mapped using geographical information system (GIS) technology.**

TSSA will need such information, and the means of analyzing it, as it creates and populates a database for the enhanced risk-based methodology we recommend. Mapping is a useful way of communicating information about physical location and the area around it.

- 10. TSSA should make available to municipalities and planning boards the locations of facilities and the defined hazard distance around each, either as maps or, if the community prefers, GIS data.**

Many Ontario communities are developing GIS maps that overlay important infrastructure onto the street grid. The ability to add information about propane facilities, especially in relation to fire-service and other public infrastructure, would enhance their ability to plan for and respond to emergencies.

- 11. TSSA should make publicly available sections of the risk and safety management plan dealing with emergency response for facilities of more than 30,000 USWG in total capacity.**

In the European Union, emergency plans are expected to include arrangements for providing members of the public with specific information relating to the incident and how they should respond.

**12. As a condition of licencing, the operator should be required to review the risk and safety management plan on the same cycle as TSSA's inspection cycle. This review should assess whether development within the defined hazard distance has increased the risks relating to the facility and the plan should be upgraded as required.**

**13. When a licence is first issued for a facility, the licence approval should state specifically that if development around the facility changes so as to increase risk, it is the responsibility of the operator to reassess and, if necessary, upgrade special mitigation measures.**

It should be made clear when the licence is first issued that if upgrading to a suitable level is impossible, it may become necessary to reduce the risk by, for example, removing or relocating tanks or parking spaces, reducing throughput, or even removing the facility.

**14. The Province should amend planning rules to require municipalities and local appeal bodies to notify facility operators of applications for official plan amendments, rezoning and minor variances where the facility's defined hazard distance extends into the area under consideration for change.**

Nearby businesses and homeowners are routinely notified already of these planning applications, but this requirement would cover propane facilities that might be located beyond the prescribed notification distance.

#### **OTHER NEW REQUIREMENTS FOR PROPONENTS**

**15. An application to TSSA for a new or expanded facility should not be considered complete until the fire service has received and approves all components of the risk and safety management plan that address fire safety, protection and emergency considerations.**

Ontario's Office of the Fire Marshal and TSSA should establish a process for resolving any differences in opinion between TSSA and a local fire service where a proponent's fire safety, protection and emergency considerations are concerned.

**16. Before commissioning a new or expanded facility, the proponent should be required to contact the local fire service for a walk-through with the aim of familiarization.**

- 17. An application to TSSA for a new facility or an expansion should not be considered complete until the proponent receives and includes the comments of the relevant local planning authority.**

At present, the municipality in which a facility wants to locate is required to provide letter confirming that the new installation will conform with current zoning. For either a new facility or expansion of an existing one, the proponent should be required to provide details about the proposal. A municipality's comments on a proposal might touch on such issues as possible future land uses or intensification. This would help the proponent better understand the potential need for special mitigation measures.

### **TRAINING AND CERTIFICATION**

- 18. Training requirements should be extended to include at least one officer, director or partner of every propane operator and licence holder.**

A requirement of this type is common in other regulated industries. It helps to ensure that the senior management of the company understands the safety requirements of the operation.

- 19. Certificate holders should have to produce proof of their training on demand.**

This recommendation would require people handling propane to carry this proof on their person or have it readily available in their workplace at all times. This is not required at present, which hampers the ability to check for compliance with training requirements. Proof of training should be in a standardized form to further aid in verifying compliance.

- 20. Certificate holders should receive site-specific training when starting work and after changing employers or facilities, and should be re-certified after being away from the job for a significant period of time.**

The employer should keep records of site-specific training, as they are currently required to keep records of the other types of training.

- 21. Every person who works at a facility should be trained in the facility's emergency procedures.**

Not just certificate holders, but others who work at a facility, for example security guards, should know about and regularly practise emergency procedures.

- 22. The training curriculum for certificate holders should cover the consequences of incorrect handling, storage or transport of propane, including the impact of major fires and explosions. It should also cover emergency procedures.**

This training should use actual case studies to underline to trainees that risks are not hypothetical, and that errors or negligence have had serious consequences in past incidents.

- 23. TSSA should set a three-year review schedule for training providers and as part of this process the training provider should review the curriculum, update it if necessary and submit it to TSSA.**

- 24. Trainers should be required to have hands-on, practical experience as well as theoretical knowledge of the subject areas they teach.**

- 25. The Office of the Fire Marshal should enhance its training for fire department personnel in the areas of prevention, mitigation and suppression of propane explosions and fires.**

Specialized training should emphasize that the seriousness of the situation responders encounter should determine their response and that danger can escalate very quickly. Vapour cloud explosions and BLEVEs, although rare, are serious events. Firefighters require up-to-date, specialized knowledge to effectively identify, assess and react to them, but not all of them have received this training. Because there are large propane facilities located in rural areas, a special concern is volunteer fire departments that have more limited access to training.

- 26. Propane facility inspectors should be trained in all aspects of propane safety, including how to recognize and respond to imminent hazards.**

Training for inspectors should include lessons learned from actual incidents and other elements of continuous learning.

## **PUBLIC EDUCATION**

- 27. TSSA, Office of the Fire Marshal, industry and others with an interest in the industry's safety should work together on a public safety and awareness program.**

This program should target propane consumers – for example, through bills for those on home or work delivery, posters at tank exchange and tank refill facilities, and notices at campgrounds – as well as the general public, including school children. The information should cover such topics as:

- the need to call the propane supplier before digging near a tank;

- the smell of propane and how to respond when its smell is detected;
- the importance of evacuating the area when ordered to do so and typical evacuation distances;
- what to do during or after a natural disaster (fire, flood, earthquake);
- how to use camp heaters safely; and,
- the signs of carbon monoxide poisoning and how to respond.

The propane industry, which ultimately means the consumer of propane, should pay the costs of this program.

### **INFORMATION-SHARING**

- 28. *As part of the code adoption process or if considering changes to other regulatory instruments, TSSA should consult with the Office of the Fire Marshal and Ontario municipalities.***
- 29. *There should be formal agreements in place so that such authorities as the Province’s Office of the Fire Marshal, Office of the Chief Coroner for Ontario, Ministry of Labour, and TSSA share information and findings and any recommendations with all parties with an interest in propane safety.***

We set out in Chapter I the areas in which these different authorities have jurisdiction.

- 30. *TSSA and provincial, municipal and other investigative authorities should create a cross-jurisdictional incident database, aggregating information on causes of incidents, lessons learned, and recommended preventative steps.***

### **INSURANCE**

- 31. *Propane operators should be required to carry insurance as a condition of licensing.***

At a minimum, the insurance requirements should set out the coverage level, the types of coverage required (including the need to insure pressure vessels as well as the site itself), and the process for providing certification of coverage. The Province should develop the details of this recommendation, including scope and coverage limits, in consultation with the industry and TSSA.

### **IMMINENT HAZARD**

- 32. *In any instance where there is an imminent hazard to safety, and the facility operator will not or cannot act to correct it, TSSA inspectors should have the full and clear authority to ensure the installation is made safe and to charge back the costs to the operator.***

Imminent hazard has been defined Chapter III. This recommendation addresses the need for inspectors to be trained to recognize imminent hazards and act appropriately. Their action may include contracting with a third party with the appropriate expertise to correct the situation. Similar powers are given to other public safety inspectors, including those enforcing environmental, building and fire legislation. TSSA inspectors, however, do not require powers to remediate or restore a site to an operational state after an incident.

#### **FIRE SAFETY**

- 33. *Operators should be required to keep records to demonstrate on-going maintenance and operational testing of fire safety equipment and systems.***
- 34. *Fire services should have clear authority to enter licensed propane facilities for familiarization purposes and/or to verify proper maintenance of fire protection equipment.***

#### **OTHER RECOMMENDATIONS**

- 35. *In light of these recommendations, TSSA should review its current code adoption document, directors' orders and branch standards, with a view to updating these as necessary.***
- 36. *The Ministry should consider approaches similar to those recommended here for propane for all liquid and gaseous fuels in use in the province to ensure that they also are covered by a best-practices regulatory framework.***
- 37. *The Ministry should review the progress of adoption and implementation of these recommendations within 18 months and report to the public, including the members of the Propane Safety Review.***
- 38. *Once recommendations have been implemented, the Ministry and TSSA should review their impacts on a periodic basis with a view to making any further changes, if necessary, to improve propane safety and should inform the public, including the members of the Propane Safety Review.***
- 39. *The Minister should ask Transport Canada to examine the potential benefits to public safety of thermal protection requirements for highway tank trucks similar to those for railway tank cars and regulations for safe parking of tank trucks, including such factors as setback and security.***

40. ***The Minister should ask the Canadian Standards Association to review and update the relevant sections of the propane installation code (B149.2 and B149.5) with a focus on setback distances, categories of installation, emergency response plans, maintenance, and special fire protection and to ensure the code aligns with international best practices.***

We are aware of the impending update of B149 in 2010, on which consultation and analysis have already been completed. We ask that the Minister request CSA to undertake a comprehensive review of the entire propane code to ensure that it is consistent both internally and with national and international best practices.

#### **A NOTE ABOUT IMPLEMENTATION AND TIMING**

We have chosen to not specify the means by which our recommendations should be implemented, as some might best be put into action by the Government through a change to regulations or legislation, or by TSSA through its own instruments such as directors' orders or policies.

Whatever means are used, we would ask the Minister to ensure that recommendations are acted on in an efficient and timely manner in consultation with TSSA, the propane industry and other entities as required.

## V CONCLUSION

The structure of Ontario's propane industry, featuring a large and complex distribution system and many companies of varying size, presents a specific set of challenges for public safety. While operators must ultimately take responsibility for ensuring the safety of their workers and the public, the regulator's role and the design of the safety system are also key elements.

We have examined in as much detail as possible in the time available to us the design, components and functioning of Ontario's propane safety system. We have heard a variety of viewpoints on the industry and how it is regulated. We have formed the view that most participants in the industry take seriously their role in ensuring public safety. We have found that the system supports them by providing a multi-barrier approach to safety, one which aims to prevent problems from occurring and limits the consequences if one occurs. This system has served Ontario well over many years, and people in Ontario should feel safe.

No regulatory system is permanent. They constantly evolve and change, and their evolution is dictated by many factors. These include public expectations, changes in technology, and new approaches to ensuring safety. This is a reminder that while perfect safety is unattainable, steps toward greater safety are always possible. The recommendations in this report set out several such steps for Ontario's propane safety system.

## APPENDIX A

### TERMS OF REFERENCE

#### **Terms of Reference for Advisors**

These Terms of Reference set out the mandate and scope for a policy review of the Ontario legislative framework for the safe handling, storage, use, supply, transfer, and transport of propane.

#### **The Review**

The Government will appoint two advisors to conduct a thorough review of the current legislative framework, including an assessment of any potential safety gaps, and report to the Minister of Small Business and Consumer Services.

The advisors will work with the government, the TSSA, the propane industry, municipal sector, other provinces, and others as appropriate, to review the current propane-related legislation and regulations and the TSSA's licensing, certification and enforcement policies against internationally recognized best practices.

#### **Mandate**

The advisors will review Ontario's propane-related legislative framework focusing on the *Technical Standards and Safety Act, 2000* and the propane regulations under the Act.

Other entities are investigating the occurrence at the Sunrise facility. This is not a review of that occurrence. This review will not make any findings of fault.

#### **Scope of the Review**

The review will examine and make recommendations on the legislative framework to enhance propane safety including:

1. Ontario's legislative requirements for the safe handling, storage, use, supply, transfer and transport of propane.
2. The standard setting criteria and process in Canada and how these compare to international processes.
3. Administrative procedures/requirements.
4. Trades personnel training, education and certification requirements for the storage, handling and transportation of propane.
5. Operator obligations.
6. Distance and zoning requirements/guidelines for propane storage sites.
7. Inspection and reporting requirements.
8. Emergency management plans at propane sites.
9. Offences and enforcement.
10. Whether a review of Ontario's legislative framework for any other fuels is needed.
11. Other matters considered to be advisable.

The review will include a comparison of Ontario's legislative framework with leading international jurisdictions.

#### **Governance**

The advisors will report to the Minister of Small Business and Consumer Services.

The Ministry will provide support to the advisors through a Secretariat to be established within the Ministry.

**Process***Consultations*

The advisors will consult with the TSSA, Ontario industry advisory councils and other key industry, federal, provincial, municipal, retail and other stakeholders in the review of the legislative framework.

*Deliverables*

The advisors will provide a report with recommendations to the Minister.

*Timing*

The advisors will provide the report to the Minister no later than 45 days from the commencement of the review.

## APPENDIX B

### BIOGRAPHIES OF REVIEW MEMBERS

#### **DR. MICHAEL BIRK**

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Professor and Head in the Department of Mechanical and Materials Engineering at Queen's University. He has been a registered Professional Engineer in the Province of Ontario since 1980. Before joining the faculty at Queen's in 1986, he worked for AMOCO Canada Petroleum in Calgary, The Canadian Institute for Guided Ground Transport in Kingston, and W.R. Davis Engineering Ltd. in Ottawa.

Dr. Birk's research and consulting activities are generally in the thermal/fluids area, with particular emphasis on fire protection of pressure vessels, failure analysis of pressure vessels exposed to accidental fires, hazards associated with the accidental release of compressed and pressure liquefied gases and industrial heat transfer. He has particular expertise with regard to the boiling liquid expanding vapour explosion (BLEVE).

#### **SUSANA KATZ**

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A Professional Engineer and former Director and Chief Inspector for gas safety for the government of British Columbia. She has managerial and technical experience in both government and private industry. She is experienced in fields such as management of safety programs, quality assurance, standards development, equipment design and manufacturing, metallurgy, urban rail transport problems, destructive and non-destructive testing, welding

Her involvement in standard setting includes sitting on and chairing numerous technical committees in such areas as installation codes, field approvals and specifications for pressure vessels and gas appliances. She holds a Master of Science in Electromechanical Engineering, has completed a number of engineering management and quality assurance programs, and is currently pursuing an Executive MBA.

## APPENDIX C

### PARTICIPANTS IN MEETINGS

#### **Propane Industry**

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Canadian Petroleum Products Institute  
Ontario Petroleum Institute  
Ontario Propane Association and Propane Gas Association of Canada  
EDPRO Canada

#### **Emergency Responders**

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Emergency Management Ontario  
Ontario Fire Marshall's Office  
Emergency Management (City of Toronto)  
Ontario Association of Fire Chiefs  
Ontario Municipal Fire Prevention Officers Association  
Ontario Professional Fire Fighters Association  
Fire Fighters Association of Ontario

#### **Consumers Safety Advocates**

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Consumers Safety Advocates  
Ancaster Ratepayer Association  
Ontario Safety League  
Maria Augimeri, City of Toronto Councilor, York Centre – Ward 9

#### **Federal Government**

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Transport Canada

#### **Provincial Government Ministries**

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Municipal Affairs and Housing  
Environment  
Labour  
Transportation  
Natural Resources

#### **Municipal Sector**

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Association of Municipalities of Toronto  
City of Toronto  
Association of Municipal Managers, Clerks and Treasurers of Ontario

#### **Insurance Industry**

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Insurance Bureau of Canada  
Boiler Inspection and Insurance Company of Canada

#### **Associations**

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Technical Standards and Safety Authority  
Canadian Standards Association

APPENDIX D  
WRITTEN SUBMISSIONS

NO.	DATE RECEIVED	ORGANIZATION
1.	August 12, 2008	Individual (letter sent to Minister Takhar)
2.	August 12, 2008	Individual (letter sent to several Ministers)
3.	September 26, 2008	Individual
4.	September 29, 2008	Individual (e-mail sent to MEDT)
5.	October 6, 2008	Individual
6.	October 8, 2008	Individual
7.	October 9, 2008	Carpenters District Council of Ontario
8.	October 9, 2008	Faculty of Environmental Studies - York University
9.	October 14, 2008	First Sentinel Technologies
10.	October 15, 2008	Insurance Bureau of Canada
11.	October 16, 2008	Individual
12.	October 16, 2008	Association of Municipalities of Ontario
13.	October 16, 2008	Ontario Association of Fire Chiefs
14.	October 16, 2008	NDP Critic for Consumer Issues
15.	October 16, 2008	Individual
16.	October 16, 2008	Individual
17.	October 16, 2008	Consumer Advisory Council TSSA
18.	October 16, 2008	Ontario Municipal Fire Prevention Officers Association
19.	October 17, 2008	Individual
20.	October 17, 2008	Individual
21.	October 17, 2008	Individual
22.	October 17, 2008	Fire Marshal of Ontario
23.	October 17, 2008	Construction Safety Association of Ontario
24.	October 17, 2008	Lisa MacLeod – MPP PC
25.	October 18, 2008	Individual
26.	October 18, 2008	Individual
27.	October 20, 2008	Ontario Home Builders' Association
28.	October 21, 2008	Fire Services - City of Toronto
29.	October 21, 2008	Individual
30.	October 21, 2008	Propane Gas Association
31.	October 27, 2008	Retail Council of Canada

## INVITATIONS FOR WRITTEN SUBMISSIONS

### **Consumers/Safety Advocates**

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TSSA's Consumer Advisory Council  
Clarington/Bowmanville Ratepayer Association  
Dr. Mark Winfield

### **Retail Sector**

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Retail Council of Canada

### **Trucking Industry**

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Ontario Trucking Association

### **Engineering Industry**

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Professional Engineers of Ontario  
Ontario Society of Professional Engineers  
Ontario Association of Certified Engineering Technicians and Technologists

### **Planning Professionals**

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Ontario Professional Planners Institute

### **Construction Industry**

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Ontario Home Builders Association  
Construction Safety Association of Ontario  
Ontario General Contractors Association

### **MPPs**

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Lisa MacLeod, Nepean-Carleton  
Andrea Horwath, Hamilton Centre

## APPENDIX E

### HAZARDS AND THEIR POTENTIAL IMPACTS

As noted in the body of the report, the potential major hazards from a propane incident are fire, explosion and projectiles.

#### **Vapour Cloud Explosions and BLEVEs**

There are two types of explosions possible from a propane release into the surroundings. One is called a vapour cloud explosion (VCE) and the other is the Boiling Liquid Expanding Vapour Explosion (BLEVE). When a cloud of propane vapour and air is ignited, the result is usually a fireball or flash fire. In rarer circumstances, however, a vapour cloud explosion may occur. Vapour cloud explosions can produce very strong overpressures, heat and projectiles.

A BLEVE is a different phenomenon that happens when a propane tank fails catastrophically (that is, bursts open). This is a physical explosion resulting from increased pressure in a vessel exposed to high temperature that causes sudden release and a change in the propane from liquid to vapour phase. BLEVEs, which produce overpressures and often large projectiles, are also rare. Once released by a BLEVE, the propane becomes a vapour cloud, which if ignited immediately becomes a fireball. Fireballs produce intense heat. Details of the hazards from these effects can be found in the open literature.

#### **The 1-psi overpressure distance**

An explosion pushes air very quickly outward from its centre, so the effects are often measured by air pressure changes. Because this pressure is in excess of normal atmospheric pressure, it is called “overpressure” and is usually measured in pounds per square inch (psi).

The overpressure, and therefore the damage it does, is highest at the centre of an explosion. The distance at which the overpressure has dropped to 1 pound per square inch is called the “1 psi overpressure distance.” At this distance, hazards are minor but not inconsequential. For example, windows break and people may be knocked down or injured by the flying glass.

#### **Worst Case Hazard**

The U.S. EPA risk management planning guidelines use the 1 psi overpressure distance to quantify the potential hazards from a worst case hazard scenario. They calculate the 1 psi overpressure distance for a vapour cloud explosion involving the contents of the single largest vessel on a site. For a 5,000 USWG vessel, the 1 psi overpressure distance is about 320 metres; for a 30,000 USWG vessel, it is about twice as large at 640 metres.

## APPENDIX F

### ALIGNMENT OF RECOMMENDATIONS WITH TERMS OF REFERENCE

The terms of reference for the review required the members to examine ten aspects of propane safety.

The following list indicates how all of the elements of the terms of reference were addressed.

Legislative requirements for the safe storage, handling, location and transport of propane

- Insurance: Recommendation 31
- Imminent Hazard: Recommendation 32
- Transient storage: Recommendations 3, 4, 5, 39

The standard setting criteria and process in Canada

- Recommendation 40

Training, education and certification requirements

- Recommendations 18 through 26

Distance and zoning requirements/guidelines for propane storage sites

- Recommendations 6, 7, 8, 9, 10, 12, 13, 14, 17

Emergency management plans at propane sites

- Recommendations 6, 7, 8, 9, 10, 11, 12, 15, 16, 33, 34

Propane operators' obligations

- Recommendations 5, 6, 7, 12, 15, 16, 17, 18, 21, 31, 33

Inspection and reporting requirements

- Recommendations 1, 2, 26, 32

Offences and enforcement

- Recommendations 1, 2, 32

Other suggestions or recommendations

- Public safety and awareness program: Recommendation 27
- Information-sharing: Recommendations 28 through 30
- Reviewing current instruments: Recommendation 35
- Extending the recommended approach: Recommendation 36
- Reporting on outcomes: Recommendations 37 and 38

In addition to the specific recommendations listed above that would affect legislation, the members of the review recognize that implementing other recommendations may also involve legislative change.

## APPENDIX G

### SOURCES

<b>CANADA: LEGISLATION, REGULATION, STANDARDS AND ASSOCIATED GUIDELINES</b>	
1.	<i>Transportation of Dangerous Goods Act</i> , 1992, c. 34
2.	Regulations Amending the Transportation of Dangerous Goods Regulations, SOR 2008/34
3.	<i>Canadian Environmental Protection Act</i> , 1999, c. 33
4.	Environmental Emergency Regulations, SOR/2003-307
5.	Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations, SOR/2008-197
6.	Canadian Environmental Protection Act – Environmental Emergency Implementation Guidelines, Environment Canada, March 2004
7.	Safety and Consumer Statutes Administration Act, 1996, S.O. c.19
8.	<i>Municipal Act, 2001</i> , S.O. c. 25
9.	<i>Planning Act</i> , R.S.O., 1990, c. P. 13
10.	Official Plans and Plan Amendments, O. Reg. 543/06.
11.	Zoning By-Laws, Holding By-Laws and Interim Control By-Laws, O. Reg. 545/06
12.	Minor Variance Applications, O. Reg. 200/96
13.	Plans of Subdivision, O. Reg. 544/06
14.	Consent Applications, O. Reg. 197/96
15.	<i>Technical Standards and Safety Act</i> , S.O. 2000 c. 16
16.	Propane Storage and Handling Regulations, O. Reg. 211/01
17.	Fuel Industry Certificates, O. Reg. 215/01
18.	Codes and Standards Adopted by Reference, O. Reg. 223/01
19.	Technical Standards and Safety Authority (TSSA): Policies and Procedures for Gas Technician/Oil Burner Technician Certification Accredited Training Provider Assessment /Audit Form Training and Certification Agreement Sample PPO-3 Training Program
20.	CAN/CSA B149.2-05, Propane Storage and Handling Code, Canadian Standards Association, Standards Council of Canada, 2005
21.	CAN/CSA B149.1-05, Natural Gas and Propane Installation Code, Canadian Standards Association, Standards Council of Canada, 2007
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24.	CAN/CSA B620-03, Highway Tanks and Portable Tanks for the Transportation of Dangerous Goods
25.	CAN/CSA B622-03, Selection and Use of Highway Tanks, Multi-unit Tank Car Tanks, and Portable Tanks for the Transportation of Dangerous Goods, Class 2
26.	Transport Canada 2008 Emergency Response Guidebook
27.	Propane Branch Standard No. 9: Requirements for Location of Propane Filling Plants, Container Refill Centres and Vehicle Conversion Centres (VCC) in Heavily Populated Areas, Technical Standards and Safety Authority, 2001
28.	Risk Management Guide for Major Industrial Accidents, Annex 4, Conseil pour la Réduction des Accidents Industriels Majeurs (CRAIM), 1993
29.	Risk-based Land Use Planning Guidelines, Major Industrial Accidents Council of Canada
30.	2007 Ontario Fire Code Compendium

## SOURCES CONTINUED

<b>UNITED STATES: LEGISLATION, REGULATION, REPORTS AND GUIDELINES</b>	
31.	<i>Emergency Planning and Community Right to Know Act</i> , USC Chapter 116, 2006
32.	Liquefied Petroleum Gas Code, National Fire Protection Association, NFPA Code 58, 2007
33.	National Fuel Gas Code, National Fire Protection Association, NFPA Code 54, 2008
34.	Standard on Explosion Prevention Systems, National Fire Protection Association, NFPA Code 69, 2008
35.	Standard for Standard for Water Spray Fixed Systems for Fire Protection, National Fire Protection Association, NFPA Code 15, 2007
36.	Fire Safety Analysis Manual for LP-Gas Storage Facilities, developed by the National Fire Protection Association and the National Propane Gas Association, 2006
37.	Risk Management Program: Guidance for Propane Storage Facilities, US Environmental Protection Agency, 55-B-00-001, 2000
38.	Handbook of Compressed Gases 3 <sup>rd</sup> ed., Compressed Gas Association, 1990
39.	Notice of Safety Advisory (Safety Advisory 2003-02), Department of Transportation, Federal Railroad Administration, August 28, 2003
40.	Investigation Report: Little General Store Propane Explosion, US Chemical Safety and Hazard Investigation Board, 2008
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41.	<i>Planning (Hazardous Substance) Act</i> , 1990
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43.	Bulk LPG Storage at Fixed Installations: Design, Installation and Operation of Vessels Located Above Ground, UK LPG Code of Practice 1, Part 1, March 2004
44.	Bulk LPG Storage at Fixed Installations: Examination and Inspection, UK LPG Code of Practice 1, Part 3, 2006
45.	Bulk LPG Storage at Fixed Installations: Buried/Mounded LPG Storage Vessels UK LPG Code of Practice 1, Part 4, 2008
<b>EUROPEAN UNION: DIRECTIVES, GUIDELINES AND REPORTS</b>	
46.	Council Directive on the Control of Major Accidents Hazards Involving Dangerous Substances, European Parliament, 96/82/EC, 1996
47.	Land Use Planning Guidelines Regarding SEVESO II, Major Accident Hazards Bureau, 2006
<b>ARTICLES AND BOOKS</b>	
48.	Guidelines for Evaluating the Characteristics of Vapor Cloud Explosions, Flash Fires, and BLEVEs, Center for Chemical Process Safety, 1994
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51.	Comparative Risk Assessment of Gasoline, Propane, and NGV Fueling and Conversion/Repair Facilities, Arthur D. Little of Canada Limited, (Reference 62379) 1991