



National Energy  
Board

Office national  
de l'énergie

# FOCUS ON SAFETY AND ENVIRONMENT

A COMPARATIVE ANALYSIS OF PIPELINE PERFORMANCE

2000-2005



MARCH 2007

National Energy  
Board



Office national  
de l'énergie

## **Focus on Safety and Environment**

A Comparative Analysis of  
Pipeline Performance

2000-2005

March 2007

**Canada**

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## LIST OF ACRONYMS AND ABBREVIATIONS

BLS	United States Department of Labor – Bureau of Labor Statistics
CAPP	Canadian Association of Petroleum Producers
CLC Part II	<i>Canada Labour Code Part II</i> – Occupational Health and Safety
COGOA	<i>Canada Oil and Gas Operations Act</i>
CONCAWE	European Oil Companies Association for Environment, Health and Safety
CSA	Canadian Standards Association
EGIG	European Gas pipeline Incident data Group
EUB	Alberta Energy and Utilities Board
FTE	Full-time Equivalent
HRSDC	Human Resources and Skills Development Canada
LWC or LWDC	Lost Workday Case
NAICS	North American Industry Classification System
NEB	National Energy Board
NGL	Natural Gas Liquid
OGP	International Association of Oil and Gas Producers
OPR-99	<i>Onshore Pipeline Regulations, 1999</i>
OPS	United States Department of Transport – Pipeline and Hazardous Material Safety Administration – Office of Pipeline Safety
PHMSA	Pipeline and Hazardous Materials Safety Administration
PLCAC	Pipe Line Contractors Association of Canada
RWC or RWDC	Restricted Workday Case
SPI	Safety Performance Indicator

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# FOREWORD

This report, titled *Focus on Safety and Environment: A Comparative Analysis of Pipeline Performance, 2000–2005*, examines the number and frequency of various incidents that affect pipeline integrity, safety and the environment. The main objective of this report is to evaluate the pipeline performance of NEB-regulated companies over time and in comparison to pipeline performance in other jurisdictions.

The first of the NEB's annual Safety Performance Indicators reports, *Focus on Safety: A Comparative Analysis of Pipeline Safety Performance*, was published in April 2003. This fifth edition of the report includes data from 1 January 2000 through 31 December 2005.

The NEB continually seeks input and feedback from stakeholders on the value of this report and ways it can be improved. Any comments or questions pertaining to this report should be directed to:

In English:

Ms. Laura Randall  
Environmental Specialist  
Operations Business Unit  
National Energy Board  
444 Seventh Avenue SW  
Calgary, AB  
T2P 0X8  
Phone: 403-299-3101  
Toll Free: 1-800-899-1265  
Facsimile: 403-292-5503  
Email: lrandall@neb-one.gc.ca

In English or French:

Mr. Denis Gagnon  
Project Manager, Integrated Compliance  
Operations Business Unit  
National Energy Board  
444 Seventh Avenue SW  
Calgary, AB  
T2P 0X8  
Phone: 403-299-3658  
Toll Free: 1-800-899-1265  
Facsimile: 403-292-5503  
Email: dgagnon@neb-one.gc.ca



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# EXECUTIVE SUMMARY

The National Energy Board (the Board or the NEB) is responsible for ensuring companies comply with regulations concerning the safety of employees, the public and the environment, as they may be affected by the design, construction, operation, maintenance and abandonment of a pipeline. As part of this accountability, the NEB prepares this annual report on pipeline safety, integrity and environmental performance based on data provided by pipeline companies regulated by the NEB. All data pertain to the performance of hydrocarbon liquid and natural gas pipeline systems.

*Focus on Safety and Environment* is a report on the safety, integrity and environmental performance of pipeline companies regulated by the Board pursuant to the *Onshore Pipeline Regulations, 1999* (OPR-99).

The following are the key findings of this report, which examines pipeline performance between 2000 and 2005:

- 2005 is the eighth consecutive year in which there have been no fatalities on NEB-regulated pipelines. Overall, data showed a decrease in worker and contractor injuries in 2005; however, contractor injuries continue to occur at a higher frequency than worker injuries. The type and severity of these injuries is not currently available and may warrant further data collection.
- The NEB data collected over the past six years indicate that, on average, one person is injured for every 200,000 hours worked annually.
- 2005 is the third consecutive year in which there were no reported ruptures on NEB-regulated pipelines. This result is primarily attributed to the introduction of Integrity Management Programs (IMPs) within the pipeline industry. The NEB was the first regulator in North America to mandate that pipeline companies must have IMPs, with the promulgation of the OPR-99. The OPR-99 reflects the Board's goal-oriented approach to regulation by directing companies to have IMPs and by allowing them the freedom to tailor the content of the IMPs to their particular circumstances.
- One pipeline contact was reported from an unauthorized activity on the right of way in 2005.
- NEB-regulated pipelines have experienced very few pipe body releases of liquid hydrocarbon products over the past six years.
- A total of 226 incidents were reported under the OPR-99 incident reporting requirements during this six-year period, with gas releases being the most common incident reported. On average, the NEB receives 38 incident reports per year reportable under the OPR-99.

Table 1 compares the performance of NEB-regulated pipelines in 2005 to their performance in 2004 and to the six-year average.

**T A B L E 1**

**Performance Indicator Comparison \***

<b>Performance Indicator</b>	<b>2004</b>	<b>2005</b>	<b>Historical Average 2000 – 2005</b>
Number of Fatalities (number of employee, contractor and third-party fatalities)	0	0	0
Worker Injury Frequency (injuries per 200,000 worker hours)	0.7	0.7	0.9
Contractor Injury Frequency (injuries per 200,000 contractor hours)	1.1	1.1	2.3
Employee Injury Frequency (injuries per 200,000 employee hours)	0.5	0.6	0.5
Liquid Pipeline Worker Injury Frequency (injuries per 200,000 worker hours)	0.5	0.9	1.5
Gas Pipeline Worker Injury Frequency (injuries per 200,000 worker hours)	0.7	0.7	0.8
Number of Ruptures (total number of pipeline ruptures)	0	0	1
Number of Contacts (total number of pipeline contacts)	2	1	1.5
Pipe Body Liquid Release Frequency (number of liquid releases per 1 000 km liquid pipelines)	0	0.1	0.07
Pipe Body Liquid Release Volume Frequency (m <sup>3</sup> of liquid released per 1 000 km)	4	18	47
Number of Operational Liquid Leaks (on liquid pipelines)	57	39	39
Operational Liquid Leak Frequency (number of leaks per 1 000 km liquid pipelines)	3.1	2.6	2.8
Pipe Body Gas Release Frequency (number of gas releases per 1 000 km gas pipelines)	0.15	0.15	0.08
Number of Operational Gas Leaks (on gas pipelines)	19	14	18
Operational Gas Leak Frequency (number of leaks per 1 000 km gas pipelines)	0.7	0.7	0.7
Number of Non-pipeline Spills (number of construction & maintenance liquid spills)	50	47	62
Number of Incidents (total number of reportable OPR-99 incidents)	36	39	38

\* See Glossary for definitions of performance indicators.

Data for this report was obtained through the OPR-99's mandatory reporting requirements and voluntary reporting under the Safety Performance Indicators (SPI) Initiative. Companies responsible for approximately 95 percent of the total length of NEB-regulated pipelines have volunteered their results. The performance indicators used are intended to demonstrate trends and illustrate some measure of relative performance.

Based on the data examined in this report, the NEB anticipates extending its analysis of injuries and non-compliances observed by NEB inspectors to determine what further actions could be taken to reduce injuries during pipeline construction, operations and maintenance activities. The NEB will continue to work with companies to develop performance indicators that provide meaningful information to industry.

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Currently, environmental performance indicator data presented in this report include pipe body releases, operational leaks and liquid spills. The NEB intends to develop and collect data on leading environmental indicators.

Overall, NEB-regulated pipelines perform consistently with reference organizations in Canada, the United States (U.S.) and overseas, within the limits of data comparability. It is noted that the pipeline industry as a whole has shown improved safety and environmental performance over the past six years. Regulators and industry need to remain diligent about continually improving safety performance to ensure that pipelines remain a safe and efficient way to transport hydrocarbon products.

# INTRODUCTION

## 1.1 The National Energy Board

The NEB's purpose is to promote safety and security, environmental protection and efficient energy infrastructure and markets in the Canadian public interest within the mandate set by Parliament in the regulation of pipelines, energy development and trade.

The Board is responsible for ensuring that pipeline companies comply with regulations concerning the safety of persons and protection of the environment, as these may be affected by the design, construction, operation, maintenance and abandonment of pipelines. For the purpose of comparison, a pipeline includes all branches, extensions, tanks, reservoirs, storage facilities, pipes, pumps, valves, racks, compressors, storage tanks and loading facilities integral to its operation.

The NEB regulates 104 oil, gas, and product pipeline companies that operate approximately 45 000 kilometres of pipelines across Canada. This network includes large diameter, high-pressure natural gas pipelines, crude oil and oil products pipelines, shorter small-diameter pipelines, and a number of commodity pipelines.

The NEB has additional regulatory responsibilities under the *Canada Oil and Gas Operations Act* (COGOA) for oil and gas exploration and production activities in the North (excluding the Yukon) and in those offshore areas that are not subject to a federal-provincial shared management agreement. Some data from COGOA-regulated activities are included for reference in this report.

Other aspects of the NEB's mandate include the regulation of gas plants under the *Processing Plant Regulations* and some international and inter-provincial power lines. Along with Natural Resources Canada, the NEB plays a leading role in ensuring the effective functioning of energy supply systems in Canada and has been responsible for the security of Canada's federally regulated energy infrastructure since April 2005. Although this current version of the *Focus on Safety and Environment* report does not include any of the above aspects of the Board's mandate, the NEB plans to request security-related incident information from NEB-regulated companies in 2007 as part of the annual performance indicator reporting.



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## 1.2 Performance Indicators

Performance indicators provide information on trends and are used by industry and government to assess performance relative to other sectors. Industry trends and benchmarking comparisons can provide valuable insight into the effectiveness of safety and integrity management programs. The NEB uses performance indicators to improve regulatory compliance programs by identifying areas where more vigilant oversight is needed as well as those areas where less oversight may be required.

In this report, performance indicators are used to evaluate the safety of pipeline workers, including both employees and contractors. Performance indicators are also used to evaluate the effectiveness of pipeline integrity programs and the protection of the environment during pipeline operations.

The Board has identified eight performance indicators, grouped under safety, integrity, environment and incidents. They are as follows:

- number of fatalities;
- number of injuries;
- number of pipeline ruptures;
- number of pipeline contacts;
- number of liquid releases, leaks and spills;
- volume and frequency of liquid releases, leaks and spills;
- number and frequency of gas releases; and
- number of OPR-reportable incidents.

## 1.3 Reference Organizations

Data from the following organizations have been selected for comparison with the NEB performance indicators contained in this report:

- **BLS:** United States Department of Labor – Bureau of Labor Statistics;
- **CAPP:** Canadian Association of Petroleum Producers;
- **COGOA:** National Energy Board activities regulated under the *Canada Oil and Gas Operations Act*;
- **CONCAWE:** European Oil Companies Association for Environment, Health and Safety ;
- **EGIG:** European Gas pipeline Incident data Group;
- **EUB:** Alberta Energy and Utilities Board;
- **HRSDC:** Human Resources and Skills Development Canada;
- **OGP:** International Association of Oil and Gas Producers.
- **OPS:** United States Department of Transport – Pipeline and Hazardous Material Safety Administration – Office of Pipeline Safety; and,
- **PLCAC:** Pipe Line Contractors Association of Canada.

Detailed information on these reference organizations including web addresses and data sources are listed in Appendix One.

Table 1.1 shows which reference organization data were used for comparative purposes within this report.

**T A B L E 1 . 1**

**Comparative Data by Source**

<b>Organization</b>	<b>Ruptures Causes</b>	<b>Fatalities</b>	<b>Injury Frequency</b>	<b>Liquid Releases</b>	<b>Liquid Leaks</b>	<b>Gas Releases</b>	<b>Unauthorized Activities on the Right of Way</b>
OPS	X			X		X	
BLS			X				
EUB	X			X			
CAPP			X		X		
PLCAC			X				
EGIG	X					X	
CONCAWE				X			
OGP		X	X				
COGOA		X	X				
HRSDC			X				
NEB	X	X	X	X	X	X	X

# METHODOLOGY

Voluntary data submissions were received from NEB-regulated pipeline companies under the NEB's Safety Performance Indicators (SPI) Initiative. Under this initiative, a written request was sent in May 2006 to all NEB-regulated pipeline companies for their 2005 safety and environmental information with a reporting deadline of 30 September 2006. Data for the 2005 calendar year were submitted voluntarily to the Board from companies owning or operating approximately 95 percent of the total length of pipelines regulated by the NEB. In addition, data from mandatory incident reporting under the *Onshore Pipeline Regulations, 1999* (OPR-99) are included in this report.



Data from external organizations used for comparative purposes was based mainly on publicly available documents provided on websites and in published reports. However, some specific data were acquired through written correspondence with the reference organizations. A list of reference organizations and data sources can be found in Appendix One.

Organizations chosen for comparative analysis of data within this report have been selected based on their similarities to the NEB. Although not all the data from reference organizations are directly comparable to NEB data, efforts have been made to harmonize the data and make comparisons meaningful. Notes have been provided throughout this report wherever there were anomalies in data collection or reporting that made direct comparisons challenging. Wherever data were not available for a given year, it is noted on the affected bar graphs.

Injury data in this report are presented in three categories: the employees of pipeline companies; their contractors; and, the combined data of the two, referred to as workers. The industry standard is to calculate injury frequencies per 200,000 hours worked. This corresponds to approximately 100 full-time equivalents (FTEs).

## 2.1 Moving Averages

Moving averages have been used in this report to smooth out data and to demonstrate trends and relative performance between reference organizations. Given that the data reported on are limited to a six-year period, a three-year moving average was determined to be most appropriate to compare trends between organizations; thus, the first moving average calculated was for 2002. A period of three years was also viewed as an appropriate time period for regulatory changes to have an impact on pipeline industry practices.

Moving averages are reactive, as they are based on the values in a given year and the historical values from the previous two years. However, they remove some of the variability found in the raw data and help to clarify trends.

# ANALYSIS

## 3.1 Safety Performance Indicators

The safety performance indicators examined in this report are the annual number of fatalities and injuries incurred. Reporting criteria and definitions for these indicators are provided in Appendix Two for NEB-regulated companies and external organizations. A low number of fatalities and injuries is an indicator that health and safety programs are successful, particularly with respect to construction activities.

The number of fatalities and injuries are monitored for employees, contractors and third-party workers. Disabling injury and injury frequencies are defined as the number of injuries per 200,000 working hours. In 2005, the equivalent of approximately 3,000 full-time workers or just over six million hours (both employees and contractors, excluding head office employees) were associated with the construction, maintenance and operation of NEB-regulated liquid and gas pipelines.

### 3.1.1 Fatalities

Fatalities have an immediate and devastating effect on families, communities, companies and the industry. They may also act as a catalyst for changes to legislation, regulations, industry codes and standards.

Fatality data provided by NEB-regulated pipelines have been separated into three categories:

1. Employee fatalities

These are fatalities that occur while an employee is involved in activities associated with their job duties. Employee data from NEB-regulated pipelines do not include head office staff but do include staff from other facility offices.

2. Contractor fatalities

These are fatalities that occur while a contract worker is involved in activities pursuant to their contract with a pipeline company. Contractor data include contractors performing activities related to the construction, operation, or maintenance of NEB-regulated pipelines.

3. Third-party fatalities

These are fatalities involving persons other than contractors or employees.





Figure 3.1 shows the number of contractor fatalities on NEB-regulated pipelines since 1991. Table 3.1 shows the number and cause of all reported fatalities on NEB-regulated pipelines since 1991. The year 2005 is the eighth consecutive year in which there have been no fatalities on NEB-regulated pipelines. All fatalities reported between 1991 and 1997 involved construction activities. Since 1997, several hundred kilometres of new pipelines have been constructed and existing pipelines expanded without any fatalities.

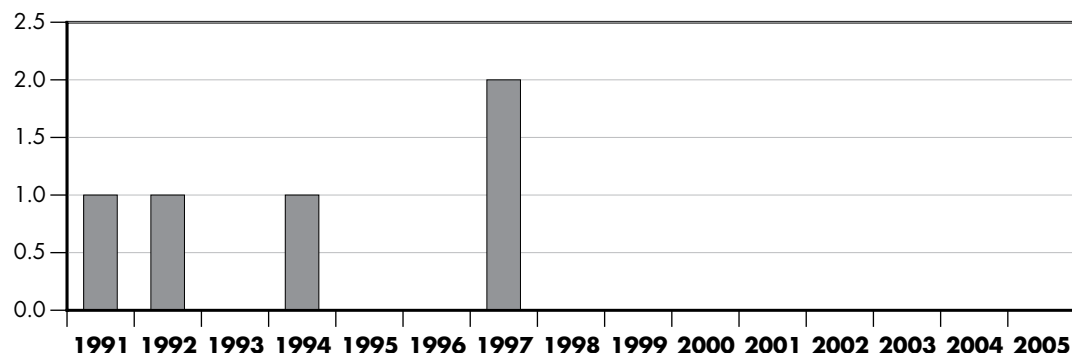
Fatality frequency data have not been compared to that of other organizations as NEB-regulated pipelines have a relatively small number of hours worked associated with them compared to other organizations.

Disabling injury frequency is defined under the *Canada Labour Code (CLC)* as lost time, restricted work and fatal injuries. As there are few fatalities associated with pipeline construction, disabling injury frequency is a good proxy indicator for work being done safely on and around pipelines. Figure 3.2 compares the worker disabling injury frequency for NEB-regulated pipelines and NEB exploration and production activities regulated under COGOA and the OGP. Worker injury frequencies are the combined frequencies of contractor and employee injuries.

**FIGURE 3.1**

**Contractor Fatalities**

**Number of Fatalities**



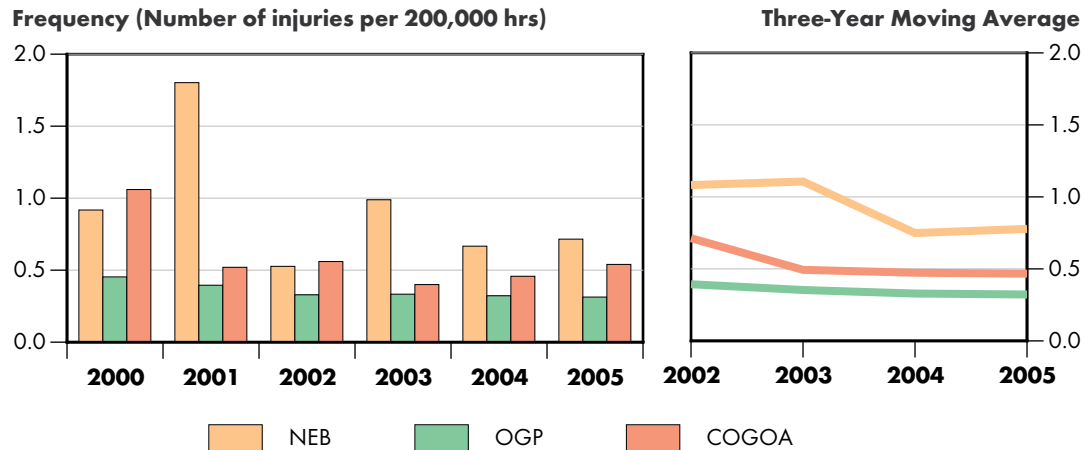
**TABLE 3.1**

**NEB-Regulated Pipeline Fatalities**

Year	Employee	Contractor	Third Party	Cause
1991	0	1	0	• Construction machinery
1992	0	1	0	• Blasting operations
1993	0	0	0	
1994	0	1	0	• Construction machinery
1995	0	0	0	
1996	0	0	0	
1997	0	2	0	• Unloading construction equipment • Construction machinery
1998-2005	0	1	0	

**FIGURE 3.2**

**Worker Disabling Injury Frequency Comparisons**



Aside from the NEB, including its COGOA-regulated facilities, no external organization publishes a worker disabling injury frequency for onshore pipelines. The OGP worker disabling injury frequency was calculated from readily available data for onshore pipelines.

Worker disabling injury frequencies on NEB-regulated pipelines increased slightly from 2004 to 2005 and remain higher than COGOA and OGP injury frequencies. COGOA activities saw a small increase in worker disabling injuries between 2003 and 2005.

CAPP publishes a total recordable worker injury frequency indicator that includes fatalities, permanent total disabilities, lost workday and restricted work cases and medical treatment cases. Because of the CAPP frequency indicator’s broader scope, their 2005 value is 1.52 injuries per 200,000 hours worked, more than twice as high as the NEB frequency value of 0.61. However, CAPP’s 2005 frequency is the lowest in the seven-year period over which the organization has been collecting mandatory data from its members. CAPP’s broad measure of total recordable injuries provides some context into the magnitude of NEB-regulated pipelines’ worker disabling injury frequency.

**3.1.2 Injuries**

**NEB-Regulated Pipeline Injuries**

Figure 3.3 shows the contractor, employee and worker injury frequencies for NEB-regulated pipelines from 1 January 2000 to 31 December 2005. This includes lost time and restricted workday injuries, but excludes fatalities. Worker injury frequencies are the combined frequencies of contractor and employee injuries.

The worker injury frequency decreased from 1.8 injuries per 200,000 hours in 2001 to 0.7 in 2005, with an overall six-year average of 0.9 injuries per 200,000 hours for all workers. The three-year moving averages presented in Figure 3.3 indicate that contractor injuries have shown the largest decrease since 2002, while employee injury frequencies increased slightly in 2005. In 2005, the injury frequency for contractors was approximately 1.9 times the employee injury frequency. From a moving average perspective, the three-year average in 2005 was three times as high for contractors as for employees.

This higher injury frequency may indicate that some companies are not implementing appropriate mitigation to address the hazards of the work conducted by contractors. For comparison, some of the

non-compliances noted by NEB inspectors during construction activities, which are often conducted by contractors, are described later in this report in Table 3.10.

Table A2.2 in Appendix Two is a summary of "injury" definitions used by the NEB and the reference organizations. Generally, all definitions reflect either the inability of a worker to report to work the next day or from effectively performing all their regular work duties. A summary of employee and contractor hours and the number of injuries since 2000 is provided in Table A3.2 of Appendix Three.

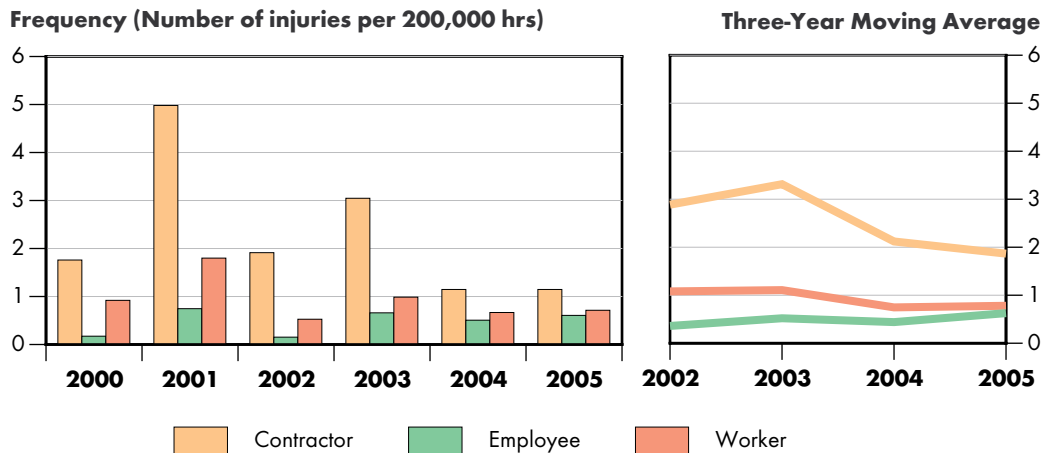
### Injury Frequency Comparisons

Figure 3.4 compares the NEB-regulated pipeline worker injury frequency to the same parameter for COGOA and the OGP from 1 January 2000 to 31 December 2005.

The worker injury frequency for NEB-regulated pipelines continues to be higher than for COGOA and OGP pipelines, and the frequency increased slightly in 2005.

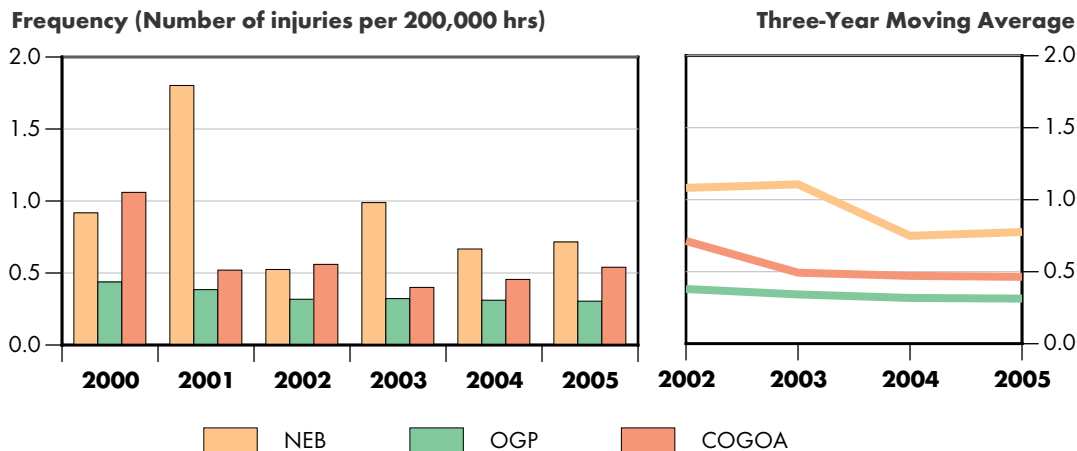
**FIGURE 3.3**

#### Injury Frequency Comparisons for NEB-Regulated Pipelines



**FIGURE 3.4**

#### Worker Injury Frequency Comparisons



Due to the NEB's ongoing concerns with injury rates, further analysis is provided in Section 3.5.

## 3.2 Integrity Performance Indicators

The two integrity performance indicators analyzed in this report are pipeline ruptures and pipeline contacts. Both of these events have the potential to impact health, safety and the environment and are indicators of the implementation of pipeline integrity programs.

### 3.2.1 Ruptures

#### NEB-Regulated Pipeline Rupture Causes

Ruptures are defined in Annex H of CSA Z662-03 as a “loss of containment event that immediately impairs the operation of the pipeline”. Pipeline ruptures, fires and releases of gas or liquids can be severely detrimental to safety and the environment.

Ruptures are investigated and analyzed to determine their primary cause. This report considers the number of ruptures and their primary cause from 1991 onwards for all NEB-regulated pipelines. 2005 is the third consecutive year in which there were no reported ruptures on NEB-regulated pipelines.

Figure 3.5 shows the annual number of ruptures over the last 15 years (1991–2005). Table 3.2 provides a breakdown of reported ruptures on NEB-regulated pipelines and their primary cause. The data are also shown in graph form in Figure 3.6. Metal loss includes both internal and external corrosion. The category of “Other Causes” includes improper operation, fire and yet to be determined causes.

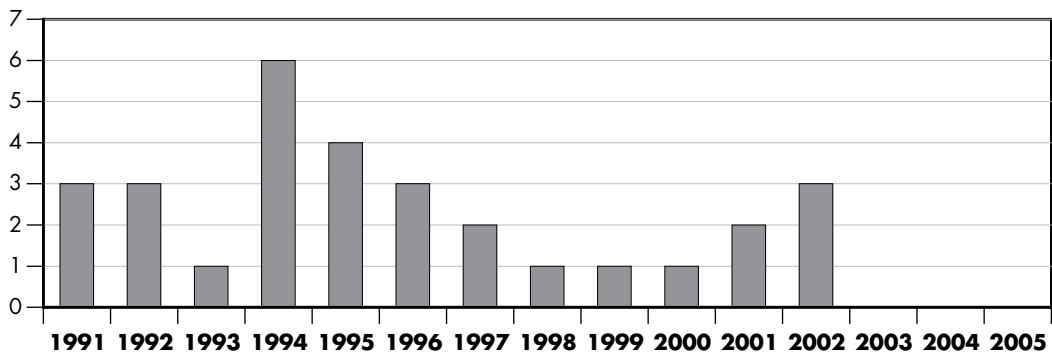
Between 1991 and 2002, there was an average of 2.5 ruptures per year and zero ruptures thereafter. Beginning in 1999, companies were required under the OPR-99 to have integrity management programs. The proactive nature and sophistication of individual company integrity management programs appears to be responsible for the low number of ruptures.

The primary cause of ruptures on NEB-regulated pipelines between 1991 and 2005 was cracking, followed by metal loss. Cracking includes stress corrosion, hydrogen-induced and mechanical damage delayed cracking, and corrosion fatigue. See Figure H.1 of Annex H, CSA Z662-03 for further information on CSA's cause classification for pipeline ruptures.

FIGURE 3.5

#### NEB-Regulated Pipeline Ruptures

Number of Ruptures



**T A B L E 3 . 2**

**Rupture Primary Causes \***

<b>Year</b>	<b>Metal Loss</b>	<b>Cracking</b>	<b>External Interference</b>	<b>Material, Manufacturing or Construction</b>	<b>Geotechnical Failure</b>	<b>Other Causes</b>	<b>Number of Ruptures</b>
1991		2		1			3
1992	1	1				1	3
1993			1				1
1994	2	1			1	2	6
1995	1	3					4
1996	2	1					3
1997	1				1		2
1998						1	1
1999		1					1
2000				1			1
2001	1	1					2
2002		1				2	3
2003							0
2004							0
2005							0
<b>Total</b>	<b>8</b>	<b>11</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>6</b>	<b>30</b>

\* Third rupture included in 1991 upon further review of data.

Some pipelines of specific vintages and construction methods have experienced higher rupture frequencies than others.<sup>1</sup> Since 1991, ruptures have not occurred on NEB-regulated pipelines that have been in operation for less than 12 years. A number of factors have contributed to the absence of ruptures on new pipelines, including the quality of pipeline coatings and cathodic protection, better construction methods, effective pressure testing and well-developed integrity management programs.

**Rupture Cause Comparisons**

Figure 3.7 compares the distribution of NEB-regulated pipeline ruptures since 1991 by cause to those reported by the EUB, OPS and EGIG. The EUB data include ruptures reported from 2000 through 2005. The OPS data include ruptures reported from 1991 through 2005. Data for EGIG ruptures are from 1970 to 2005.

To facilitate comparison between organizations with different reporting criteria, ruptures caused by metal loss and cracking as defined by CSA Z662-03 have been combined and compared to ruptures caused by corrosion. Ruptures brought on by natural causes are compared with geotechnical and other rupture causes.

As mentioned previously, each of the organizations shown in Figure 3.7 have different time frames over which they have examined rupture causes. However, evidence from some of these organizations suggests that the leading cause of ruptures remains the same over time. For example, EGIG indicated in its 1970–1997 report that the leading cause (50 percent) of ruptures was external interference

<sup>1</sup> Jeglic, F. *Analysis of Ruptures and Trends on Major Canadian Pipeline Systems*. National Energy Board, Calgary, Canada, 2004.

compared to 47 percent for 1993–1997. Since the leading cause of ruptures is, on average, the same regardless of the different timeframes, the comparisons in Figure 3.7 are meaningful and useful.

A comparison of the EUB’s six-year totals to individual year totals provides similar results. External interference was the primary rupture cause over both the six-year period and year-over-year from 2000 to 2005.

The leading cause of ruptures on NEB-regulated pipelines is cracking, followed by metal loss. In contrast, corrosion is the leading cause of pipeline ruptures in the U.S., followed by external interference.

Because of differences in pipeline content and purpose (i.e., gathering, transmission, distribution), exact comparisons are difficult. This may account for differences in rupture or failure modes. The population density in the U.S. and Europe is significantly greater than Canada’s, which may account for the increased number of ruptures caused by external interference reported to EGIG and OPS. The density of the EUB-regulated pipeline network coupled with high levels of construction in the Alberta oil and gas sector may account for higher external interference rates in Alberta.

### 3.2.2 Pipeline Contacts

Unauthorized activities reported under the NEB *Pipeline Crossing Regulations Part 1* and *Part 2* include actions that have the potential to damage a pipeline or that may impede access to a pipeline for maintenance or emergency response.

Unauthorized activities or events considered to be indicators related to pipeline integrity include:

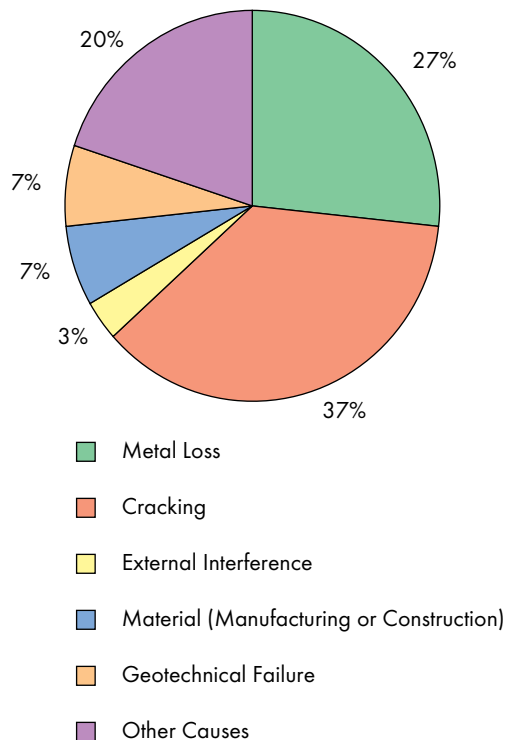
- movement of vehicles or equipment over pipelines;
- construction activities with no soil disturbance;
- construction, landscaping or grading that results in soil disturbance; and
- construction, landscaping or grading that results in pipeline contact.

The number of reported, unauthorized activities with the potential to damage pipelines is provided in Table 3.3.

The number of occurrences increased from 62 in 2004 to 75 in 2005. Unauthorized activities in both years are above the six-year average of 53. The percentage of pipeline contacts ranges between one and four percent of the total number of unauthorized activities, indicating that even if an unauthorized activity occurs on the right of way, there is a low frequency of physical contact with the

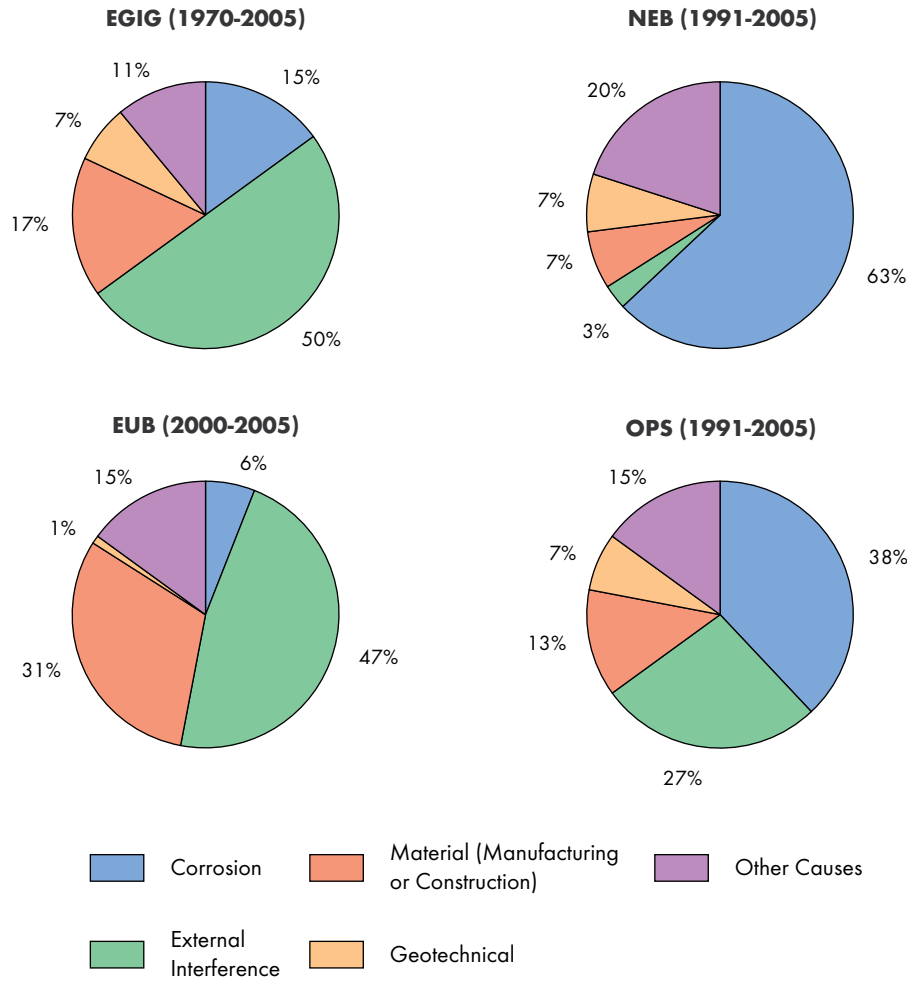
**FIGURE 3.6**

**NEB Pipeline Ruptures – Primary Causes (1991-2005)**



**FIGURE 3.7**

**Comparison of Leak/Break/Rupture by Cause**



**TABLE 3.3**

**Unauthorized Activities on Rights of Way**

Year	Movement of Vehicles or Equipment Over Pipelines		Activities With No Soil Disturbance		Activities With Soil Disturbance		Pipeline Contacts		Total
	Landowner	Contractor	Landowner	Contractor	Landowner	Contractor	Landowner	Contractor	
2000	2	2	5	0	12	26	0	2	49
2001	1	1	7	0	14	27	1	0	51
2002	0	2	2	0	7	13	0	1	25
2003	1	6	9	4	7	30	2	0	59
2004	2	7	4	2	12	33	1	1	62
2005	1	3	11	2	20	37	0	1	75
Average	1.2	3.5	6.3	1.3	12	27.2	0.7	0.8	53.5

pipe. Increasing urban encroachment on pipeline rights of way is expected to become a more significant concern in the future and may have an impact on the number of unauthorized activities along rights of way.

No reference organizations appear to produce data with which unauthorized activities on rights of way can be readily compared. As such, it is difficult to assess whether the number of pipeline contacts relative to the number of unauthorized activities is cause for concern. This should in no way diminish the importance of pipeline contacts as a performance indicator as any pipeline contact could have serious consequences.



### 3.3 Environmental Performance Indicators

Environmental performance indicator data are obtained from releases, leaks and spills that are reportable to the NEB. Although releases and leaks may have a root cause in pipeline integrity, the results can also have environmental consequences.

An attempt was made to normalize the number and volume of liquid releases, leaks and spills using throughput data on NEB-regulated pipelines for 2005. However, since only a small number of NEB-regulated companies report these values, they are not presented in this report. There is potential for the NEB to collect these numbers from a wider range of companies in the future.

The NEB has not yet begun to collect data on environmental leading indicators. Some data have been collected from environmental construction and post-construction inspections conducted by the NEB, and other sources of data will be explored in the future. One data source may be Corporate Sustainability Reports; however, these are generally only produced by the larger NEB-regulated pipeline companies.

The frequency data included below were calculated by normalizing the number or volume of releases, leaks and spills per 1 000 kilometres of corresponding pipeline. The number of liquid releases and leaks is reported as well as the release volume, where appropriate.

#### 3.3.1 Liquid Releases, Leaks and Spills

##### *NEB-Regulated Liquid Pipelines*

##### **Pipe Body Liquid Releases (Ruptures and Leaks)**

For the purposes of this report, liquid releases are the result of pipe body failures (includes both ruptures and leaks) and have a volume exceeding 1.5 m<sup>3</sup>. Liquid releases smaller than 1.5 m<sup>3</sup> are not reportable under the OPR-99.

Table 3.4 shows the number and volume of liquid releases from the pipe body on NEB-regulated liquid pipelines between 2000 and 2005.

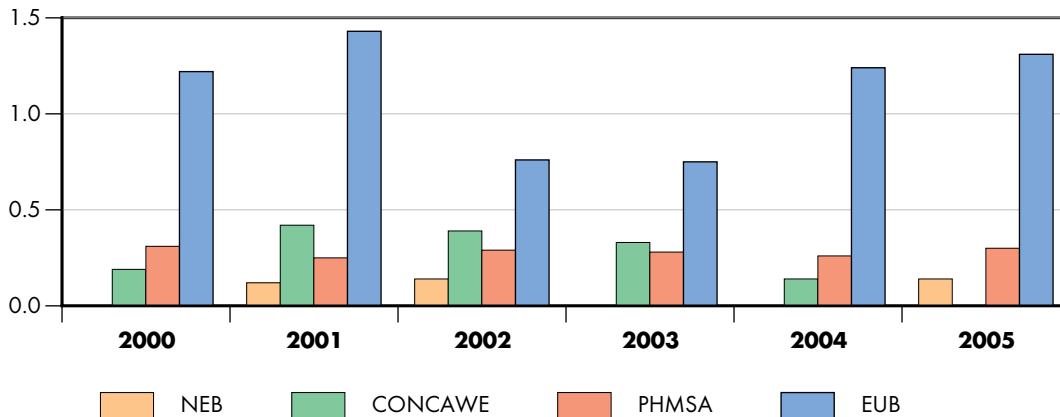
TABLE 3.4		
<b>Pipe Body Liquid Releases</b>		
<b>Year</b>	<b>Number of Releases &gt;1.5 m<sup>3</sup></b>	<b>Total Release Volume (m<sup>3</sup>)</b>
2000	0	0
2001	2	3 650
2002	2	52
2003	0	0
2004	0	0
2005	2	218



**FIGURE 3.8**

**Pipe Body Liquid Release Frequency Comparisons**

Frequency (Number of releases per 1 000 km)



**Pipe Body Liquid Release Frequency Comparisons**

Figure 3.8 compares the pipe body liquid release frequency for NEB-regulated liquid pipelines to that of reference organizations. Regulatory bodies vary in their reporting requirements for releases. For example, releases reported by CONCAWE<sup>2</sup> are at least 1 m<sup>3</sup> in size while the minimum release volume used by the NEB is 1.5 m<sup>3</sup>. Definitions are provided in Table A2.3 in Appendix Two.

NEB-regulated pipelines have experienced very few liquid pipe body releases over the past six years, particularly when compared to the reference organizations. There were no liquid releases in 2000, 2003 and 2004 from NEB-regulated pipelines. The two liquid pipe body releases in 2005 occurred at a pipeline terminal and a pump station; both were contained within the facilities. Overall, NEB-regulated pipelines have a very low release frequency with a six-year average of 0.05 liquid releases per 1,000 kilometres of liquid pipelines.

CAPP also publishes data on liquid leaks and ruptures, normalized to the total kilometres of CAPP-operated pipelines, but those numbers are not presented in this report. CAPP’s data include all releases on upstream and midstream pipelines used to transport raw or treated crude oil, natural gas liquids (NGLs) or water, but does not include leaks from on-lease process piping. As a result, the CAPP liquid release frequency appears to be high relative to the organizations shown in Figure 3.8. CAPP’s

release data for 2005 indicate a frequency of 2.8 releases per 1 000 kilometres.

**TABLE 3.5**

**Pipe Body Liquid Release Volume Comparisons (m<sup>3</sup>)**

Year	NEB	CONCAWE*	OPS	EUB
2000	0	360	13 199	510
2001	3 650	1 150	13 803	183
2002	52	2 185	12 874	359
2003	0	2 830	6 625	415
2004	0	138	8 218	2 792
2005	218	n/a	6 727	588

\* CONCAWE 2005 liquid release data will be made available in the next issue of this report.

**Pipe Body Liquid Release Volume Comparisons**

Table 3.5 shows the pipe body liquid release volumes for NEB-regulated liquid pipelines and reference organizations from 2000 through 2005. All volumes are in cubic metres (m<sup>3</sup>).

Most organizations shown in Table 3.5 have large variability in liquid release

2 CONCAWE 2005 liquid release data will be made available in the next issue of this report.

volumes. To normalize this data, Figure 3.9 shows the liquid release volume over the pipeline length for NEB-regulated pipelines and reference organizations from 2000 to 2005.

The frequency of liquid releases reported by EUB-regulated companies as shown in Figure 3.8 is greater than the frequencies reported by the NEB or other organizations. These pipelines are predominantly small diameter, upstream gathering lines carrying unrefined (and often corrosive) products, as opposed to large diameter transportation systems carrying crude oil and refined products, which are more typical of the pipelines regulated by the NEB. However, as shown in Figure 3.9, the volume of fluids released, normalized over the pipeline system length, is generally much lower among EUB-regulated companies.

The annual data presented in Figure 3.9 indicate that a single large rupture or break can have a significant impact on the liquid release volume frequency indicator. This is particularly evident for the NEB in 2001 and for the EUB in 2004. These large events set this indicator's upper range, which is in excess of 200 m<sup>3</sup> and 150 m<sup>3</sup> per 1 000 kilometres of liquid pipelines for the NEB and EUB, respectively. All of the organizations shown in Figure 3.9 had less than 40 m<sup>3</sup> of liquid releases per 1 000 kilometres of pipeline in 2005.

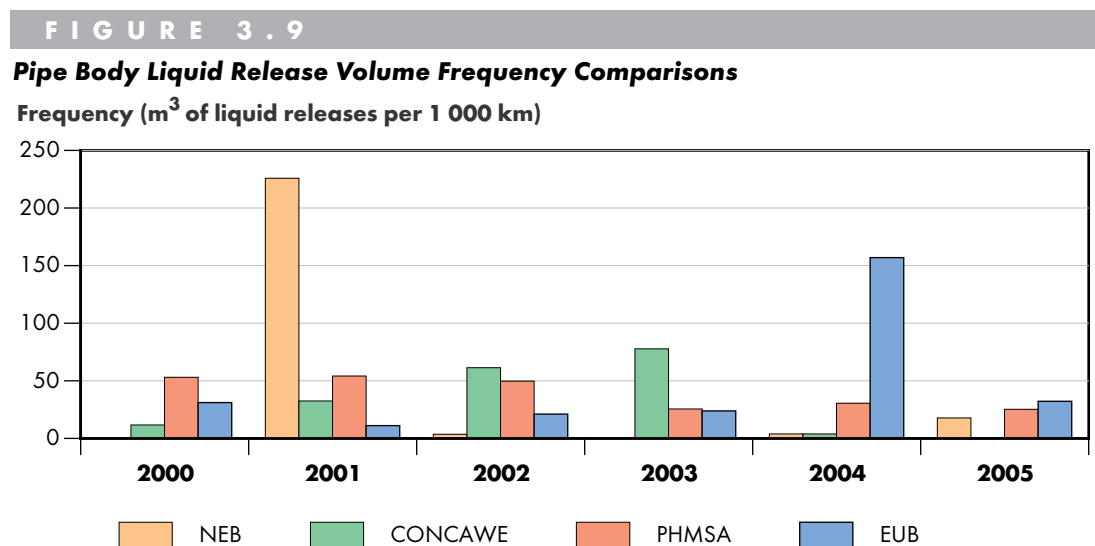
### Operational Liquid Leaks (Releases from non-pipe body sources)

Leaks on liquid pipelines can be associated with pipeline operations and originate from pipeline components such as flanges, valves, pumps and storage tanks. These leaks are usually contained within fenced pipeline facilities and exclude leaks from pipe bodies. Typically, these kinds of leaks are less than 1.5 m<sup>3</sup>; however, they can be much larger. Liquids are considered to be both Low Vapour Pressure (LVP) and High Vapour Pressure (HVP) pipeline products.

Table 3.6 shows the number and volume of liquid leaks for NEB-regulated liquid pipelines for the six-year period from 2000 through 2005. Note that pipe body releases are excluded from this data.

A large liquid leak in 2002 occurred at a pump station, and a large leak (950 m<sup>3</sup>) in 2005 occurred at an oil terminal, which resulted in a high total leak volume for those years.

On average, approximately 38 leaks per year are reported on NEB-regulated pipeline systems. Much like pipe body releases, a single large leak from other pipeline components can have a measurable impact on total annual leak volume.



## Operational Liquid Leak Frequency

No reference organizations publish a liquid leak frequency comparable to that of the NEB. Figure 3.10 shows the liquid leak frequency indicator for NEB-regulated liquid pipelines from 2000 through 2005.

Liquid leaks from non-pipe body sources have been below 3.1 leaks per 1 000 kilometres of pipeline for the past five years.

**TABLE 3.6**

### Operational Liquid Leaks on NEB-Regulated Liquid Pipelines

Year	Number of Leaks (≤1.5 m <sup>3</sup> )	Number of Leaks (>1.5 m <sup>3</sup> )	Total Leaks	Leak Volume (m <sup>3</sup> )
2000	40	2	42	13
2001	15	3	18	21
2002	28	9	37	1 184
2003	39	1	40	11
2004	34	5	39	33
2005	48	9	57	1 049

**TABLE 3.7**

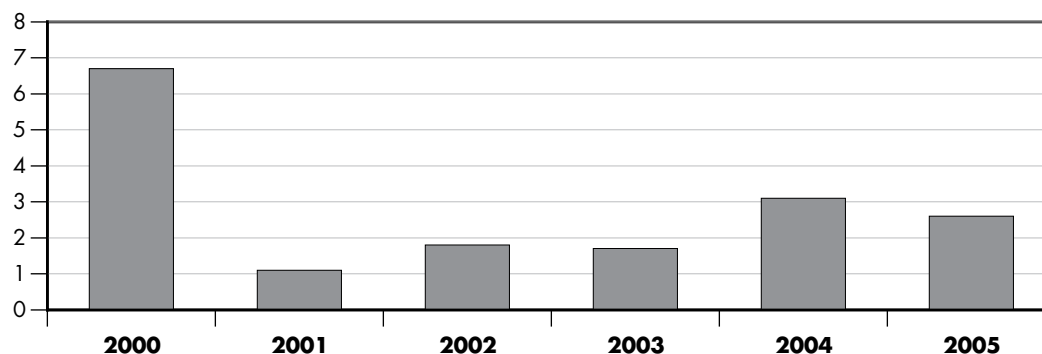
### Liquid Spills on NEB-Regulated Liquid and Gas Pipelines

Year	Number of Spills (≤1.5 m <sup>3</sup> )	Number of Spills (>1.5 m <sup>3</sup> )	Total Number of Spills	Total Spill Volume (m <sup>3</sup> )
2000	222	0	222	16
2001	28	0	28	10
2002	35	0	35	2
2003	52	1	53	5
2004	88	0	88	5
2005	47	3	50	14

**FIGURE 3.10**

### Operational Liquid Leak Frequency (NEB-Regulated Pipelines)

Frequency (Number of leaks per 1 000 km)



### NEB-Regulated Liquid and Gas Pipelines

#### Non-pipeline Liquid Spills

For the purposes of this report, liquid spills are associated with pipeline construction, maintenance and operations on both liquid and gas pipelines. They typically include small volumes of lubricating or hydraulic oils or fuel, but exclude product leaks from liquid pipeline systems. Table 3.7 shows the volume and combined number of liquid spills greater than and less than 1.5 m<sup>3</sup>.

High levels of construction activity in 2000 caused a significant number of reported spills. Overall, the average volume per spill is small, with the six-year average being 0.11 m<sup>3</sup> (110 litres) per spill.

CAPP publishes a non-pipeline spill indicator, which has a considerably

larger scope than spills caused by construction and maintenance activities. For CAPP, non-pipeline spills include spills from any well site, gathering station or processing facility. This indicator also includes spills related to offshore construction, drilling and production. For perspective only, the CAPP average volume per spill from 2000 through 2005 was approximately 30 m<sup>3</sup> (30 000 litres). While the number of spills reported in 2005 was slightly higher than in 2004, the average spill volume decreased by two-thirds.

### 3.3.2 Gas Releases and Leaks

#### NEB-Regulated Gas Pipeline Releases and Leaks

Pipe body natural gas releases can be the result of pipe body failures including both ruptures and leaks.

Operational natural gas leaks can occur through routine equipment functions such as venting from valves or seepage at flanges through gaskets. The data presented here do not include the release of gas from planned events, such as venting or blowdowns. There is no minimum reportable volume associated with gas releases or leaks; all gas leaks on NEB-regulated pipelines must be reported.

The data used to calculate the gas release and leak frequencies for NEB-regulated pipelines are shown in Table 3.8.

The reporting criteria for gas releases vary between the reference organizations referred to in Chapter 1 of this report. These differences are summarized in Table A2.4 (Appendix Two). Pursuant to the OPR-99, all gas releases and leaks from flanges, fittings, and other operating equipment on NEB-regulated pipelines are reportable, regardless of volume.

**TABLE 3.8**

**Gas Releases and Leaks on NEB-Regulated Pipelines**

Year	Number of Pipe Body Gas Releases	Number of Operational Gas Leaks
2000	1	23
2001	1	23
2002	2	11
2003	0	11
2004*	4	19
2005	4	18

\* 2004 data has been updated since last year's report.

#### Pipe Body Gas Release Frequency Comparisons

Figure 3.11 shows the pipe body gas release frequency for NEB-regulated gas pipelines and reference organizations. The OPS data were analyzed so that hydrocarbon releases not originating from the pipe body were removed from the aggregate data.

The six-year average of the gas pipe body release frequency indicator for NEB-regulated pipelines is approximately 0.08 releases per 1 000 kilometres or one gas release per 12 500 kilometres. The three-year moving average shows a general trend upwards for OPS and NEB gas releases.

The NEB numbers for gas release frequencies are generally aligned with the EGIG and OPS data; however, the NEB gas release frequency was elevated in 2004 and 2005.

#### Operational Gas Leak Frequency

Figure 3.12 shows the gas leak frequency for NEB-regulated gas pipelines from non-pipe body sources.

At a frequency of approximately 0.7 leaks per 1 000 kilometres, operational gas leaks on NEB-regulated gas pipelines occur 10 times more often than pipe body gas releases, shown in Figure 3.11.

Different reporting requirements for gas leaks between the NEB and the OPS make comparison of the gas leak frequency difficult, so OPS data are not presented in this report. Although some gas leaks are reported to the OPS, only those resulting in a fatality or a property loss of US\$50,000 are required to be reported.

### 3.4 Incident Performance Indicators

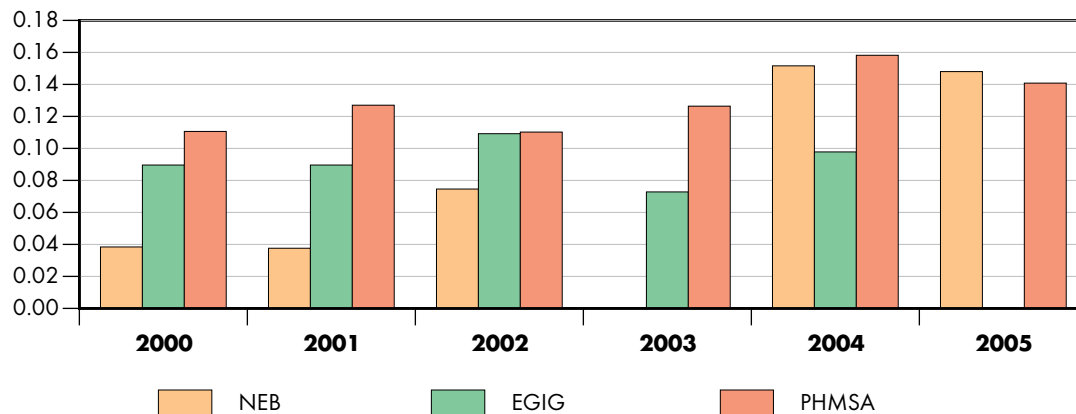
NEB-regulated companies are required to report any incidents to the NEB pursuant to section 52.(1) of the OPR-99, which states:

A company shall immediately notify the Board of any incident relating to the construction, operation or abandonment of its pipeline and shall submit a preliminary and detailed incident report to the Board as soon as is practicable.

**FIGURE 3.11**

#### Pipe Body Gas Release Frequency Comparisons

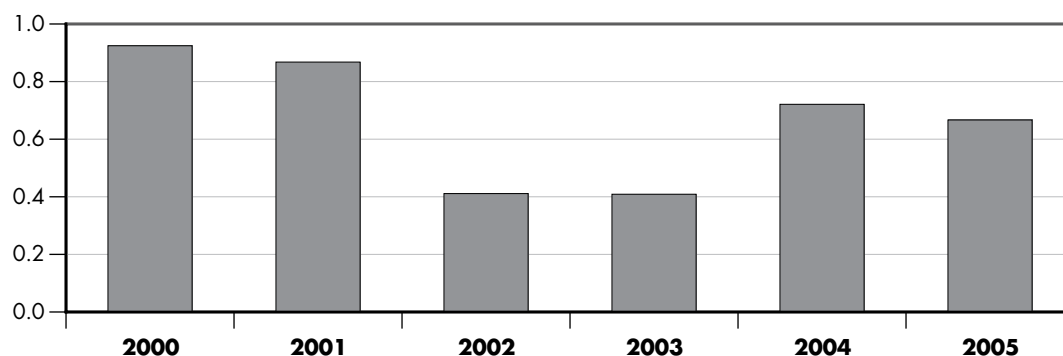
Frequency (Number of releases per 1 000 km)



**FIGURE 3.12**

#### Operational Gas Leak Frequency (NEB-Regulated Pipelines)

Frequency (Number of leaks per 1 000 km)



The data presented here do not include incidents voluntarily reported under the SPI Initiative. Incidents that must be reported include:

- death or serious personal injury;
- a significant adverse effect on the environment;
- an unintended fire or explosion;
- the unintended or uncontained release of LVP hydrocarbon liquids in excess of 1.5 m<sup>3</sup>;
- the unintended or uncontrolled releases of gas or HVP hydrocarbons; and
- the operation of a pipeline beyond its design limits as determined under CSA Z662, CSA Z276 or any operating limits imposed by the Board.

All reportable pipeline incidents pursuant to the OPR-99 from 1 January 2000 to 31 December 2005 are presented in Figure 3.13, by occurrence type.

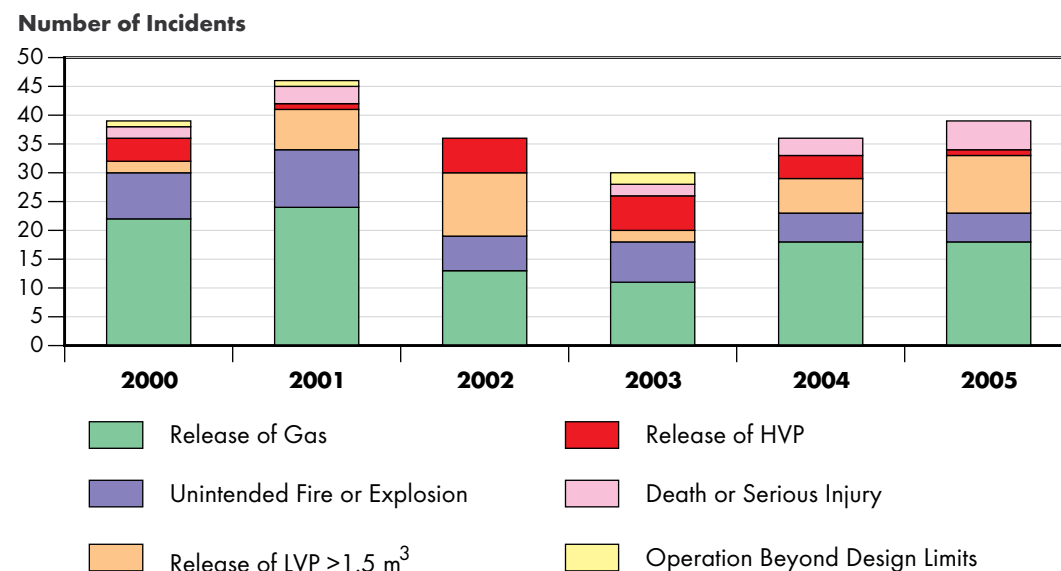
A total of 226 incidents were reported during this six-year period. Gas releases were the most common incident reported in each year. This may be a result of all gas releases being reportable under the OPR-99, whereas only liquid releases larger than 1.5 m<sup>3</sup> are reportable. Unintended fire or explosion was the second most common incident. On average, the NEB receives 38 incident reports per year.

### 3.5 Detailed Injury Analysis

The analysis below examines liquid and gas pipeline injury frequencies, contractor and employee injury frequencies, contractor serious injury types and causes, and non-compliances observed by the NEB on construction projects. Some of the injury data below are separated into liquid and gas pipeline-related injuries to enable companies to compare themselves to other companies in the same sector.

**FIGURE 3.13**

#### OPR Incidents by Occurrence Type



## NEB-Regulated Liquid Pipeline Injuries

Liquid pipelines include crude oil, refined product and NGL pipelines. Figure 3.14 shows the contractor, employee and worker injury frequencies for NEB-regulated liquid pipelines. Note that there were no contractor or employee injuries reported in 2002.

The liquid pipeline contractor injury frequency has decreased in the last six years from more than 10 injuries per 200,000 hours worked to about one injury per 200,000 hours worked. Overall, there was a small increase in both the contractor and employee injury frequency in 2005. The NEB does not have sufficient information to understand the reason for this increase.

## NEB-Regulated Gas Pipeline Injuries

Figure 3.15 shows the contractor, employee and worker injury frequencies for NEB-regulated gas pipelines.

The gas pipeline contractor injury frequency in 2005 was consistent with the frequency in 2004 at approximately one injury per 200,000 hours worked. The 2005 contractor injury frequency is similar

FIGURE 3.14

### NEB Liquid Pipeline Injury Frequency

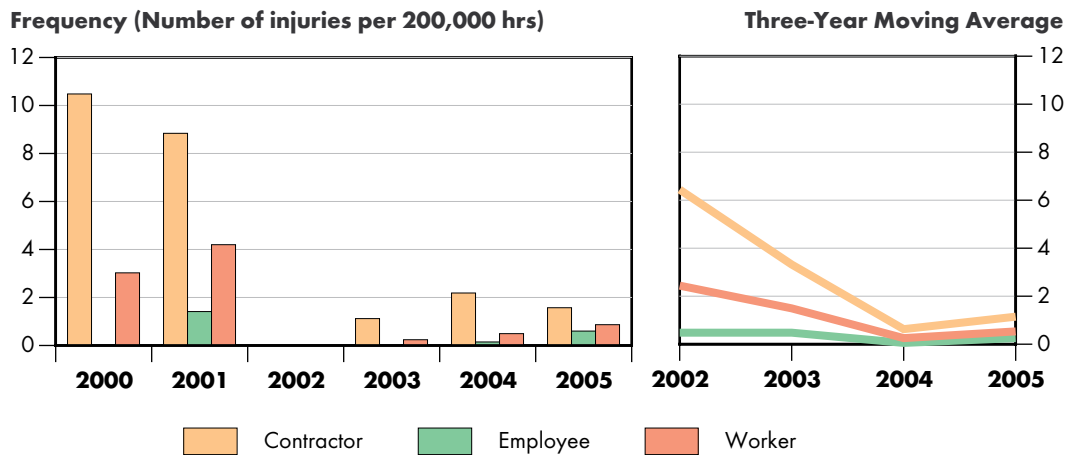
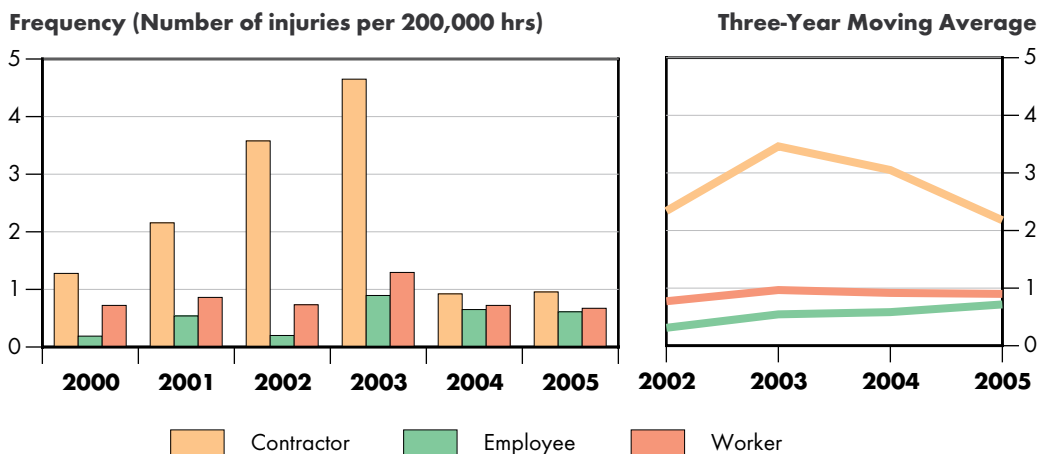


FIGURE 3.15

### NEB Gas Pipeline Injury Frequency



to the gas pipeline worker six-year average of 0.8 injuries per 200,000 hours worked. The three-year moving average for contractors shows an overall decline in injury frequency over the past three years.

Both oil and gas pipeline companies are currently experiencing a downward trend in contractor injury frequency, which may indicate that safety programs are helping to improve contractor safety performance.

Figure 3.16 compares the NEB-regulated pipeline employee injury frequency to the same parameter for reference organizations for 1 January 2000 to 31 December 2005.

NEB-regulated pipeline companies had a small increase in the number of employee injuries between 2004 and 2005, while the OGP frequencies remained essentially the same. As discussed in Table A2.2 of Appendix Two, the 2003 to 2005 injury data for the U.S. Bureau of Labor Statistics (BLS) are for the U.S. pipeline transportation industry. It is considered comparable to employee data from NEB-regulated pipelines. The NEB was unable to determine the reasons for the U.S. pipeline transportation industry's higher employee injury frequency.

Human Resources and Skills Development Canada (HRSDC) also publishes employee injury frequency data, which include disabling injuries to employees working in head and regional offices, while NEB-regulated pipeline employee injury data do not. No data are available from HRSDC for 2003 to 2005, so they are not included in Figure 3.16. However, the HRSDC employee injury frequency for 2000 to 2002 ranged from 0.3 to 0.56 injuries per 200,000 hours, a similar range to the NEB frequencies.

Figure 3.17 compares the NEB-regulated pipeline contractor injury frequency to the same parameter for the reference organizations for 1 January 2000 to 31 December 2005. The PLCAC frequency indicator includes lost time injuries and illnesses.

The injury frequency rate for contractors working on NEB-regulated pipelines is generally mid-way when compared to other organizations. The NEB six-year average indicates that two to three contractors are injured for every 200,000 hours worked annually.

As further discussed in Table A2.2 of Appendix Two, the 2003 to 2005 BLS frequency indicator used in Figures 3.16 and 3.17 shows data for the U.S. utility system construction industry. The data

**FIGURE 3.16**

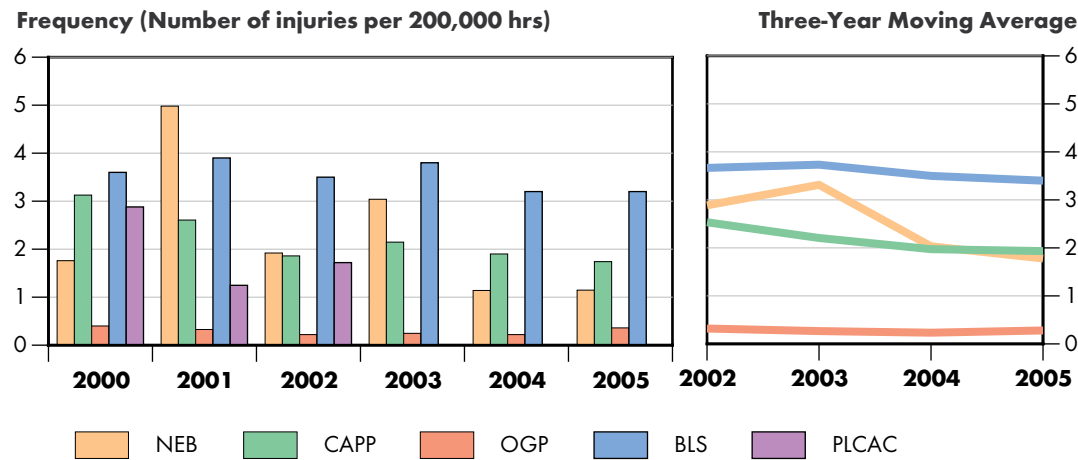
**Employee Injury Frequency Comparisons**





**FIGURE 3.17**

**Contractor Injury Frequency Comparisons**



are considered comparable to contractor data for NEB-regulated pipelines. The PLCAC reported no injuries between 2003 and 2005, primarily due to low mainline construction activity. In fact, for mainline construction, which is the comparative figure used for this report, the threshold minimum man hours worked was not achieved in 2003 through 2005 for PLCAC member companies; thus, a moving average could not be calculated for PLCAC.

Table 3.9 provides a summary of the types of serious injuries incurred by contractors on NEB-regulated pipelines between 2000 and 2005 that were reported pursuant to the OPR-99. A definition for serious injuries, as defined by the OPR-99, is presented in Table A2.2 (Appendix Two). There were no serious injuries reported in 2002.

Between two and four serious contractor injuries occurred per year over the past six years.

The NEB has conducted further analysis on the causes of OPR-reportable incidents, particularly in relation to contractors. The results of the analysis are presented in Table 3.10. The NEB is aware that contractor injuries, both serious and lost time injuries, are significantly higher than those associated with employees. They are separated into direct (or immediate) and basic (or underlying) causes.

The NEB reminds companies of their responsibilities in relation to contractor injuries. The OPR-99 indicate that the company holding the Certificate or the Order approving a pipeline must take all reasonable steps to ensure that all agents, contractors and operators

**TABLE 3.9**

**OPR-99 Contractor Serious Injuries (2000-2005)**

Type of Event or Exposure	Number of Serious Injuries
<b>Contact with Objects &amp; Equipment</b>	
Struck by Object	4
Caught in Object	3
Struck against Object	1
Contact with Electricity	2
Other	0
<b>Falls</b>	
Fall on Same Level	0
Fall to Lower Level	2
Other	0
<b>Transportation Accidents</b>	0
<b>Fire and Explosions</b>	0
<b>Total Number of Serious Injuries</b>	12

**TABLE 3.10**

**Contractor Serious Injury Causes (2000-2005)**

<b>Direct Causes</b>		<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>Total</b>
Substandard Acts	Improper position for task		1			1		2
	Improper placement	1	1		1			3
	Using equipment improperly		1				1	2
	Failure to warn	1						1
	Failure to secure				1			1
	Failure to follow procedures						1	1
Substandard Conditions	Hazardous environmental conditions						1	1
	Inadequate sign or label					1		1
	<b>Total Injuries</b>							<b>12</b>
<b>Basic Causes</b>								
Job Factors	Inadequate leadership/supervision	1	2					3
	Inadequate tools and equipment				1			1
	Inadequate work standards				1	1		2
	Inadequate engineering						1	1
Personal Factors	Inadequate mental capability (poor judgment)		1				1	2
	Lack of knowledge						1	1
	Improper motivation	1				1		2
	<b>Total Injuries</b>							<b>12</b>

are aware of and comply with the OPR-99, follow good safety and environmental practices, and obtain all necessary approvals and permits.

In other words, the NEB views contractors as equivalent to employees of a company pursuant to the OPR-99 and expects companies to be responsible for the safety of all workers on its sites.

**Construction Safety Inspections**

As part of its activities to monitor compliance with the OPR-99 and other safety regulations, the NEB regularly inspects pipeline construction projects. Table 3.11 shows the number and category of safety non-compliances observed during inspections in 2004 and 2005.

A number of recurring non-compliances were observed on pipeline construction projects in 2004 and 2005, including the misuse or lack of face shields or safety glasses, riding or straddling suspended pipe and pinch points. These non-compliances could lead to injuries on construction sites and it would be worthwhile for companies to examine the areas of repeated non-compliances more closely.

The NEB will continue to inspect pipeline construction to evaluate field activities and to better understand the measures that can be taken to improve contractor safety.

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**TABLE 3.11****Contractor Non-Compliances Observed on Safety Inspections (2004-2005)**

<b>Type of Non-Compliance</b>	<b>2004</b>	<b>2005</b>
<b>Personal Protective Equipment</b>		
Hearing Protection	0	1
Face Shields or Safety Glasses	8	14
Hard Hats	1	1
High Visibility Vests	1	0
<b>Unsafe Work Practices</b>		
Riding Suspended Pipe/Straddling Pipe	4	3
Pinch Points	2	3
Guidelines/Tag Lines	4	0
Explosion Hazard	1	0
Ingress/Egress	2	1
MSDS	1	0
Danger Zones	1	1
Scaffolding	1	0
<b>Total Number of Non-compliances Observed</b>	<b>26</b>	<b>24</b>
<b>Number of NEB Construction Safety Inspections Conducted</b>	<b>8</b>	<b>14</b>

## CONCLUSIONS

Direct comparisons between the NEB and reference organizations are made difficult by existing differences in industry reporting standards and definitions. However, the performance indicators in this report are intended to be demonstrative of trends and relative performance. The NEB is pleased to report that the safety performance of its regulated pipelines has improved over the past five years, consistent with the entire pipeline industry.

The Board uses performance indicators as one element in the development of compliance verification prioritization plans. These plans ensure that the NEB focuses its regulatory oversight in areas of highest priority.



Improving and harmonizing reporting standards would enhance the NEB's ability to compare the worker disabling injury frequency and other indicators with reference organizations. Harmonized reporting implies that every jurisdiction or organization requesting injury data would do so using standard injury definitions, an objective worthy of pursuing but difficult to achieve. As a first step, improved reporting could be attained by requesting specific injury types rather than requesting data for a broad injury definition. For its part, the NEB will work not only to improve the manner in which it obtains its information but also to improve the specificity of information sought for the 2007 *Focus on Safety and Environment* report.

The following are some other ways in which pipeline performance indicators for NEB-regulated pipelines could be improved:

- Many NEB-regulated companies do not report under the SPI Initiative, particularly those that have small lengths of pipeline under NEB jurisdiction. Although 95 percent of the pipeline lengths under the NEB's jurisdiction are reported upon, valuable data are not being captured in these reports. Improved harmonization of reporting between the NEB, other regulators and industry organizations is the key to having a thorough data set for analysis. The NEB acknowledges the companies listed in Appendix Three, that have voluntarily reported their safety and environmental performance data.
- A recommendation in the 2006 version of this report was to use throughput data to normalize releases, leaks and spills. Although these data are not currently collected from many of the companies under the NEB's jurisdiction, there may be value in requesting the data through the SPI initiative.
- The economic costs and environmental impacts of leaks, releases and spills are not well understood as they are not typically included in mandatory or voluntary reporting formats

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submitted to the NEB. Future work may include consulting with industry on approaches to capture this information. A review of external organizations indicated that external comparisons of this type are not readily available either.

- The development of leading indicators for safety, integrity and the protection of the environment continues to be an objective of the NEB. In this current version of the report, we present data on non-compliances observed during construction inspections as an example of a leading indicator for safety. Unauthorized soil disturbances and pipe contacts are also leading indicators. The NEB is considering further developing these indicators to provide useful information on the factors associated with pipeline contacts.
- Although near miss data were part of the original SPI Initiative information requested by the NEB and was rejected by regulated companies, the NEB is considering revisiting this indicator and working with companies to find indicators that provide meaningful information to industry. Leading indicators are a way of measuring how proactive a safety program is, which can lead to the development of a safety culture within a company and the industry as a whole. The NEB sees benefit in reporting on a consistent set of leading indicators and sharing those with industry.

For the third consecutive year, there have been no ruptures of NEB-regulated pipelines. This result is primarily attributed to the introduction of Integrity Management Programs (IMPs) within the pipeline industry. The NEB was the first regulator in North America to mandate that pipeline companies must have IMPs, with the promulgation of the OPR-99. The OPR-99 reflects the Board's goal-oriented approach to regulation by directing companies to have IMPs and by allowing them the freedom to tailor the content of the IMPs to their particular circumstances.

Contractor injury frequencies were highlighted in this report with the inclusion of an injury cause analysis including the types of events and exposures that led to serious contractor injuries between 2000 and 2005 and the direct and underlying causes of those injuries. With additional data collection, the NEB anticipates extending this analysis in future versions of this report. Contractor injuries, although improving, remain a systemic problem. The NEB will work with industry to better understand and improve contractor safety performance.

In conclusion, NEB-regulated pipelines perform consistently with reference organizations in Canada, the U.S. and overseas, within the limits of data comparability. The pipeline industry as a whole has shown improved safety and environmental performance over the past six years. Regulators and industry need to continue working towards safer pipelines to maintain high standards for workers and the public. Pipelines remain an efficient and safe method of transporting hydrocarbon products.

Contractor Fatalities	fatalities which occur while a contract worker is involved in activities pursuant to his/her contract with a pipeline company.
Disabling Injury Frequency	the number of fatalities plus lost time injuries plus restricted workday injuries multiplied by 200,000 and divided by the corresponding employee, contractor or combined employee and contractor (worker) hours worked.
Employee Fatalities	fatalities which occur while an employee is involved in activities associated with their job duties.
Injury Frequency	the number of lost time and restricted workday injuries multiplied by 200,000 and divided by the corresponding employee, contractor or worker hours worked.
Lost Time Injury	Any occupational injury that prevents an employee from reporting for work or from effectively performing all the duties connected with the employee's regular work on any day subsequent to the day on which the injury occurred, whether or not that subsequent day is a working day for the employee (definition of "disabling injury" in <i>Canada Occupational Health and Safety Regulations Part XV</i> , section 15.1(a))
Non-pipeline Liquid Spills	spills are associated with small volumes of lubrication and hydraulic oils and fuel spilled during pipeline construction, maintenance and gas pipeline operations.
Non-pipeline Liquid Spills Frequency	the number of liquid spills from integral gas pipeline components and the number of liquid spills caused by pipeline construction and maintenance activities multiplied by 1 000 and divided by the combined total kilometres of liquid and gas pipelines.
Operational Gas Leak Frequency	the total number of gas leaks caused by components integral to the operation of gas pipelines multiplied by 1 000 and divided by the total kilometres of gas pipelines.
Operational Liquid Leak Frequency	the number of liquid leaks caused by components integral to the operation of liquid pipelines multiplied by 1 000 and divided by the total kilometres of liquid pipelines.
Operational Liquid Leaks	associated with the operation of pipeline systems and arise from other components such as flanges, valves, compressors and pumps. Typically, liquid leaks are less than 1.5 m <sup>3</sup> but, they can be larger.

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Pipe Body Gas Release Frequency	the number of releases caused by gas pipeline body failure multiplied by 1 000 and divided by the total kilometres of gas pipelines.
Pipe Body Liquid Releases	pipe body failures that exceed 1.5 m <sup>3</sup> of liquids.
Pipe Body Liquid Release Frequency	the number of releases exceeding 1.5 m <sup>3</sup> caused by liquid pipeline body failure multiplied by 1 000 and divided by the total kilometres of liquid pipelines.
Pipe Body Liquid Release Volume Frequency	the volume released from a liquid pipeline body failure multiplied by 1 000 and divided by the total kilometres of liquid pipelines.
Performance Indicator	a statistic or parameter that, tracked over time, provides information on trends in the condition of a phenomenon.
Reportable Incidents (under the OPR-99):	<ul style="list-style-type: none"> <li>• death or serious personal injury;</li> <li>• a significant adverse effect on the environment;</li> <li>• an unintended fire or explosion;</li> <li>• the unintended or uncontained release of low vapour pressure (LVP) hydrocarbon liquids in excess of 1.5 m<sup>3</sup>;</li> <li>• the unintended or uncontrolled releases of gas or high vapour pressure (HVP) hydrocarbons; and</li> <li>• the operation of a pipeline beyond its design limits as determined under CSA Z662, CSA Z276 or any operating limits imposed by the Board.</li> </ul>
Ruptures	loss of containment event that immediately impairs the operation of the pipeline (Annex H to CSA Z662-03).
Serious Injury (under the OPR-99)	includes an injury that results in: (a) the fracture of a major bone; (b) the amputation of a body part; (c) the loss of sight in one or both eyes; (d) internal hemorrhage; (e) third degree burns; (f) unconsciousness; or, (g) the loss of a body part or function of a body part.
Third Party Fatalities	fatalities involving persons other than contractors or employees.
Worker	refers to the combined data for employees and contractors.

## **A1.1 Reference Organizations and Data Sources**

Organizations chosen for comparative analysis of data within this report have been selected based on their similarities to the NEB. A comparison of the terms used within each reference organization is provided in Appendix Two.

### **A1.1.1 Human Resources and Skills Development Canada (HRSDC)**

*Website: [www.brsdc.gc.ca](http://www.brsdc.gc.ca)*

Under the Canadian constitution, labour legislation is primarily a provincial responsibility. The federal government, however, administers labour affairs in specific sectors including certain works and industries such as pipelines which have inter-provincial or international character.

The Labour Program of Human Resources and Skills Development Canada (HRSDC) is responsible for developing, administering and enforcing legislation and regulations related to the workplace, including the *Canada Labour Code Part II – Occupational Health and Safety (CLC Part II)*.

HRSDC collects, researches and analyzes data pertaining to health and safety at all federally regulated workplaces, including those regulated by the NEB.

HRSDC data are presented within this report for comparison with NEB injury frequency data.

#### **Data Sources**

*Occupational Injuries Among Canadian Federal Jurisdiction Employers, 1998–2002.*

### **A1.1.2 Alberta Energy and Utilities Board (EUB)**

*Website: [www.eub.gov.ab.ca](http://www.eub.gov.ab.ca)*

The Alberta Energy and Utilities Board (EUB) is an independent, quasi-judicial agency of the Government of Alberta. Its mission is to ensure that the discovery, development, and delivery of Alberta's resources takes place in a manner that is fair, responsible, and in the public interest.

The EUB regulates the safe, responsible, and efficient development of Alberta's energy resources including oil, natural gas, oil sands, coal, and electrical energy.

Regulation is done through four core functions: adjudication and regulation, applications, surveillance and enforcement, and information and knowledge.

EUB data are presented within this report for comparative purposes for ruptures and liquid releases.



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## Data Sources

### *Written correspondence:*

Dated 4 April 2003, 20 hydrocarbon liquid releases from crude oil pipelines in 2000 and 24 releases in 2001 and corresponding crude oil release volumes;

Dated 17 December 2003, 13 hydrocarbon liquid releases from crude oil pipelines in 2002 and corresponding crude oil release volumes;

Dated 17 December 2004, 13 hydrocarbon liquid releases from crude oil pipelines in 2003 and corresponding crude oil release volumes;

Dated 31 October 2005, 22 hydrocarbon liquid releases from crude oil pipelines in 2004 and corresponding crude oil release volumes; and

Dated 15 January 2007, 24 hydrocarbon liquid releases from crude oil pipelines in 2004 and corresponding crude oil release volumes.

### *Statistical Series 57 – Field Surveillance Provincial Summary:*

April 2001/March 2002, published in July 2002;



January–December 2002, published in May 2003;

January–December 2003, published in April 2004; and

January–December 2004, published in May 2005.

### *Statistical Series 99 – EUB Provincial Surveillance and Compliance Summary:*

January–December 2005, published in June 2006.

## A1.1.3 Canadian Association of Petroleum Producers (CAPP)

*Website: [www.capp.ca](http://www.capp.ca)*

The Canadian Association of Petroleum Producers (CAPP) represents more than 150 member companies and 130 associate members that explore for, develop and produce natural gas, NGLs, crude oil, oil sands, and elemental sulphur throughout Canada. CAPP member companies produce more than 95 percent of Canada's natural gas and crude oil. CAPP also has 125 associate members that provide a wide range of services that support the upstream crude oil and natural gas industry. Together, these members and associate members are an important part of a \$100-billion-a-year national industry that affects the livelihoods of more than half a million Canadians.

CAPP data are presented within this report for comparative purposes for the following performance indicators:

- 
- injury frequency;
  - liquid leaks; and
  - spills.

#### **Data Sources**

*2006 Stewardship Progress Report*, published by CAPP in January 2007.

#### **A1.1.4 Pipeline Contractor Association of Canada (PLCAC)**

*Website: [www.pipeline.ca](http://www.pipeline.ca)*

The Pipe Line Contractors Association of Canada (PLCAC) represents contractors in labour relations matters and establishes training courses for the development of Canadian workers in special pipeline construction skills.

PLCAC interests and activities extend to issues such as occupational health and safety, legislative review, pipeline standards and codes and a host of other activities.

PLCAC data are presented within this report for comparison with NEB injury frequency data.

#### **Data Sources**

*Mainline Contractor Injury Frequencies*, Safety Statistics Page from <http://www.pipeline.ca/>.

#### **A1.1.5 United States Department of Transport, Pipeline and Hazardous Material Safety Administration – Office of Pipeline Safety (OPS)**

*Website: <http://ops.dot.gov>*

The Office of Pipeline Safety (OPS) administers the Department of Transport's national regulatory program to assure the safe transportation of natural gas, petroleum, and other hazardous materials by pipeline. The OPS develops regulations and other approaches to risk management to assure safety in design, construction, testing, operation, maintenance, and emergency response of pipeline facilities.

OPS safety jurisdiction over pipelines covers more than 3,000 gathering, transmission, and distribution operators as well as some 52,000 master meter and liquefied natural gas operators who own and/or operate approximately 1.6 million miles of gas pipelines, in addition to over 200 operators and an estimated 155,000 miles of hazardous liquid pipelines.

For the purposes of this report, only information on gas transmission and hazardous liquid pipelines has been used. OPS data are presented within this report for comparative purposes for the following performance indicators:

- ruptures;
- liquid releases; and
- gas releases.

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## Data Sources

PHMSA website:

- Natural Gas Transmission Incident Data – mid-1984 to 2001 and 2002 to present; and
- Hazardous Liquid Accident Data – 2000 to 2005 Statistics.

### A1.1.6 United States Department of Labor – Bureau of Labor Statistics (BLS)

*Website: [www.bls.gov](http://www.bls.gov)*

The Bureau of Labor Statistics (BLS) is the principal fact-finding agency for the federal government of the United States in the broad field of labor economics and statistics. The BLS is an independent



national statistical agency that collects, processes, analyzes, and disseminates essential statistical data to the American public, the U.S. Congress, other Federal agencies, State and local governments, business, and labor. The BLS also serves as a statistical resource to the Department of Labor.

BLS data must satisfy a number of criteria, including relevance to current social and economic issues, timeliness in reflecting today's rapidly changing economic conditions, accuracy and consistently high statistical quality, and impartiality in both subject matter and presentation.

BLS began using the 2002 North American Industry Classification System (NAICS) to compile the *2003 Workplace Injuries and Illnesses* data. As a result, the classifications used in this report changed slightly after 2002 and better represent the work activities that occur in relation to pipelines. As such, caution should be taken when comparing to previous years.

BLS data are presented within this report for comparison with NEB injury frequency data.

## Data Sources

U.S. Department of Labor website:

- Table 1, Incidence rates of non-fatal occupational injuries and illnesses by industry and selected case types, 2000 through 2002 inclusive. Contractor is “Heavy construction, except highway”, and employee is “Gas production and distribution”;
- Table 1, Incidence rates of non-fatal occupational injuries and illnesses by industry and selected case types, 2003 and 2004. Contractor is “2371 Utility System Construction”; and employee is “486 Pipeline Transportation”; and
- Table 1, Incidence rates of nonfatal occupational injuries and illnesses by selected industries and case types, 2005. Contractor is “2371 Utility System Construction”; and employee is “486 Pipeline Transportation”.

Lost workday injuries where total lost workday cases involve days away from work, days of restricted work activity or both.

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### **A1.1.7 European Gas pipeline Incident data Group (EGIG)**

*Website: [www.egig.nl](http://www.egig.nl)*

In 1982, six European gas transmission system operators took the initiative to gather data on the unintentional releases of gas in their pipeline transmission systems. This co-operation was formalized by the setting up of EGIG (European Gas pipeline Incident data Group). Now EGIG is a co-operation between a group of nine major gas transmission system operators in Western Europe and is the owner of an extensive gas pipeline-incident database.

The creation of this extensive pipeline-incident database has helped pipeline operators to demonstrate the safety performances of Europe's gas pipelines. This information has helped the pipeline operators to improve safety in their gas pipeline transmission systems.

Considering the number of participants, the extent of the pipeline systems and the exposure period involved (from 1970 onwards for most of the companies), the EGIG database is a valuable and reliable source of information. The regional differences are not taken into account so that the result of the database presents an average of all participating companies.

EGIG data are presented within this report for comparative purposes for ruptures and gas releases.

#### **Data Sources**

3rd EGIG Report, *1970–1997 Gas Pipeline Incidents*, Document No. EGIG 98.R.0120 published in December 1998.

5th EGIG Report, *1970–2001 Gas Pipeline Incidents*, Document No. EGIG 02.R.0058, published in December 2002.

Data published at [www.egig.nl](http://www.egig.nl) (the EGIG website). Mileage interpolated from the incident frequency rate.

### **A1.1.8 European Oil Companies Association for Environment, Health and Safety (CONCAWE)**

*Website: [www.concawe.be](http://www.concawe.be)*

Most oil companies that refine crude oil in Western (OECD) Europe are members of CONCAWE. CONCAWE is founded as an international association with a scientific objective and without profit-making intent. The organization produces sound economic, technical and scientific information.

CONCAWE data are presented within this report for comparative purposes for the liquid releases performance indicator.

#### **Data Sources**

*Western European Cross Country Oil Pipelines 30 Year Performance Statistics*, Report No. 1/02, published in February 2002, page 48.

*Performance of European cross-country oil pipelines – statistical summary of reported spillages – 2001*, Report no. 1/03, published February 2003.

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*Performance of European cross-country oil pipelines – statistical summary of reported spillages – 2002*, Report no. 7/04.

*Performance of European cross-country oil pipelines – statistical summary of reported spillages – 2003*, Report no. 3/05, published May 2005.

*Performance of European cross-country oil pipelines – statistical summary of reported spillages – 2004*, Report no. 3/06, published June 2006.

### **A1.1.9 International Association of Oil and Gas Producers (OGP)**

*Website: [www.ogp.org.uk](http://www.ogp.org.uk)*

The International Association of Oil and Gas Producers (OGP) is a worldwide association of oil and gas companies involved in exploration and production. OGP members include private and state-owned oil and gas companies, national associations and petroleum institutes. OGP's purpose is to:

- provide information to interested bodies on the oil and gas exploration and production industry;
- represent member's interests at global and regional regulatory bodies; and
- develop operating guidelines.

OGP data are presented within this report for comparative purposes for the injury frequency performance indicator.

#### **Data Sources**

*Safety Performance of the Global E & P Industry, 2000* by the International Association of Oil and Gas Producers, Report No. 6.93/319, published June 2001.

*Safety Performance of the Global E & P Industry, 2001* by the International Association of Oil and Gas Producers, Report No. 6.59/330, published July 2002.

*Safety Performance of the Global E & P Industry, 2002* by the International association of Oil and Gas Producers, Report No. 345, published June 2003.

*Safety Performance Indicators, 2003*, Report No. 353, published in June 2004.

*Safety Performance Indicators, 2004*, Report No. 367, published in May 2005.

*Safety Performance Indicators, 2005*, Report No. 379, published in May 2006.

## A2.1 Reporting Criteria and Injury Definitions

**T A B L E A 2 . 1**

### **Comparison of Reporting Criteria for Ruptures**

<b>Source</b>	<b>Reporting Requirements</b>
NEB	Rupture "Loss of containment event that immediately impairs the operation of the pipeline." (per CSA Z662-3, Annex H)
EUB	When a leak or break occurs in a pipeline, the licensee shall immediately cause the Board to be informed of the location of the leak or break. "Break" means a rupture in any part of a pipeline and "leak" means the escape of substance from a pipeline.
OPS	Incident: Gas releases that were associated with a death or personal injury requiring hospitalization, or a total cost of US\$50,000 or more. Loss of 8 or more cubic metres of hazardous liquids or where property damage costs exceed US\$50,000. After 7 February 2003, a release of 5 gallons (19 litres) or more.
EGIG	Incidents include any unintentional release of gas that occurs on an onshore pipeline operating at greater than 1500 kPa outside of the fenced boundaries of installations and excluding all components except the pipe.

Table A2.2 provides a summary of the "injury" definitions used by reference organizations.

**T A B L E A 2 . 2**

**Injury Definitions of Comparative Data Sources**

Organization	Definitions	Comment
NEB	<p>Under the SPI Initiative:</p> <p>"Any occupational injury that prevents an employee from reporting for work or from effectively performing all the duties connected with the employee's regular work on any day subsequent to the day on which the injury occurred, whether or not that subsequent day is a working day for the employee." (<i>Canada Occupational Health and Safety Regulations Part XV, section 15.1 (a)</i>)</p> <p>Under the OPR-99:</p> <p>"serious injury" includes an injury that results in: the fracture of a major bone; the amputation of a body part; the loss of sight in one or both eyes; internal hemorrhage; third degree burns; unconsciousness; or the loss of a body part or function of a body part.</p>	<p>Guidance provided to companies by the NEB: "medical aid where the employee can not return to work the following day regardless of the day of the week or injury".</p>
COGOA	<p>Data represents "lost time injuries" that prevent an employee from reporting for work or from effectively performing all the duties connected with the employee's regular work on any day subsequent to the day on which the injury occurred, whether or not that subsequent day is a working day for the employee.</p>	<p>The definition is identical to the definition used by the NEB for the SPI Initiative.</p>
HRSDC	<p>Disabling Injury:</p> <p>"Any occupational injury that:</p> <ul style="list-style-type: none"> <li>a) prevents an employee from reporting for work or from effectively performing all the duties connected with the employee's work on any day subsequent to the day on which the occupational injury occurred, whether or not that subsequent day is a working day for that employee;</li> <li>b) results in the loss by an employee of a body member or a part thereof or in a complete loss of the usefulness of a body member or part thereof; or</li> <li>c) results in the permanent impairment of a body function of an employee." <p>Disabling injury incidence:</p> <p>Disabling plus fatal injuries.</p> </li></ul>	<p>The definition is similar to the combined definition under the OPR-99 and SPI Initiative.</p>

**TABLE A 2.2 (CONTINUED)**

**Injury Definitions of Comparative Data Sources**

<p>CAPP</p>	<p>Any cut, fracture, sprain, amputation, loss of consciousness, etc., that results from an exposure involving a single event in the work environment.</p> <p>Lost Time Injuries – include fatalities, permanent total disabilities and lost workday cases resulting from work-related injuries.</p> <p>Recordable Injuries – include fatalities plus permanent total disability plus lost workday cases plus restricted work cases plus medical treatment cases.</p> <p>Lost Workday Cases (LWC) – lost workday cases are work-related injuries that render the injured person temporarily unable to perform any regular job or restricted work activity on any normally scheduled workday after the day on which the injury occurred.</p> <p>Restricted Work Cases (RWC) – a work-related injury or illness that results in an individual being unable to perform all normally assigned work functions during any scheduled work shift, or being assigned to another job on a temporary or permanent basis after the day of the injury or illness.</p>	<p>CAPP members are primarily upstream oil and gas companies and data may not be directly comparable to pipeline transmission companies.</p>
<p>PLCAC</p>	<p>Any work-related personal injury or illness that results in time lost from work. Time lost begins on the day subsequent to the day the accident occurs.</p>	<p>PLCAC data do not include non-union pipeline contractor data. Mainline construction data should be roughly comparable to contractor data under the SPI Initiative.</p>
<p>BLS</p>	<p>Data presented is taken from industry classification for “Heavy construction, except highway – 162” and from “Gas production and distribution – 492” for injuries resulting in “days away from work, days of restricted work activity, or both for the years 2000 to 2002”</p> <p>Industry classifications changed in 2003. Data presented for 2003 to 2005 is taken from industry classification for “Utility System Construction – 2371” and from “Pipeline Transportation – 486” for injuries resulting in “days away from work, days of restricted work activity, or both”</p>	<p>Heavy construction and Utility System construction data should be roughly comparable to NEB contractor data.</p> <p>Gas production and distribution data and pipeline transportation data should be comparable to NEB company data.</p>
<p>OGP</p>	<p>Injury is referred to as a Lost Workday Case (LWDC) and Restricted Workday Case (RWDC). Any work-related injury other than a fatal injury that results in a person being unfit for work or severe enough to prevent a person from performing normal duties on any day after the day of occurrence of the occupational injury. “Any day” includes rest days, weekend days, leave days, public holidays or days after ceasing employment.</p>	



**T A B L E A 2 . 3**

**Comparison of Liquid Release Reporting Criteria**

<b>Source</b>	<b>Reporting Requirements</b>
NEB	Any unintended or uncontained release of liquid hydrocarbons associated with pipe body failure and a release volume in excess of 1.5 cubic metres.
EUB	When a leak or break occurs in a pipeline, the licensee shall immediately cause the Board to be informed of the location of the leak or break.  "Leak" means the escape of substance from a pipeline.  "Break" means a rupture in any part of a pipeline.
CAPP	A pipeline rupture is defined as an "any tearing or fracturing of pipeline material, immediately impairing the operation of the pipeline" [CAPP 2007].  A pipeline leak is defined as "any opening crack or hole in the pipeline causing some product loss, but not immediately impairing the line's operation" [CAPP 2007].
OPS	Loss of 8 or more cubic metres or where property damage costs exceeds US\$50,000.  After 7 February, 2003: a release of 5 gallons (19 litres) or more.
CONCAWE	The minimum spill size has been set at 1 m <sup>3</sup> for reporting purposes unless there are exceptional serious safety/environmental consequences as a result of a <1 m <sup>3</sup> spill.

**T A B L E A 2 . 4**

**Comparison of Gas Release Reporting Criteria**

<b>Source</b>	<b>Reporting Requirements</b>
NEB	Any unintended or uncontrolled release of natural gas.
OPS	Gas releases associated with a death or personal injury requiring hospitalization or a total cost of US\$50,000 or more.
EGIG	Any unintentional release of gas that occurs on an onshore pipeline operating at greater than 1 500 kPa outside of the fenced boundaries of installations and excluding all components except the pipe.

### A3.1 Raw Data

Data for the period 1 January 2005 to 31 December 2005 was submitted voluntarily to the Board from companies owning or operating approximately 95 percent of the total length of pipelines regulated by the NEB under the *National Energy Board Act*. The data were provided as part of the NEB's SPI Initiative by the companies listed below for 2005. In future versions of this report, the NEB intends to publish a list of reporting and non-reporting NEB-regulated companies. The listed companies typically report on all NEB-regulated pipelines systems that they own.

Reporting Companies for 2005:

Alliance Pipeline Ltd.	Kinder Morgan Canada Inc.
AltaGas Pipeline Partnership	Manitoba Hydro
Berens Energy Ltd.	Many Islands Pipe Lines (Canada) Limited
BP Canada Energy Company	Montreal Pipe Line Limited
Canadian Natural Resources Limited	Nexen Inc.
Duke Energy Gas Transmission	Omimex Canada Ltd.
Enbridge Inc.	Pengrowth Corporation
EnCana Corporation	Pioneer Natural Resources Canada Inc.
ExxonMobil Canada Ltd.	St. Clair Pipelines L.P.
Harvest Operations Corp.	Trans-Northern Pipelines Inc.
Husky Oil Limited	TransCanada PipeLines Limited
ISH Energy Ltd.	Union Gas Limited

The length of pipelines reported upon is provided in Table A3.1.

**T A B L E A 3 . 1**

#### **NEB-Regulated Pipeline Statistics**

<b>Year</b>	<b>Number of Kilometres Reported Upon</b>	<b>Total Kilometres</b>
2000	39 190	42 919
2001	42 670	42 968
2002	41 555	43 124
2003	42 189	43 252
2004	41 386	43 371
2005	41 270	43 440

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The raw data used to calculate the injury frequencies of NEB-regulated pipelines are presented in Table A3.2.

**T A B L E A 3 . 2**

***NEB-Regulated Pipeline Injury Data***

<b>Year</b>	<b>Contractor Hours</b>	<b>Employee Hours</b>	<b>Contractor Injuries</b>	<b>Employee Injuries</b>
2000	6,255,390	7,034,954	55	6
2001	1,606,271	4,827,678	40	18
2002	788,466	5,103,983	13	4
2003	788,466	4,869,253	12	16
2004	1,573,743	4,722,044	9	12
2005	1,218,350	4,925,620	7	15

Table A3.3 provides comparative pipeline length data for the reference organizations cited within this report.

**TABLE A3.3**

**Reference Organization Statistics**

<b>Year</b>	<b>Organization</b>	<b>Kilometres of Gas Pipeline</b>	<b>Kilometres of Hydrocarbon Liquids Pipeline</b>	<b>Total Reported Kilometres</b>
2000	NEB	25,970	13,220	39,190
2000	EUB	229,034	16,410	245,444
2000	CAPP	n/a	n/a	175,646
2000	OPS	524,000	249,020	773,020
2000	EGIG	110,236	n/a	110,236
2000	CONCAWE	n/a	30,800	30,800
2001	NEB	26,510	16,170	42,680
2001	EUB	245,466	16,818	262,284
2001	CAPP	n/a	n/a	182,818
2001	OPS	479,800	255,060	734,860
2001	EGIG	110,236	n/a	110,236
2001	CONCAWE	n/a	35,575	35,575
2002	NEB	26,752	14,803	41,555
2002	EUB	255,032	17,118	272,150
2002	CAPP	n/a	n/a	225,482
2002	OPS	526,007	258,409	784,899
2002	EGIG	109,524	n/a	n/a
2002	CONCAWE	n/a	35,592	35,592
2003	NEB	26,943	15,245	42,189
2003	EUB	268,549	17,391	285,940
2003	CAPP	n/a	n/a	266,356
2003	OPS	522,020	258,892	780,912
2003	EGIG	114,285	n/a	n/a
2003	CONCAWE	n/a	36,422	36,422
2004	NEB	27,146	14,812	41,958
2004	EUB	288,388	17,793	306,181
2004	CAPP	n/a	n/a	272,221
2004	OPS	518,283	270,262	788,545
2004	EGIG	122,168	n/a	122,168
2004	CONCAWE	n/a	35,383	35,383
2005	NEB	27,002	14,269	41,270
2005	EUB	305,274	18,019	323,534
2005	CAPP	n/a	n/a	309,391
2005	OPS	522,960	266,493	789,452
2005	EGIG	n/a	n/a	n/a
2005	CONCAWE	n/a	n/a	n/a

n/a: not available

Comparative data are listed by source organization in Table A3.4.

**T A B L E A 3 . 4**

**Injury Frequency Data  
(Number of Injuries per 200,000 Hours Worked)**

<b>Year</b>	<b>Source *</b>	<b>Contractor Injury Frequency</b>	<b>Employee Injury Frequency</b>	<b>Overall</b>
2000	NEB	1.69	0.23	0.92
2000	COGOA	n/a	n/a	1.06
2000	HRSDC	n/a	0.51	n/a
2000	CAPP	3.13	1.05	2.49
2000	PLCAC	2.88	n/a	n/a
2000	BLS	3.60	3.00	n/a
2000	OGP	0.40	0.29	0.36
2001	NEB	5.35	0.87	1.99
2001	COGOA	n/a	n/a	0.52
2001	HRSDC	n/a	0.56	n/a
2001	CAPP	2.61	0.89	2.06
2001	PLCAC	1.25	n/a	n/a
2001	BLS	3.90	2.50	n/a
2001	OGP	0.33	0.26	0.31
2002	NEB	1.92	0.16	0.53
2002	COGOA	n/a	n/a	0.56
2002	HRSDC	n/a	0.30	n/a
2002	CAPP	1.86	1.02	1.64
2002	PLCAC	1.72	n/a	n/a
2002	BLS	3.50	3.00	n/a
2002	OGP	0.22	0.18	0.21
2003	NEB	3.04	0.66	0.99
2003	COGOA	n/a	n/a	0.40
2003	HRSDC	n/a	n/a	n/a
2003	CAPP	2.15	1.34	1.83
2003	PLCAC	0.00	n/a	n/a
2003	BLS	6.90	2.10	n/a
2003	OGP	0.25	0.15	0.22
2004	NEB	1.40	0.51	0.73
2004	COGOA	n/a	n/a	0.46
2004	HRSDC	n/a	n/a	n/a
2004	CAPP	1.91	1.00	1.65
2004	PLCAC	0.00	n/a	n/a
2004	BLS	6.00	2.50	n/a
2004	OGP	0.22	0.17	0.22
2005	NEB	1.15	0.61	0.72
2005	COGOA	n/a	n/a	0.54
2005	HRSDC	n/a	n/a	n/a
2005	CAPP	1.74	0.93	1.53
2005	PLCAC	0.00	n/a	n/a
2005	BLS	3.20	0.90	n/a
2005	OGP	0.20	0.15	0.18

\* CAPP data is for Total Recordable Injury Frequency and includes fatalities and medical treatment cases, which are not included in the NEB data.

n/a: not available



## **GOALS 1 AND 2**

**NEB-regulated facilities and activities are safe and secure, and are perceived to be so.**

**NEB-regulated facilities are built and operated in a manner that protects the environment and respects the rights of those affected.**