Pipeline Performance Summary

BC Oil & Gas COMMISSION

2016 Annual Report

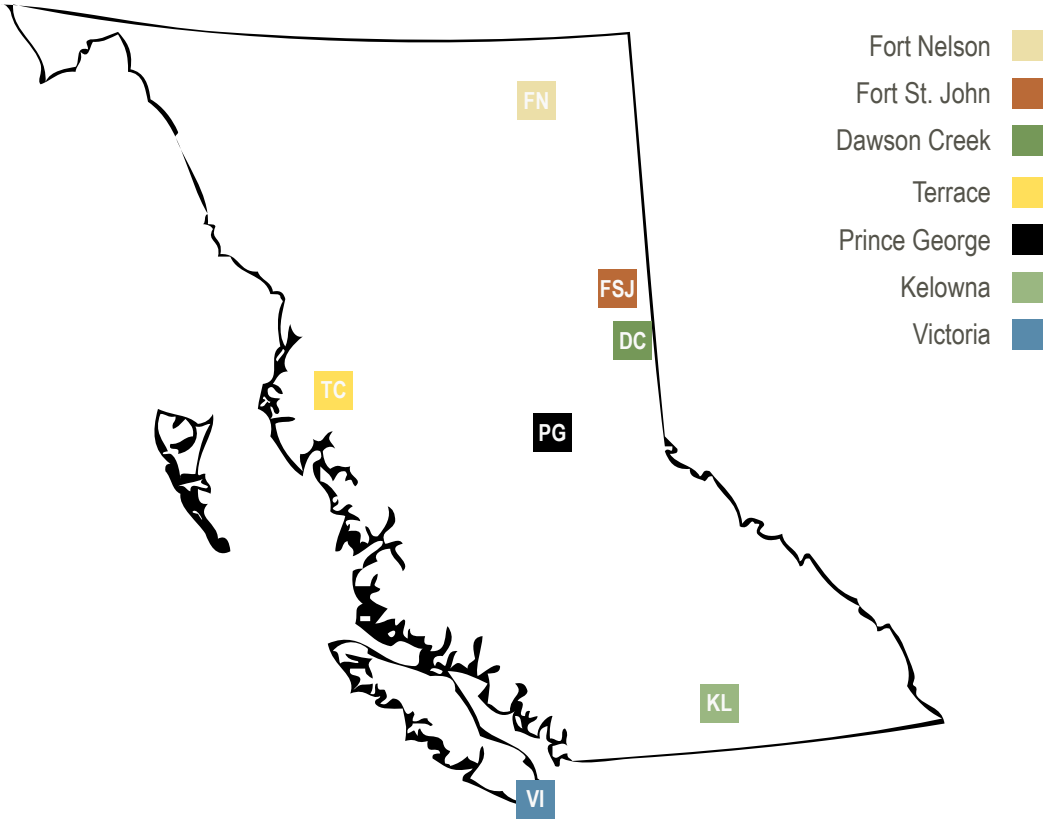
Role of the

BC OIL AND GAS COMMISSION

The BC Oil and Gas Commission (Commission) is the provincial regulatory agency with responsibilities for regulating oil and gas activities in British Columbia, including exploration, development, pipeline transportation and reclamation.

The Commission's core services include reviewing and assessing applications for industry activity, consulting with First Nations, cooperating with partner agencies, and ensuring industry complies with provincial legislation and all regulatory requirements. The public interest is protected by ensuring public safety, respecting those affected by oil and gas activities, conserving the environment, and ensuring equitable participation in production.

For general information about the Commission, please visit www.bcogc.ca or phone 250-794-5200.



The Commission's workforce consists of 250 employees operating out of seven locations - Fort Nelson, Fort St. John, Dawson Creek, Terrace, Prince George, Kelowna and Victoria, with the largest number of employees concentrated in Fort St. John, the heart of oil and gas activity in the province. The offices in Fort Nelson and Dawson Creek ensure the Commission's presence in the communities of the Horn River Basin and Montney gas plays respectively.

OUR VISION

To provide oil and gas regulatory excellence for British Columbia's changing energy future.

OUR MISSION

We regulate oil and gas activities for the benefit of British Columbians.

We achieve this by:

- Protecting public safety,
- Respecting those affected by oil and gas activities,
- Conserving the environment, and
- Supporting resource development.

Through the active engagement of our stakeholders and partners, we provide fair and timely decisions within our regulatory framework.

We support opportunities for employee growth, recognize individual and group contributions, demonstrate accountability at all levels, and instill pride and confidence in our organization.

We serve with a passion for excellence.

OUR VALUES

Respectful	Accountable
Effective	Efficient
Responsive	Transparent

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INTRODUCTION

PURPOSE OF REPORT

British Columbia's oil and gas industry depends on pipelines for the distribution of products such as natural gas, water and oil. Pipelines are recognized as a safe and economical mode of transportation, and secure operation is essential to protecting public safety and the environment.

This report provides a statistical overview of pipelines regulated by the Commission in the 2016 calendar year. It includes data on types of pipelines, lengths, uses and overall pipeline incident rates. The multi-stage lifecycle of a pipeline is explained, and incident response protocols are outlined. It also summarizes the Integrity Management Program, a documented framework outlining the practices by which operators test and maintain pipelines to mitigate potential integrity issues.

Previous annual pipeline performance summaries can be found on the Commission's website at https://www.bcogc.ca/publications/Reports.

PIPELINE REGULATION

The Commission's jurisdiction extends to the majority of pipelines in British Columbia, as defined in legislation by the Oil and Gas Activities Act (OGAA). Activities regulated by the Commission extend throughout the lifecycle of a pipeline, and include pre-activity consultation and notification, permitting, construction, operation, maintenance and abandonment. Pipelines not under the Commission's jurisdiction include those crossing provincial and/or national borders and gas utility pipelines, are not addressed in this report.

Pipelines are regulated under the Pipeline Regulation, which states they must be operated and maintained in accordance with CSA Z662 – Oil and Gas Pipeline Systems. CSA Z662 is a national standard developed and maintained by the Canadian Standards Association (CSA) and covers the design, construction, operation and maintenance of oil and gas industry pipeline systems.

It is required that operators comply with other applicable regulations including the Environmental Protection and Management Regulation, Consultation and Notification Regulation, Pipeline Crossings Regulation, and Emergency Management Regulation.

The Commission is additionally responsible for provincial authorizations involving the Land Act, Water Sustainability Act, and the Forest Act for pipeline right-of-ways, roads, land clearing and other minor works.

The Legislation page of the Commission website provides the full list of acts and regulations governing oil and gas activities in the province.

PIPELINE INVENTORY

44,552 KILOMETRES

The Commission's annual Oil and Gas Reserves and Production reports have shown an upward trend in production year-over-year, with gas production almost doubling since 2010. This upturn contributes to increased pipeline capacity requirements and a gradual rise in the total number of pipelines.

The Commission currently regulates 44,552 kilometres (km) of pipelines in British Columbia. Pipelines transport a number of refined and unrefined products including natural gas, sour natural gas, liquid hydrocarbons (such as crude oil and high vapour pressure hydrocarbons), water and other miscellaneous gases. Eighty per cent of the pipelines regulated by the Commission transport natural gas, while approximately 10 per cent carry liquid hydrocarbons. The remainder carry water or other gases or liquids. Pipeline definitions and product classifications are available on page 14.

As shown in Table 1, the total length of pipelines in the province in 2016 was 44,552 km. This is a net addition of 968 km of total registered pipelines (starting operation or reactivated) over the previous year. Deactivated pipelines increased by 690 km while abandoned pipelines increased by 230 km. Operating pipelines in 2016 only slightly increased by 48 km.

TABLE 1: TOTAL LENGTHS OF PIPELINES BY TYPE AND STATUS (IN KILOMETRES)

TYPE	TOTAL	OPERATING	DEACTIVATED	ABANDONED
Natural Gas	21,773	19,843	1,162	768
Sour Natural Gas	14,062	12,103	1,595	364
Water	3,557	3,177	198	182
Liquid Hydrocarbons	4,816	3,953	577	286
***Other**	344	287	47	10
2016 GRAND TOTAL	**44,552**	**39,363**	**3,579**	**1,610**
Natural Gas	21,117	19,503	959	655
Sour Natural Gas	13,997	12,440	1,240	317
Water	3,450	3,146	138	166
Liquid Hydrocarbons	2,876	2,404	320	150
Other	2,143	1,821	231	92
2015 GRAND TOTAL	**43,584**	**39,315**	**2,889**	**1,380**
Natural Gas	20,865	19,564	703	598
Sour Natural Gas	13,739	12,715	763	261
Water	3,205	3,000	61	144
****Crude Oil**	2,336	2,073	168	95
****HVP**	358	302	10	46
Other	2,178	1,927	71	180
2014 GRAND TOTAL	**42,681**	**39,581**	**1,776**	**1,324**

*'Other' category shows lower 2016 totals due to reclassification of some product types into 'Liquid Hydrocarbons' category.

**Crude Oil and high vapour pressure (HVP) categories combined into Liquid Hydrocarbon category post 2014.

PIPELINE LIFECYCLE

MULTI-STAGE PLANNING

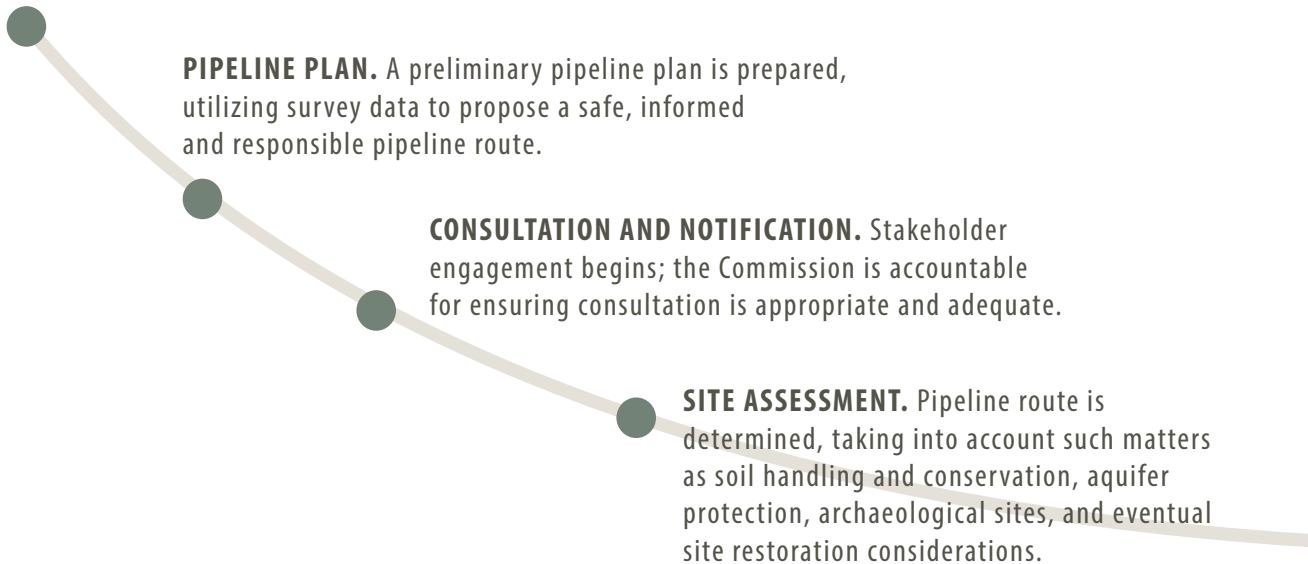
From the creation of a preliminary pipeline plan, through construction and inspections, to deactivation and abandonment, the lifecycle provided here depicts the multiple stages of a typical pipeline from initial land surveys to final site restoration.

At the outset, Commission decision makers conduct a comprehensive review of each pipeline application for engineering standards, legal requirements, and for environmental and public safety considerations. The Commission ensures proponents have conducted consultations with land owners and other rights holders on pipeline projects that will directly affect them, including the legal obligation to consult and accommodate First Nations.

If a pipeline application is approved, Commission specialists may set permit conditions as necessary to protect key environmental assets, such as water, wildlife and forest values. A significant component of the Commission's framework for managing the impacts of oil and gas development on the environment is Area-based Analysis, described on the Commission website.

The Commission then monitors the project throughout its lifecycle, confirming thorough inspections are performed, and equipment and operations are regularly tested. Should any deficiencies be identified at a site, the Commission may order the operator to cease activities as necessary until appropriate actions are performed to safely resume operations.

As detailed in the Commission's mandate, and considering the many stages of a pipeline's lifecycle, the protection of public safety is top priority. Permit holders are required to report to the Commission before, during and upon completion of their oil and gas activities. The framework under which pipelines are operated includes such initiatives as the pipeline Integrity Management Program (IMP), designed to help prevent spills before they happen. IMPs are described on page 8.

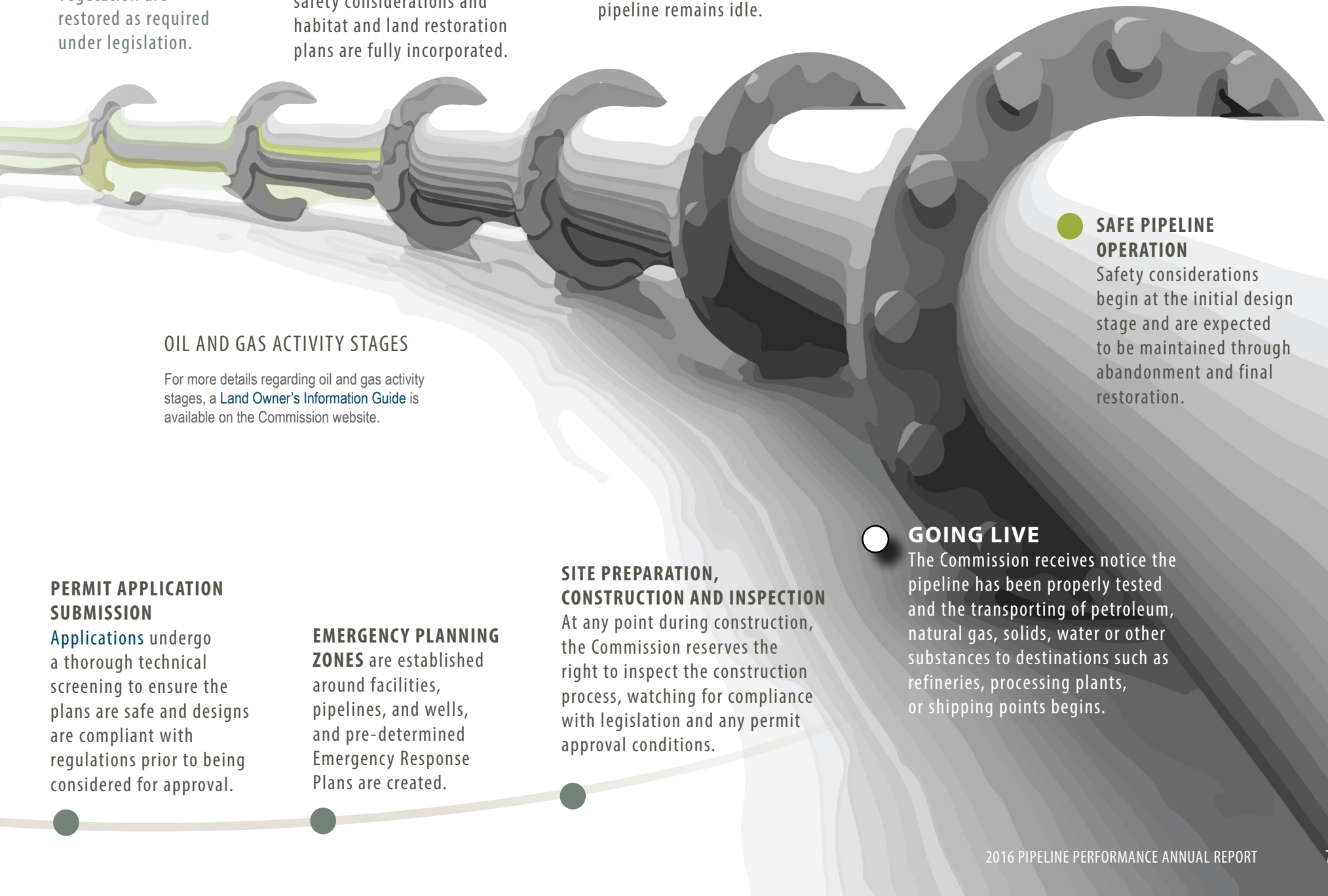


REMEDIATION
Soil stability, productivity and vegetation are restored as required under legislation.

DECOMMISSIONING
The Commission reviews abandonment (removal from service) requests to ensure safety considerations and habitat and land restoration plans are fully incorporated.

DEACTIVATION
The Commission evaluates deactivation requests for appropriate maintenance and monitoring measures, to prevent or minimize adverse effects while the pipeline remains idle.

INTEGRITY MANAGEMENT PROGRAM REVIEW
During the operating life of the pipeline, the Commission will review a company's IMP and any incidents and repairs that occur.



SAFE PIPELINE OPERATION
Safety considerations begin at the initial design stage and are expected to be maintained through abandonment and final restoration.

OIL AND GAS ACTIVITY STAGES

For more details regarding oil and gas activity stages, a Land Owner's Information Guide is available on the Commission website.

GOING LIVE
The Commission receives notice the pipeline has been properly tested and the transporting of petroleum, natural gas, solids, water or other substances to destinations such as refineries, processing plants, or shipping points begins.

SITE PREPARATION, CONSTRUCTION AND INSPECTION
At any point during construction, the Commission reserves the right to inspect the construction process, watching for compliance with legislation and any permit approval conditions.

EMERGENCY PLANNING ZONES are established around facilities, pipelines, and wells, and pre-determined Emergency Response Plans are created.

PERMIT APPLICATION SUBMISSION
Applications undergo a thorough technical screening to ensure the plans are safe and designs are compliant with regulations prior to being considered for approval.

INTEGRITY MANAGEMENT PROGRAM

COMPLIANCE ASSURANCE

To prevent and reduce pipeline incidents, the Pipeline Regulation requires all pipeline operators in the province implement an Integrity Management Program (IMP). Pipeline IMPs are documented programs specifying the processes and practices used by pipeline operators to ensure public safety, environmental protection, and operational reliability. The IMP programs incorporate a management system approach.

As per the B.C. Pipeline Regulation (PR), Section 7, every pipeline permit holder planning, designing, constructing, operating, maintaining or abandoning pipeline infrastructure within the province must have developed and implemented IMPs. Compliance protocols are available to operators, outlining Commission expectations and operating requirements, and guiding them in developing, implementing and maintaining effective IMPs.

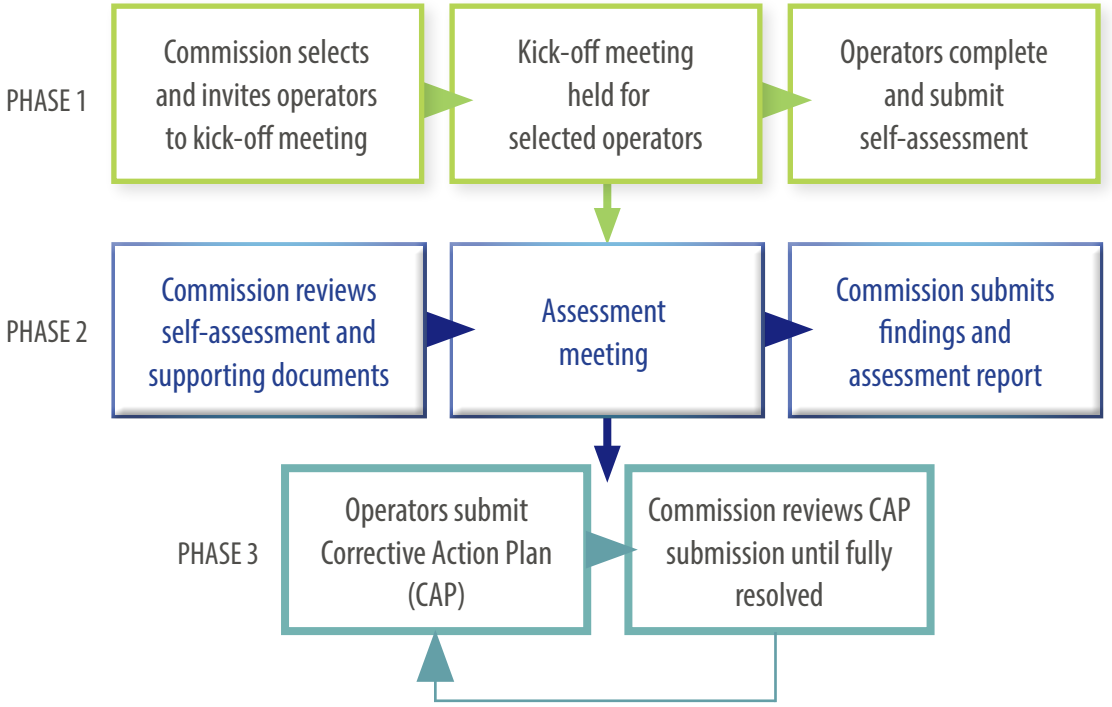
The Commission has been assessing the effectiveness of permit holders' IMP programs since 2011. The pipeline IMP compliance assurance process consists of three phases (Figure 1). The first phase is a self-assessment, completed by the operator and submitted to the Commission. The second phase consists of an assessment meeting, where findings from the pipeline IMP assessment are reviewed face-to-face with the permit holder, with subsequent meetings arranged as necessary. The third phase allows for corrective action plans and follow ups. Details of the compliance assurance process and the scope of the protocol can be viewed on the Commission website.

During 2016, the Commission assessed the IMP programs of 19 pipeline operators. Where non-compliances were identified, operators were required to develop and implement corrective actions to rectify the deficiencies.

The Commission monitors and assesses all corrective actions to ensure all non-compliance is fully resolved.

The Commission will continue to undertake IMP compliance assessments for all B.C. pipeline operators, engaging with companies to improve the design, construction, operation and maintenance of pipelines, including older, legacy pipes.

FIGURE 1:
COMPLIANCE ASSURANCE PROCESS - PIPELINE INTEGRITY MANAGEMENT PROGRAM



PIPELINE INCIDENTS

AND EMERGENCY RESPONSE PROGRAMS

To coordinate and prepare for incidents in advance, permit holders must develop and maintain emergency response programs and response contingency plans (ERPs), as directed in the Emergency Management Regulation (EMR).

Emergency response programs guide the creation, management and implementation of a permit holder's ERPs, allowing for quick access to critical information, coordination of multiple-responder activities, and identification of predetermined equipment and services available for deployment in an emergency. They equip incident responders with hands-on training and emergency response exercises, ensuring personnel understand their incident command structure, communication methods, and responsibilities in an emergency event.

The Commission's Security and Emergency Management Branch regularly audits ERPs to ensure consistent compliance with the EMR, and oversees and may participate in permit holder emergency response exercises. Should a permit holder's emergency protocols fail to meet requirements, the Commission may utilize compliance and enforcement actions, which may include issuing orders, penalties, or shutting-in a pipeline system.

The requirements in the EMR are designed to create a framework for the protection of the public, emergency responders, property and the environment from incidents occurring due to oil and gas activities. Although emergency preparation, equipment and protocols help reduce the rate of incidents, the Commission strives to continually improve emergency management measures.

2016 INCIDENTS

In 2016 there were 26 incidents on pipelines regulated by the Commission[1], however not all led to the release of a product. Table 2 shows an overall incident frequency of 0.58 for every 1,000 km of pipelines, a significant decrease from 1.03 in 2015.

As stated, not all incidents result in a spill or release of a product. In 2010 the implementation of OGAA led to broader reporting criteria, meaning all incidents – including those that have the potential to affect the integrity of a pipeline but did not cause spillage – must be reported.

Additional information regarding emergency response and management, including guidelines and forms, is available on the Commission's Emergency Response and Safety webpage.

> The Emergency Management Regulation outlines several requirements for creating an emergency response plan framework, establishing a comprehensive approach that addresses prevention, mitigation, preparedness, response, and recovery components.

TABLE 2: TOTAL NUMBER OF INCIDENTS PER 1,000 KM OF PIPELINE INVENTORY

	2012	2013	2014	2015	2016
LENGTH OF PIPELINES (KM)	40,125	40,392	42,681	43,584	44,552
NUMBER OF INCIDENTS	27	38	42	45	26
INCIDENT FREQUENCY (PER/1,000 KM)	0.67	0.94	0.98	1.03	0.58

[1] These incidents apply only to events on operating pipelines. Incidents that occur prior to a line going active (such as during construction or pressure testing) and some near misses have not been included. There were 25 incidents related to construction in 2016.

INCIDENT RESPONSE

AND ENFORCEMENT ACTIONS

An incident is defined as a present or imminent event or circumstance, resulting from an oil and gas activity that is outside the scope of normal operations, and may or may not be an emergency. Operators must communicate all reportable incidents to the Commission. Non-minor incidents must be reported immediately (within 1 hour), and minor incidents must be reported within 24 hours. The Commission's Incident Classification Matrix outlines spill reporting criteria, and how incident levels are assessed, determined and reported.

Any person aware spillage is occurring, or believes there is the potential for spillage, can provide assistance by calling the operating company indicated on the signage and identifying the location of the pipeline, or by calling the Commission's 24/7 emergency number at 1-800-663-3456.

The Commission responds to all incidents, establishing communication with the operator, confirming the incident level, and assessing the operator's response. Commission staff further determine what remedial actions must be taken, whether a pipeline can continue to operate safely, and whether compliance or enforcement actions are required.

Subsequent incident investigations allow the Commission to confirm the cause and any contributing factors, and whether repairs or solutions should be broadly communicated to all other operators to prevent similar incidents from occuring. Inspections may also be triggered by public enquiries and incidents reported to the Commission.

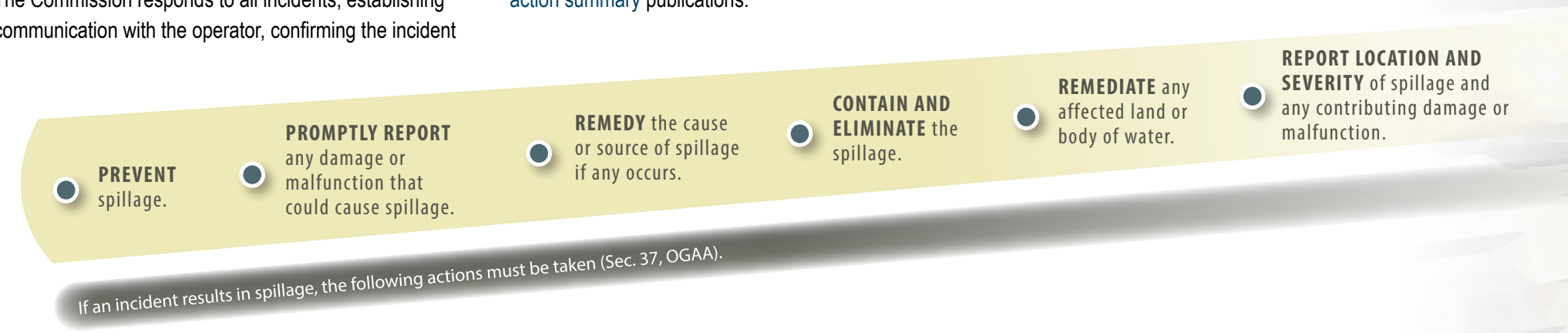
When required, Orders, tickets and/or penalties are issued to the operator. The Commission is committed to publishing its enforcement actions on its website in a timely and transparent manner by way of its Compliance and Enforcement page, and through quarterly enforcement action summary publications.

ORDERS - issued if an operator fails to comply with OGAA, associated regulations, permits or authorizations, a previous Order, or to deal with issues of public safety or protection of the environment.

TICKETS - issued under the authority of provincial acts, including the Water Sustainability Act.

ADMINISTRATIVE PENALTIES - levied in the event of a contravention of OGAA.

CHARGES - recommended to Crown counsel for prosecution and possible court conviction.

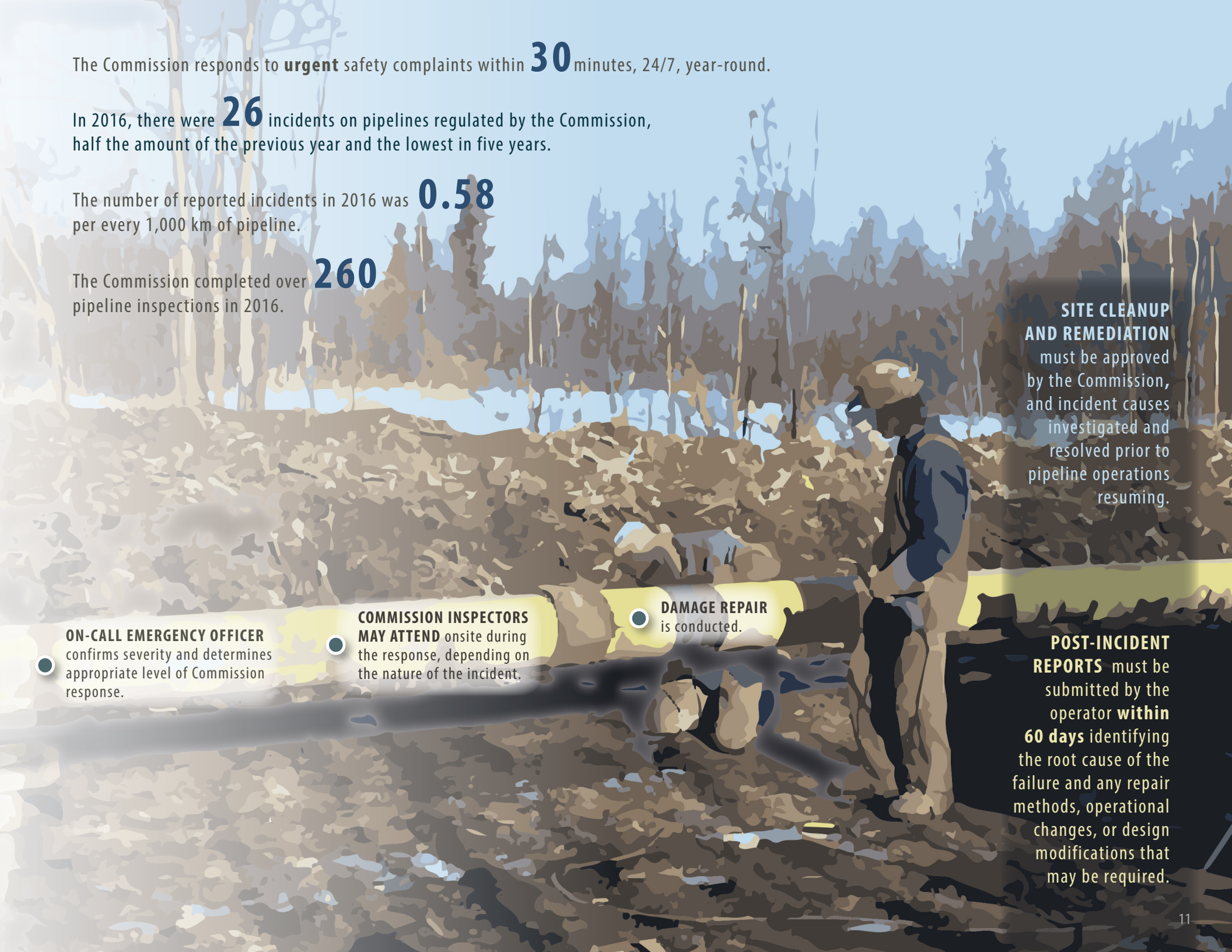


The Commission responds to **urgent** safety complaints within **30** minutes, 24/7, year-round.

In 2016, there were **26** incidents on pipelines regulated by the Commission, half the amount of the previous year and the lowest in five years.

The number of reported incidents in 2016 was **0.58** per every 1,000 km of pipeline.

The Commission completed over **260** pipeline inspections in 2016.



RELEASES AND SPILLS

2016 STATISTICS

In terms of incidents that involved a release or spill, Table 3 shows sour natural gas pipelines had the lowest incident rate with a frequency of 0.21 per 1,000 kilometres. Pipelines conveying product labeled as 'Other' transport miscellaneous liquids or gases, and had one incident. This category can also include service liquids and gases such as water/methanol mix and inert nitrogen gas.

In the event of a pipeline gas release or liquid spill, the Commission ensures complete clean up and remediation by the company, and that all problems are fixed before operations resume.

The largest gas release from a pipeline in 2016 was a 17,800 m^3 release of dry, sweet gas in the city of Surrey. The cause of the incident was a landowner excavation that damaged a farm tap and caused the gas release. Controlled excavation and exposure of the primary service tee allowed for isolation of the flow of gas, and the damaged section was replaced with new pipe.

The largest liquid spill from a pipeline in 2016 was 250 m^3 of produced water in the Clarke Lake region south of Fort Nelson. The operator activated its emergency response plan and shut-in the pipeline. A full incident assessment was conducted. The cause of failure was found to be external corrosion. The spill was cleaned up and the ruptured pipe was replaced with new pipe. An internal, instrumented pipe inspection was performed on the entire pipeline.

INCIDENT CAUSES

Table 4 shows metal loss was the leading cause of pipeline incidents in 2016, contributing to 12 incidents. External interference was the second leading cause of failures contributing to seven incidents. The interactive web-based BCOGC Incident Map provides the location of pipeline incidents dating back to 2009. It includes data on pipeline spills, releases, and damage to active and discontinued pipelines, including the status of incidents.

MOVING FORWARD

With 2016 being a low year for activity levels, and industry activity expected to return to higher historical averages, the Commission's number one goal is the continued refinement of safety standards through enhanced preparedness, prevention, response, and partnerships.

As tools are developed and operationalized to elevate pipeline performance, spill preparedness and emergency response capabilities, lessons learned will continue to be shared across the Commission and with stakeholders and experts throughout industry to successfully meet the demands of a strong safety culture.

TYPE OF PIPELINE	# OF INCIDENTS WITH RELEASE	LENGTH OF PIPELINE (KM)	FREQUENCY (PER 1,000 KM)
SOUR NATURAL GAS	3	14,062	0.21
NATURAL GAS	7	21,773	0.32
LIQUID HYDROCARBONS	6	4,816	1.25
WATER	6	3,557	1.69
OTHER	1	344	2.91

TABLE 3: TOTAL NUMBER OF INCIDENTS WITH RELEASE PER 1,000 KM BY TYPE OF PIPELINE IN 2016

TABLE 4: CLASSIFICATION OF PIPELINE FAILURES

INCIDENT CAUSE	DEFINITION	2016	2015	2014	2013	2012	2011
METAL LOSS	Wall thickness reduction due, for example but not exclusively, to corrosion						
CORROSION METAL LOSS		**12**	**25**	**21**	**22**	**12**	**17**
PIPELINE/EQUIPMENT FAILURE							
CRACKING IN PIPE	Mechanically driven or environmentally assisted cracking of the pipe	1	0	3	0	1	0
PIPE FITTINGS/JOINT FAILURE	Failure in valve, weld, flange, etc.	3	1	0	4	4	6
MISCELLANEOUS EQUIPMENT	Failure in tank, compressor, etc.	0	4	0	0	1	0
TOTAL CRACKING		**4**	**5**	**3**	**4**	**6**	**6**
EXTERNAL INTERFERENCE	External activities causing damage to pipe						
THIRD PARTY INTERFERENCE	Interference by someone other than operating company or its employees/contractors	5	3	1	5	2	1
COMPANY	Interference by operating company or its employees/ contractors	2	4	8	4	1	5
VANDALISM	Interference caused willfully by someone through attempted theft of service fluid	0	0	0	0	0	0
TOTAL EXTERNAL INTERFERENCE		**7**	**7**	**9**	**9**	**3**	**6**
MATERIAL MANUFACTURING OR CONSTRUCTION	Defects in the fitting, construction or components	**1**	**1**	**1**	**2**	**0**	**2**
GEOTECHNICAL FAILURE	Loss of integrity due to geotechnical effect, for example, slope movement or weather	**1**	**2**	**8**	**1**	**4**	**2**
OTHER CAUSES							
IMPROPER OPERATION	Decision error made by operating company during service	1	5	0	0	2	1
OVERPRESSURE	Failure caused due to overpressure of pipe	0	0	0	0	0	0
TOTAL OTHER CAUSES		**1**	**0**	**0**	**0**	**2**	**1**
TOTAL INCIDENTS		**26**	**45**	**42**	**38**	**27**	**34**

PIPELINES DEFINED

PIPELINE: pipelines regulated by the Commission are defined in OGAA (except in Section 9) as piping through which any of the following is conveyed or transported:

- Petroleum or natural gas.
- Water produced in relation to the production of petroleum or natural gas or conveyed to or from a facility for disposal into a pool or storage reservoir.
- Solids.
- Substances prescribed under Section 133(2)(v) of the Petroleum and Natural Gas Act.
- Other prescribed substances.

The scope of the definition also includes installations and facilities associated with the piping, but does not include:

- Piping used to transmit natural gas at less than 700 kilopascals (kPa) to consumers by a gas utility as defined in the Gas Utility Act.
- A well head.
- Anything else that is prescribed.

ABANDONED PIPELINE: pipelines removed from service and not maintained for a later return to service.

DEACTIVATED PIPELINE: pipelines removed from service but maintained for a later return to service.

OPERATING PIPELINE: pipelines actively used for the transport of fluids related to oil and gas operations, and piping that has been suspended from service for less than 18 months but not formally deactivated.

PRODUCT CLASSIFICATIONS

CRUDE OIL: crude oil, sour crude and low-vapour-pressure hydrocarbons.

LIQUEFIED NATURAL GAS: natural gas in its liquid form, achieved through cooling. The cooling process can reduce the volume of gas by 600 times, allowing for efficient tranport. Includes sweet gas and fuel gas.

NATURAL GAS: includes natural gas, sweet gas, and fuel gas. Consisting mostly of methane, natural gas is a colourless, odourless, flammable gaseous hydrocarbon.

OTHER: miscellaneous gases and liquids, condensate and oil emulsion/effluent.

SOUR NATURAL GAS: natural gas with a hydrogen sulphide (H_2S) partial pressure greater than 0.3 kilopascals.

OTHER

HIGH-VAPOUR PRESSURE (HVP) HYDROCARBONS: examples include ethylene, propane, pentanes and liquid ethane. These products can quickly convert to gaseous form at atmospheric pressure.

INCIDENT: for the purposes of this report, a present or imminent event or circumstance, resulting from an oil and gas activity that is outside the scope of normal operations, and may or may not be an emergency.

LOW-VAPOUR PRESSURE (LVP) HYDROCARBONS: these products flow through pipelines in liquid or quasi-liquid form at a lower pressure than HVP hydrocarbons. Examples include oil, heavy oil, and synthetic oil.

m^3: a measure of volume - cubic metres; 1m x 1m x1m; 1,000 litres.

PIPELINE PERMIT: a permit that includes permission to construct, maintain, and operate a pipeline.

SHUT-IN: the isolation or closure of a well zone, a pipeline or a facility. For example, the temporary shut-in of a well allows for the analysis of such factors as a well's productive capacity, pressure, and permeability.

SPILL: as defined in OGAA; petroleum, natural gas, oil, solids or other substances escaping, leaking, or spilling from a pipeline, well, shot hole, flow line, or facility (or any source apparently associated with any of those substances).

WATER: freshwater, produced water, salt water and sour water.

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OGC.Communications@bcogc.ca