

STANDARDS RESEARCH

Opportunities for Environmental Management Standards for the Canadian Petroleum and Natural Gas Sector

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Authors

Zakiah Kassam, PEng., AirVironment Canada

Ganjina Vanjova, B.Eng., AirVironment Canada

Arman Velani, M.Eng., AirVironment Canada

Project Advisory Panel

Melanie Hartt, Emera Brunswick Pipeline Company Ltd.

Pascale St. Germain, Imperial Oil

Richard Slocomb, BC Energy Regulator

Roy McKnight, NorthRiver Midstream

Usha Mulukutla, Canada Energy Regulator

Dragica Jeremic Nikolic, CSA Group

Genevieve Yip, CSA Group (Project Manager)

Larisa Logan, CSA Group

Mervah Khan, CSA Group

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List of abbreviations

AB	Alberta
AER	Alberta Energy Regulator
AHJ	Authority having jurisdiction
API	American Petroleum Institute
BC	British Columbia
BCER	British Columbia Energy Regulator
CER	Canada Energy Regulator
CCME	Canadian Council of Ministers of the Environment
CSA	Canadian Standards Association
EA	Environmental assessment
EIA	Environmental impact assessment
EFN	Environmental flow needs
EM	Environmental management
EMP	Environmental management plan
EMS	Environmental management system
EOR	Enhanced oil recovery
ESA	Environmental site assessment
ESI	Environmental sensitivity index
FEMP	Fugitive emissions management plan
FVRG	Flaring and Venting Reduction Guideline
GHG	Greenhouse gas
GM	Gas migration
GRI	Global Reporting Initiative
HQN	High-quality nonsaline
IFRS	International Financial Reporting Standards
ISO	International Organization for Standardization
ISSB	International Sustainability Standards Board
LDAR	Leak detection and repair
LNG	Liquefied natural gas
MSAPR	Multi-Sector Air Pollutants Regulations
NB	New Brunswick
NPRI	National Pollutant Release Inventory
OBPS	Output-based pricing system
ON	Ontario
PNG	Petroleum and natural gas
POI	Point of impingement
PTTW	Permit to take water
QC	Quebec
SAGD	Steam assisted gravity drainage
SASB	Sustainability Accounting Standards Board
SCC	Standards Council of Canada
SCVF	Surface casing vent flow
SK	Saskatchewan
SK MER	Saskatchewan Ministry of Energy and Resources
VOC	Volatile organic compound
WSSA	Water supply source assessment

Executive Summary

Standards can help guide organizations in the petroleum and natural gas (PNG) sector to comply with regulatory requirements by authorities having jurisdiction (AHJ) for environmental management (EM).

The objective of this report is to undertake a jurisdictional review of laws and soft law instruments, industry practices and environmental management standards employed by the Canadian PNG sector to manage environmental impacts across project life cycles. This research includes:

- Reviewing EM acts, regulations and associated instruments across Canada to understand their scope, applicability and aspects covered
- Gathering insight into existing industry practices, including the use of voluntary standards, through literature review and engagement with interested parties
- Identifying gaps in the current EM requirements
- Recommending standardization approaches to address identified gaps

PNG activities covered included upstream, midstream and downstream activities. The components of the biophysical environment are atmospheric environment, soil, water, vegetation, and wildlife and biodiversity.

In Canada's legislative framework, four layers of laws and instruments were examined:

- Layer 1: General environmental protection and environmental assessment acts and regulations
- Layer 2: General biophysical component acts and regulations
- Layer 3: Canadian PNG-sector-specific acts
- Layer 4: Canadian PNG-sector-specific environmental protection regulations and soft law instruments

The scope of the jurisdictional review was limited to six provinces – British Columbia (BC), Alberta (AB), Saskatchewan (SK), Ontario (ON), Quebec (QC) and New Brunswick (NB) – as well as federal instruments. These six provinces were chosen because of their relatively high concentration of PNG activities compared to other jurisdictions in Canada.

The jurisdictions reviewed have similar approaches to management of environmental impacts of projects through Layer 1 and Layer 2 instruments. In the case of Layer 3 instruments, not all jurisdictions have an act that establishes a regulator with specific responsibilities for the PNG sector. The Canada Energy Regulator (CER), the Alberta Energy Regulator (AER), the British Columbia Energy Regulator (BCER), and the Saskatchewan Ministry of Energy and Resources (SK MER) have been vested with authority to oversee the responsible development, regulation and enforcement of energy resource activities within their jurisdictions, including regulating compliance with

environmental practices. In NB, ON and QC, PNG activities are overseen by a combination of provincial agencies, with less emphasis on direct oversight of resource extraction compared to the provinces with energy regulators.

This difference in approach to governance, together with differences in the nature and magnitude of PNG activities, is reflected in the extent to which Layer 4 instruments exist. AB, BC and SK have multiple Layer 4 instruments developed under the authority of the provincial regulator. The CER also developed specific Layer 4 instruments for the management of environmental impacts from PNG activities falling under its jurisdiction.

Voluntary standards are most likely to support gaps in Layer 4 instruments or in the development of new Layer 4 instruments. Given the variability in approaches across jurisdictions, areas of opportunity include the application of environmental management system (EMS) standards, methane leak detection and repair (LDAR) requirements, and endpoints for reclamation and biodiversity.



"By examining existing acts and regulations, standards used by the PNG sector, and management practices, this research aims to uncover inconsistencies and opportunities for further exploration."

1 Introduction

The PNG industry plays a significant role in the Canadian economy [1]. However, its activities may pose potential risks to the environment, particularly to biophysical components such as the atmospheric environment, soil, water, vegetation, and wildlife and biodiversity. Environmental impacts from these activities can arise as a result of activities occurring across the full life cycle of a project – from exploration and development to operations and decommissioning (see Figure 1).

Managing these environmental risks is complicated by the fragmented and sometimes overlapping regulatory frameworks governing the PNG sector. The division of powers under Sections 91 and 92 of the *Canadian Constitution Act, 1867* [2] allocates jurisdiction over natural resources to provincial and territorial governments, while interprovincial pipelines fall under federal jurisdiction. This creates a complex regulatory landscape where environmental standards and management practices can vary across regions and stages of project development.

This research addresses the challenge of navigating this complex regulatory environment to support EM across Canada's PNG sector. Specifically, it focuses on identifying gaps and opportunities for alignment of environmental protection instruments, both in i) legally binding acts and regulations, which are also known as laws, legislation or hard law instruments, and hereafter referred to as mandated instruments throughout the report and ii) soft law instruments, such as guidelines, manuals and standards.

An act is legislation passed by Parliament or a provincial legislature, while regulations are laws that are implemented under the authority of an act of Parliament or an act of a provincial legislature. In some cases, the legally binding documents include other forms of instruments such as directives in AB and SK, or standards in NB. Soft law instruments do not have legally binding force, but still have legal relevance as they are often used to interpret or inform understanding of legislation and regulations [3]. The goal of this research is to provide a comprehensive review of environmental management practices that can address environmental impacts consistently and effectively across the entire value chain of PNG activities, from upstream exploration to downstream processing and refining (see Figure 2).

By examining existing acts and regulations, standards used by the PNG sector, and management practices, this research aims to uncover inconsistencies and opportunities for further exploration. The findings contribute to the development of more coherent and robust environmental management strategies to help mitigate the environmental risks posed by PNG activities. Mandated and soft law instruments in effect during this study have been considered.

Figure 1: Life cycle of a PNG project



Planning
Design, regulatory approvals, and risk assessments are completed for construction activities and for exploration, production, processing, and transportation activities.

Operations
Extraction, processing, and transporting petroleum and natural gas while maintaining compliance with environmental and regulatory requirements.

Decommissioning, Abandonment, and Reclamation
Process of safely shutting down facilities, restoring sites to their original state or a sustainable condition, and addressing environmental impacts after PNG activities are complete.

Figure 2: Upstream, midstream and downstream activities [4]



Upstream
Activities involving the exploration and production of crude petroleum and natural gas, including from oil sands and reservoirs.

Midstream
Transportation and storage of petroleum and natural gas from production sites to refineries or processing facilities.

Downstream
Activities involving refining of petroleum and natural gas into finished products such as gasoline and petrochemicals.

Regulations currently being revised and instruments in development are considered outside the scope of this study.

The objective of this report is to undertake a jurisdictional review of current mandated instruments and soft law instruments, industry practices and EM standards employed by the Canadian PNG sector to manage impacts to the biophysical environment across project life cycles. This includes:

- Reviewing the EM acts and regulations across Canada to understand their scope, applicability, and the environmental aspects they cover
- Gathering insight into existing industry practices, including the use of voluntary standards, through literature review and engagement with interested parties
- Identifying gaps in the current EM requirements
- Recommending approaches to address identified gaps

The biophysical environment encompasses both biotic (living) and abiotic (non-living) factors surrounding an organism or population, influencing their survival, development and evolution. The components of the biophysical environment are atmospheric environment, soil, water, vegetation, and wildlife and biodiversity, as shown in Table 1.

While vegetation and wildlife are components of biodiversity, and vegetation can also be a component of wildlife, the term wildlife in this report has been used specifically to capture the fauna component of the biophysical environment. The concept of biodiversity has been combined with wildlife as a biophysical component, as some legislative provisions target biodiversity objectives broadly, not specifying vegetation or wildlife requirements.

2 Methods

2.1 Literature review

As there is a high concentration of PNG activities in the provinces of BC, AB, SK, ON, QC and NB [4], the primary focus of this research is the mandated instruments and soft law instruments in these provinces, along with federal regulations and instruments.

The literature review involved the analysis of acts, regulations and soft law instruments sourced from provincial and federal government websites of AHJ. Table 2 shows the factors that were considered in the literature review of laws and soft law instruments that manage environmental impacts of petroleum and natural gas activities.

Table 1: Components of the biophysical environment

Component	Description
Atmospheric Environment	The layer of air near the Earth's surface.
Soil	The uppermost layer of the Earth's surface, composed of minerals, organic matter, water, and air, serving as a foundation for vegetation growth and a medium for nutrient cycling and water filtration.
Water	All freshwater and marine resources such as rivers, lakes, groundwater, oceans, essential for supporting ecosystem, regulating climate, and sustaining all forms of life.
Vegetation	The diverse plant life covering the Earth's surface, which contributes to habitat creation, carbon sequestration, oxygen production, and the regulation of hydrological and nutrient cycles.
Wildlife and Biodiversity	The variety of living organisms, including animals, plants, fungi and microorganisms, forming intricate ecosystems that maintain ecological balance.

Table 2: Factors considered in jurisdictional review of instruments

Factor	Description
Year	Mandated instruments and soft law instruments that have been established more recently are more likely to reflect current best practices than older instruments.
Scope	A mandated or soft law instrument may cover activities (e.g., extraction, upgrading, refining) or be applicable to different capacities of oil and gas producers.
Biophysical Elements	Coverage of biophysical elements may differ such as air pollution emissions, land impacts, water impacts, remediation requirements, etc.
Prescriptive Requirements	Prescriptive requirements include emissions thresholds or quantitative methodologies that need to be used by the entity subject to the instrument.
Process Requirements	Process requirements include steps, procedures and elements of management that need to be implemented.
Life Cycle Stages	Mandated and soft law instruments may cover a single stage or multiple life cycle stages. Instruments may also cover multiple life cycle stages together.
Normative References	Mandated and soft law instruments may make normative reference to national or international standards (e.g., ISO 14001, ISO 14064-1).
Other Elements	Other elements that may be examined include monitoring and evaluation mechanisms, reporting mechanisms, and continuous improvement mechanisms.

Lumivero's NVivo data analysis software was used for qualitative data analysis of the information retrieved from the federal and provincial governments [5]. Requirements of each document were coded to a theme or sub-theme, with the core themes being the specific components of the biophysical environment. The coding element enabled extraction of provisions related to a particular theme across provinces and documents.

The components of the biophysical environment used for coding purposes were:

- Atmospheric environment
- Soil
- Water
- Vegetation
- Wildlife and biodiversity

2.2 Engagement

The primary goal of the engagement sessions was to identify challenges and opportunities from the perspectives of interested parties. These insights were then validated through a more detailed investigation of the mandated and soft law instruments applicable to the identified issues. Engagement of interested parties targeted the identification of challenges and opportunities from the perspective of regulators and operators.

This engagement with interested parties was comprised of two components. The first component was in depth interviews with subject matter experts (SMEs) to gain insight about challenges and trends related to the adoption of voluntary standards in the PNG sector. The second component involved focus

group sessions, gathering insights and opinions through a structured discussion facilitated by a moderator. The interaction between focus group participants stimulates conversation and can result in deeper insights than in one-on-one interviews [7].

Interviewees and focus group participants were invited through regulatory entities and industry organizations. A focus group session was also conducted with the members of the Research Project Advisory Panel. The smallest focus group was comprised of two individuals, and the largest focus group was comprised of four individuals. Participants included consultants working in the PNG sector on environmental issues, SMEs from regulatory agencies, and representatives of industry associations.

The survey questions and focus group guides are provided in Appendix A. A total of 13 individuals participated in interviews or focus groups, seven of whom worked for regulatory agencies and six of whom were from operating companies, industry associations or consulting companies.

3 Results

3.1 Legal Structures in Relation to Environmental Management

3.1.1 Constitutional Division of Powers

Sections 91 and 92 of the *Constitution Act, 1867* [2] set out the legislative authority of the Parliament of Canada and the exclusive powers of provincial legislatures. Matters falling under the legislative authority of the Parliament of Canada include the seacoast and inland fisheries [2]. Local works and undertakings that connect a province with any other province, or that extend beyond the limits of the province, also fall under the legislative authority of the Parliament of Canada [2]. The CER at the federal level has responsibility over interprovincial pipelines and trade in energy products [8].

In each province, the provincial legislature has the authority to make laws in relation to exploration for non renewable natural resources, and the development, conservation and management of non-renewable natural resources [2]. Consequently, each province has jurisdiction over its resources and is responsible for approval of PNG activities and their oversight and regulation. The management of the atmospheric environment is a shared responsibility, and judicial interpretations of the Parliament's authority to make laws for peace, order and good government (Section 91 of the *Constitution Act, 1867* [2]) has allowed the federal government to establish environmental laws that apply across Canada.

3.1.2 Layers of Analysis of Acts, Regulations and Soft Law Instruments

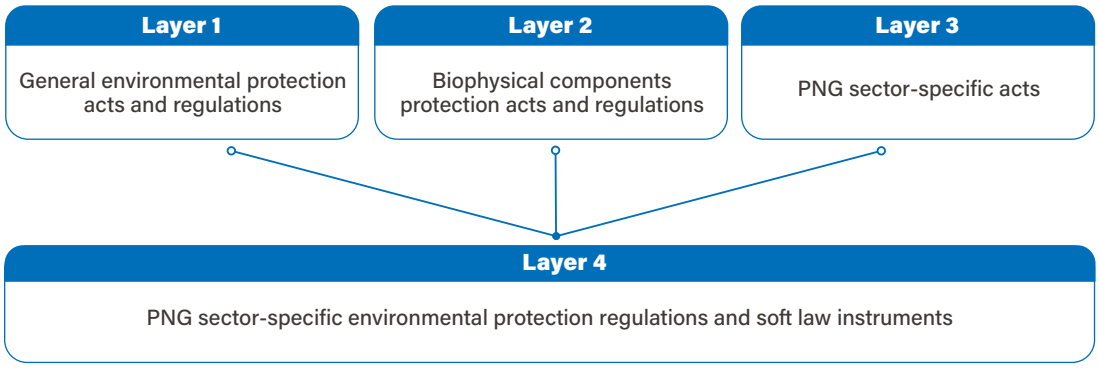
Figure 3 outlines the layers analyzed. This layered approach distinguishes between acts and regulations that apply broadly to environmental protection, those targeting specific biophysical components, and those designed specifically for the PNG sector.

Environmental protection instruments were categorized into four layers:

- Layer 1: Acts and regulations addressing overall environmental protection and environmental assessment of new undertakings
- Layer 2: Acts and regulations protecting biophysical components of the environment
- Layer 3: Acts establishing authority and oversight for PNG activities
- Layer 4: Regulations, directives and soft law instruments in Layer 1, Layer 2 or Layer 3 specific to management of environmental impacts of the PNG sector

This layered framework facilitates clarity on jurisdictional authority and considers the potential relationship between environmental management standards and mandated and soft law instruments that could reference them. Appendix B shows existing standards referenced within Layer 1, Layer 2, Layer 3, and Layer 4 instruments in each jurisdiction.

Figure 3: Layers of instruments analyzed



3.1.3 Layer 1 – General Environmental Protection and Management

There are generally two types of acts or regulations in Canada aimed at protecting the environment broadly – legislation for general environmental protection and management, and legislation for environmental assessment (see Figure 4).

3.1.3.1 Environmental Protection and Management Legislation

The first type of Layer 1 instrument is environmental legislation that has overall protection of the environment as its focus. This includes the:

- *Canadian Environmental Protection Act, 1999* [9]
- *Environmental Management Act* (BC) [10]
- *Environmental Protection and Enhancement Act* (AB) [11]
- *Environmental Management and Protection Act* (SK) [12]
- *Environmental Protection Act* (ON) [13]
- *Environmental Quality Act* (QC) [14]
- *Clean Environment Act* (NB) [15]

These acts have pollution prevention and the protection of the environment as their core objectives. The only exemption among these documents is the *Saskatchewan Environmental Code* [16], which is a consolidation of chapters from multiple laws [17]. It uses an outcomes-based regulatory approach, meaning it emphasizes the achievement of environmental goals, while allowing flexibility in how these goals are achieved [16]. All standards referenced in the Code, developed by AHJs and standards development organizations, become mandatory as a consequence of their adoption by reference in the Code [17].

3.1.3.2 Environmental Assessment Instruments

The second type of Layer 1 instrument is environmental assessment (EA) legislation. This includes the:

- *Federal Impact Assessment Act* [18] and associated *Physical Activities Regulation* [19]
- *Environmental Assessment Act* (BC) [20] and associated *Reviewable Projects Regulation* (BC) [21]
- *Environmental Assessment Regulation* (AB) [22], *Activities Designation Regulation* (AB) [23], and *Environmental Assessment (Mandatory and Exempted Activities) Regulation* (AB) [24], all made pursuant to the *Environmental Protection and Enhancement Act* (AB) [11]
- *Environmental Assessment Act* (SK) [25]
- *Environmental Assessment Act* (ON) [26]
- Regulation respecting the environmental impact assessment and review of certain projects (QC) [27]
- *Environmental Impact Assessment Regulation* (NB) [28]

Figure 4: Layer 1 instruments for environmental protection and assessment

Environmental Protection & Environmental Assessment

	Environmental Protection	Environmental Assessment
CANADA	▪ Canadian Environmental Protection Act, 1999	▪ Impact Assessment Act ▪ Physical Activities Regulations
BC	▪ Environmental Management Act	▪ Environmental Assessment Act ▪ Reviewable Projects Regulation
AB	▪ Environmental Protection and Enhancement Act	▪ Environmental Assessment Regulation ▪ Activities Designation Regulation ▪ Environmental Assessment (Mandatory and Exempted Activities) Regulation (AB)
SK	▪ Environmental Management and Protection Act ▪ Saskatchewan Environmental Code	▪ Environmental Assessment Act
ON	▪ Environmental Protection Act	▪ Environmental Assessment Act
QC	▪ Environmental Quality Act	▪ Regulation Respecting Environmental Impact Assessment and Review of Certain Projects
NB	▪ Clean Environment Act	▪ Environmental Impact Assessment Regulation

Environmental assessment (EA) is, in general, the first step in environmental management. Petroleum and natural gas projects may be subject to federal or provincial EA requirements, or both.

While federal environmental impact assessment (EIA) processes are governed by the *Impact Assessment Act* [18], provinces and territories have their own EIA requirements. An EIA determines the baseline conditions and predicts the extent of impact based on the project activities. The EIA process starts with an initial screening or scoping phase that assesses the need for an EIA, and determines the studies and information to be included in an impact report. Consultation with interested parties is a critical component of an EIA.

The federal *Impact Assessment Act* [18] applies to "designated projects," as defined by the *Physical Activities Regulations* [19]. Projects categorized as "designated projects" require federal impact assessments due to their potential environmental impacts. In relation to PNG activities, onshore and offshore petroleum and natural gas facilities, pipelines used for the transportation of petroleum or natural gas, and the development of new oil sands mines all fall under the category of "designated projects" because of their potential environmental impacts [19].

In October 2023, the Supreme Court of Canada determined that the federal government overreached its jurisdiction in articulating the "designated projects" scheme in the *Physical Activities Regulations* [29].



Even though elements of this scheme are no longer applicable as a result of the Supreme Court of Canada ruling, the components required when undertaking an impact assessment are important to consider.

There are some differences between provincial definitions of EIA-mandatory and exempted projects. Quebec's EA regulations [27] provide a more detailed list than *Alberta's Environmental Assessment Regulation* [22], and not all provinces have a clearly defined list of requirements embedded in the mandated instrument. The Quebec regulations set out 39 different types of projects that are subject to the provincial EIA and review procedure. These projects include installations for natural gas or biomethane regasification or liquefaction, oil pipelines and gas pipelines, natural gas storage projects, and petroleum, gas and coal processing projects.

In contrast, the *Alberta Environmental Assessment (Mandatory and Expective Activities) Regulation* [24] sets out a list of 27 different activities for which an EA is required. These include oil sand mines, commercial oil sands, heavy oil extraction, upgrading or processing plants producing more than 2000 cubic metres of bitumen a day, oil refineries, and sour gas processing plants that emit more than 2.8 tonnes of sulphur per day [24]. The number and nature of projects designated for review will vary based on the industries in each jurisdiction.

The contents to be included in an EIA report are also different amongst provinces. The *Environmental Assessment Act* (BC) [20] sets out a specific list of matters that must be considered in every assessment, and the *Environmental Assessment Act* (Ontario) [26] includes a minimum list of components that must be covered when undertaking an environmental assessment, but the components are not the same.

In Saskatchewan, the *Environmental Assessment Act* [25] requires an EIA and approval of an Environmental Impact Statement (EIS) for projects that may have significant environmental impact. The *Environment Impact Assessment Regulation* [28] in New Brunswick mandates certain projects to undergo an EIA to identify and address potential environmental impacts early in the planning process.

As noted in Table B.1 of Appendix B, there are no references to standards in any of the Layer 1 instruments, with the exception of the Saskatchewan Environmental Code. Layer 1 instruments, however, do confer authority on the regulator to establish regulations and other instruments against which compliance is required by law.

3.1.4 Layer 2 – Acts and Regulations for Biophysical Components

At both federal and provincial levels, additional legislation addresses the protection of specific

biophysical components of the environment, as shown in Figure 5. Federal and provincial acts and regulations comprising this layer address specific biophysical components and are applicable to all industrial sectors. Legislation specific to the management of greenhouse gas emissions have not been included in Figure 6, although these instruments are discussed in detail in Section 3.2.1.2.6 of the report.

The division of authority between federal and provincial levels of government influences the application of Layer 2 instruments to biophysical components of the environment. For example, while the federal government has constitutional responsibility for seacoast waters and inland fisheries [2], matters concerning land within provincial borders fall under the authority of the provincial legislatures.

Figure 5: Layer 2 legislation specific to biophysical components of the environment

Biophysical Components of the Environment:



Soil

- Land Act (BC)
- Contaminated Sites Regulation (BC)
- Remediation Regulation (AB)
- On-Site and Excess Soil Management Regulation (ON)
- Records of Site Condition Regulation (ON)



Water

- Canada Water Act
- Fisheries Act (Federal)
- Water Sustainability Act (BC)
- Water Act (AB)
- Water Security Agency Act (SK)
- Ontario Water Resources Act (ON)
- Water Taking and Transfer Regulation (ON)
- Water Withdrawal and Protection Act (QC)
- Clean Water Act (NB)
- Water Quality Regulation (NB)



Air

- Multi-Sector Air Pollutants Regulations (Federal)
- Waste Discharge Regulations (BC)
- Substance Release Regulation (AB)
- Local Air Quality (ON)
- Clean Air Act (NB)
- Regulation Respecting Mandatory Reporting of Certain Emissions of Contaminants into the Atmosphere (QC)
- Air Quality Regulation(NB)
- Clean Air Regulation (QC)



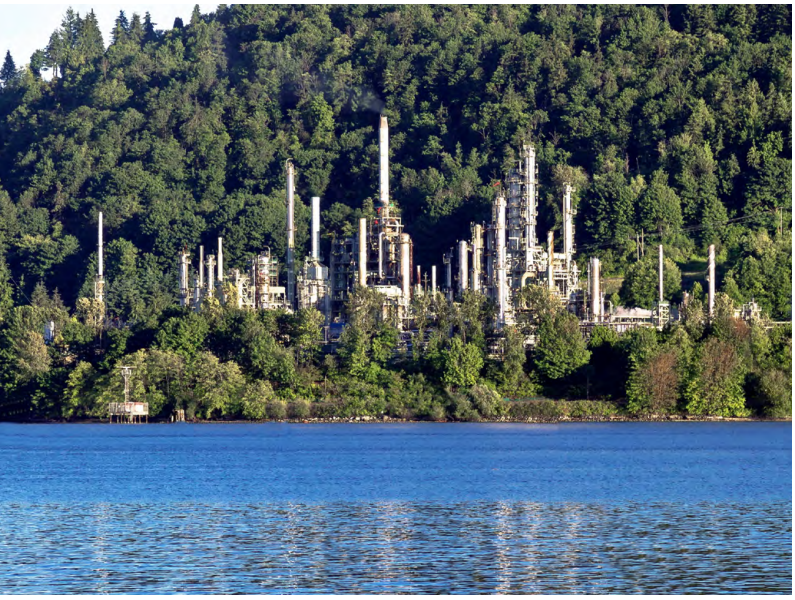
Vegetation

- Sustainable Forest Development Act (QC)
- Forest Protection Regulation (QC)
- Forest Act (BC)
- Forests Act (AB)
- Crown Lands and Forests Act (NB)
- Regulation Respecting Threatened or Vulnerable Plant Species and their Habitats (QC)



Wildlife/Biodiversity

- Species at Risk Act (Federal)
- Migratory Birds Convention Act (Federal)
- Wildlife Act (BC)
- Wildlife Act (AB)
- Wildlife Habitat Protection Act (SK)
- Endangered Species Act (ON)
- Act respecting threatened or vulnerable species (QC)
- Regulation respecting threatened or vulnerable wildlife species and their habitats (QC)
- Protected Natural Areas Act (AB)
- Species at Risk Act (NB)



"*The Canada Water Act* recognizes the shared responsibility among governments for the management of water resources."

Consequently, the federal government has established legislation specific to water through the *Fisheries Act* [30], but there is no federal environmental law specific to land that applies across Canada. Similarly, the *Migratory Birds Convention Act* [31] exists at the federal level because it stems from an international treaty between Canada and the United States, and migratory birds often cross provincial and national borders. The *Canada Water Act* [32] recognizes the shared responsibility among governments for the management of water resources. It provides the authority for the federal government to undertake initiatives with respect to international or boundary waters, or enter into agreements with provincial governments to facilitate coordination and implementation of water policies and programs.

The federal *Multi-Sector Air Pollutants Regulations* (MASPR) [33] establishes requirements for the emissions of nitrogen oxides (NO_x) from boilers, heaters and reciprocating engines in industrial sectors. The MASPR also set out rules in relation to continuous emission monitoring systems. Because provincial and territorial governments are responsible for managing air quality in their air zones [34], the *Canadian Ambient Air Quality Standards* [35] are not legally binding unless implemented by provincial governments, so are not included in Figure 6.

In British Columbia, the *Waste Discharge Regulation* [36] prescribes classes of industry that are prohibited to discharge a contaminant to the environment without a permit. The PNG industry is listed among the prescribed industries [36]. The Government of British Columbia has further delegated responsibility for air quality in the Metro Vancouver region to the municipality [37]. Metro Vancouver manages industrial emissions from industrial sources through its own set of by-laws, permits, compliance assessment and enforcement mechanisms [37].

The Saskatchewan Environmental Code [16] is comprised of five sections. The first section covers general and administrative matters, while the remaining four sections cover biophysical components, specifically land, water, natural resources and forestry, and air. Although the "Industrial Source (Air Quality)" chapter of the Saskatchewan Environmental Code [16] is not specific to any sector, oil and gas facilities fall under the *Oil and Gas Conservation Act* (SK) [38] and *The Pipelines Act* (SK) [39], and are therefore excluded from this chapter [16]. Only Chapter C.3.1 of the Saskatchewan Environmental Code on hydrostatic testing used in the upstream oil and gas industry is applicable to PNG activities [16].

As noted in Table B.2 of Appendix B, few instruments comprising Layer 2 refer to non-governmental standards. The MSAPR is the main instrument that references non-governmental standards, primarily ASTM standards for determination of chemical composition and heating values of fossil fuels and their exhaust streams in different types of combustion equipment. The other non-governmental standards, such as the ones referenced in the *Clean Air Regulation*

(QC) [40] and the *Air Quality Regulation* (NB) [41] (made pursuant to the *Clean Air Act* (NB) [42]), are test methods for determining vapour pressure of fuel.

3.1.5 Layer 3 – Acts Specific to Petroleum and Natural Gas Sector

Both the federal and provincial levels of government have acts specific to the PNG sector. Provisions within these acts directly or indirectly protect the environment. Figure 6 shows the acts comprising Layer 3 instruments. There are generally two categories of acts falling under this third layer of legislation specific to the PNG sector. The first category is acts establishing the authority of an energy regulator and the powers of the regulator. The second category is acts addressing activities in the petroleum and natural gas sector. In some instances, an act may straddle both these categories. For example, Part 2 of the *Energy Resource Activities Act* (BC) concerns the establishment of the BC Energy Regulator, while Part 3 concerns energy resource activities [43].

3.1.5.1 Acts Establishing Energy Regulator

The *Canadian Energy Regulator Act* [5], the *Energy Resource Activities Act* (BC) [43] and the *Responsible Energy Development Act* (AB) [44] establish and grant powers to an energy regulator that oversees PNG activities. Ontario, Quebec and New Brunswick do not have acts that establish an independent energy regulator. Oversight of PNG activities is through multiple government ministries and agencies.

Saskatchewan does not have an act that establishes an energy regulator. However, through *The Ministry of Energy Resources Regulations* [45], issued under the *Executive Government Administration Act* [46], the Saskatchewan Ministry of Energy and Resources (SK MER) was granted its objects and purposes for the exploration, development and management of non-renewable resources. Saskatchewan's *Oil and Gas Conservation Act* [38] regulates all operations for the production of oil and gas, while protecting the environment, property and safety of the public. It also grants the SK MER responsibility for all matters relating to the conservation and development of oil and gas resources in Saskatchewan. In Saskatchewan, the SK MER has been vested with authority over PNG activities through multiple provincial legislative acts, including *The Energy and Mines Act* [47], the *Oil and Gas Conservation Act* [38] and the *Mineral Resources Act* [48].

The Layer 3 acts that establish a regulator are important to note because the purpose of the regulator includes oversight of environmental impacts. For example, Section 6 of the *Canadian Energy Regulator Act* [5] notes that one of the Act's purposes is to ensure that industry activities are carried out in a manner that protects the environment. Similarly, Section 4 of the *Energy Resource Activities Act* (BC) [43] states that one of the purposes of the regulator is regulation of energy resource activities in a manner that protects the environment. Section 2 of the *Responsible Energy Development Act* (AB) [44] includes within the mandate of the regulator oversight of environmentally responsible development of energy resources and regulation for the protection of the environment.

3.1.5.2 Acts for Petroleum and Natural Gas Activities

These Layer 3 acts address the development of PNG resources. While their objectives are broader than environmental protection, they do include management of environmental impacts. In certain cases, these acts are specific to the types of activities in the value chain (e.g., upstream versus downstream activities).

At the federal level, the *Canada Petroleum Resources Act* [49] focuses on the upstream activities and the management of petroleum rights, including issuance of exploration licences and production licences. Meanwhile, the *Canada Oil and Gas Operations Act* [50] focuses on operational aspects and safety of PNG activities.

In British Columbia, the *Energy Resource Activities Act* [43] sets out permit requirements for PNG activities and the rights and obligations of the permit holder. This includes the obligation to comply with environmental measures established through a regulation made under the act. The *Petroleum and Natural Gas Act* [51] primarily concerns upstream activities and governs the exploration, development and production of PNG resources in the province. The *Petroleum and Natural Gas Act* [51] also refers to the *Energy Resource Activities Act* [43] in several sections.

Figure 6: Layer 3 acts specific to petroleum and natural gas sector

Petroleum and Natural Gas Activities

	Acts Addressing PNG Activities	Acts Establishing Regulator + PNG Activities
CANADA	▪ Canada Oil and Gas Operations Act ▪ Canada Petroleum Resources Act	▪ Canadian Energy Regulator Act
BC	▪ Petroleum and Natural Gas Act	▪ Energy Resource Activities Act
AB	▪ Oil Sands Conservation Act ▪ Oil and Gas Conservation Act ▪ Gas Resources Preservation Act ▪ Pipelines Act	▪ Responsible Energy Development Act
SK	▪ Oil and Gas Conservation Act ▪ The Energy and Mines Act ▪ The Pipelines Act ▪ The Mineral Resources Act	
ON	▪ Oil, Gas and Salt Resources Act ▪ Mining Act	
QC	▪ Act Respecting Natural Gas Storage and Natural Gas and Oil Pipelines ▪ Act Ending Exploration for Petroleum & Underground Reservoirs and Production of Petroleum & Brine ▪ Act Respecting Transparency Measures in the Mining Oil & Gas Industries	
NB	▪ Oil and Natural Gases Act ▪ Bituminous Shale Act ▪ Pipeline Act ▪ Gas Distribution Act	

In Alberta, the provincial *Oil Sands Conservation Act* [52] focuses on oil sands development, including the process of approvals for oil sands projects, while the *Oil and Gas Conservation Act* [53] is focused on conventional petroleum and natural gas activities. The *Gas Resources Preservation Act* [54] concerns the export of gas produced in Alberta, and it is intended to facilitate natural gas security of Alberta for domestic consumption to meet current and future needs. Both the *Oil Sands Conservation Act* [52] and the *Oil and Gas Conservation Act* [53] mention pollution control or pollution prevention amongst the purposes of the Acts.

In Saskatchewan, The *Oil and Gas Conservation Act* (SK) [38] regulates the exploration, development and production of PNG resources to promote responsible use and conservation. It sets out requirements for safe drilling, production and environmental protection, while promoting efficient recovery and minimizing waste.

In Ontario, *Oil, Gas and Salt Resources Act* [55] regulates the exploration, drilling and production of oil, natural gas and salt resources in the province. It sets out licensing requirements, operational standards and safety protocols [55].

In Quebec, the *Act ending exploration for petroleum and underground reservoirs and production of petroleum and brine* [56] was implemented in recognition of the Paris Agreement and goals to achieve carbon neutrality by 2050. The Act [56] prohibits petroleum exploration and production and brine production. It revokes petroleum exploration licences, petroleum production licences and authorizations to produce brine issued or deemed issued under the *Petroleum Resources Act* [57].

In New Brunswick, the *Bituminous Shale Act [*58] is specific to non-conventional oil resources, although it notes in several locations that provisions and regulations of the *Oil and Natural Gas Act* [59] apply to bituminous shale.

As noted in Table B.3 of Appendix B, no Layer 3 instrument references non-governmental standards. However, several of these acts establish authority for the creation of regulations or standards for the purposes of achieving their objectives.

3.1.6 Layer 4 – Regulations, Directives and Soft Law Instruments Specific to PNG Activities

Layer 4 instruments are comprised of regulations, directives and soft law instruments specific to PNG activities. These instruments may be created through the authority granted to an environmental agency through a Layer 1 or Layer 2 act or regulation, or through the authority granted to an energy regulator or another AHJ (e.g., the Minister) pursuant to a Layer 3 instrument. In some cases, soft law instruments, including guidelines, manuals and standards, are given legal effect through reference by an act or regulation.

3.1.6.1 Layer 4 Instruments Made Pursuant to Layer 1 and Layer 2 Instruments

Across jurisdictions, there are cases of regulations or other instruments that are specific to the PNG sector, but have been issued pursuant to a Layer 1 or a Layer 2 laws (i.e., issued under the authority of an environmental act or regulation). The *Oil and Gas Waste Regulation* (BC) [60] made pursuant to the *Environmental Management Act* (BC) [10] is one example of a Layer 4 instrument made pursuant to a Layer 1 instrument. The *Petroleum Refinery Liquid Effluent Regulations* [61] made pursuant to the *Fisheries Act* [30] is an example of a Layer 4 instrument made pursuant to a Layer 2 instrument.

A number of jurisdictions have supplemented regulatory requirements with guidelines to provide direction for producing an EIA report. For example, Alberta has developed the Guide to Preparing Environmental Impact *Assessment Reports in Alberta,* which describes content of the EIA report[62]. In Saskatchewan, the *Environmental Review Guidelines for Oil and Gas Activities* [63] provides guidelines for the preparation of proposals for PNG projects, and it describes the roles of different ministries in reviewing various types of projects. *A Guide to Environmental Impact Assessment in New Brunswick* [64] provides guidelines for projects that are required to undertake an EIA, and these guidelines include content requirements for the EIA.



3.1.6.2 Layer 4 Instruments Made Pursuant to Layer 3 Instruments

In British Columbia, the *Environmental Protection and Management Regulation* [65] was made pursuant to the *Energy Resource Activities Act* [43] and sets out the government's environmental objectives for various biophysical components of the environment. This *Regulation* is an example of a Layer 4 instrument made pursuant to a Layer 3 instrument.

The application of management systems, and specifically environmental management systems (EMSs), is a common theme across regulations, as well as guidance documents. Under *Canada Oil and Gas Drilling and Production Regulations* [66], upstream activities that fall within federal jurisdiction are required to develop an integrated management system that incorporates operations and technical systems with management of financial and human resources. *The Canada Oil and Gas Drilling and Production Regulations* [66] made pursuant to the *Canada Energy Regulator Act* also mandates compliance with these management system requirements. Similarly, the *Canadian Energy Regulator Onshore Pipeline Regulations* [67] requires companies to establish, implement and maintain a management system that applies to the full life cycle of the company's activities. Section 48 of these regulations requires companies to establish, implement and maintain an environmental protection program to manage and mitigate potential environmental impacts [67].

British Columbia's Oil and Gas Processing Facility Regulation [68] mandates the creation and maintenance of a management system, which must be established prior to the construction of a facility and operate throughout the life cycle of the facility. The management system must include an environmental management program (EMP) and site-specific environmental protection plans (EPPs) [68]. Under these British Columbia regulations, the management system must align with the process safety management system requirements set out in CSA Z767 [69]. While the concept of management systems exists in regulation, the concept of a specific EMS does not, although management of environmental impacts is expected to fall within the broader management system concepts.

While environmental acts and regulations in the other provinces do not mandate the use of an EMS or a related management system, there are broad requirements in relation to identification of environmental risks, planning for and implementation of measures to control risks, and monitoring and taking corrective action where deficiencies are found. These are core concepts in management system standards such as CSA Z767 [69] and ISO 14001 [70]. *The Canada Energy Regulator (CER) Environmental Protection Plan Guidelines* [71] makes reference to CAN/CSA-ISO 14001:2004, which is not the most recent version of the Canadian adoption of ISO 14001 [70]. It should be noted that these CER guidelines published in 2011 are among the older

instruments reviewed. CER is currently in the process of reviewing the *Onshore Pipeline Regulations* and its corresponding filing manuals [72].

As shown in Table B.4 of Appendix B, several Layer 4 instruments refer to standards developed by non-governmental organizations. Environmental management standards to support regulatory objectives may be best placed in Layer 4 instruments.

3.2 Biophysical Components

This section entails an analysis of mandated instruments and soft law instruments specific to different biophysical components of the environment as they apply to activities in the PNG sector.

3.2.1 Atmospheric Environment

3.2.1.1 Planning Requirements

Air dispersion modeling is conducted to predict the maximum ambient ground-level concentration or the deposition rate of substances. It is a required component of the permit application process for PNG activities and additional requirements apply when the proposed project emits pollutants that have the potential to adversely impact air quality. For example, air dispersion modeling is required in applications for wells and facilities if the concentration of hydrogen sulphide (H_2S) in any flare gas exceeds prescribed thresholds. In some cases, modeling of secondary substances may also be required. The planning requirements to obtain permits and the contaminants that need to be modeled depend on the permitting regime of each province. Regulations and guidelines across jurisdictions set out the underlying methods and approaches for undertaking dispersion modeling, as shown in Table 3.

Through dispersion modeling, air emissions from PNG activities are assessed against ambient air quality standards, objectives or guidelines, with three types of assessments possible – screening, refined and advanced modeling. A screening assessment predicts the concentration of substances in a worst-case scenario, and screening may be sufficient if modeling demonstrates that ambient air quality standards can be met. Otherwise, refined assessments using more sophisticated models, as well as changes to engineering design of systems (e.g., flare stacks), may be required until the air quality standards are met. Advanced air quality modeling entails more detailed input parameters such as detailed topographical parameters, local meteorology and consideration of sensitive receptors.

Table 3: Regulations and guidelines for air dispersion modeling

Jurisdiction	Relevant Regulations and Guidelines
Canada	▪ *CER Filing Manual* [73]
BC	▪ *British Columbia Air Quality Dispersion Modeling Guideline* [74] ▪ *Guidance for NO_2 Dispersion Modelling in British Columbia* [75] ▪ *BCER Flaring and Venting Reduction Guideline* [76]
AB	▪ *AER Directive 60* [77] ▪ *Alberta Air Quality Model Guideline* [78]
SK	▪ *Saskatchewan Air Quality Modelling Guideline* [79]
ON	▪ *Air Pollution – Local Air Quality Regulation (Part II)* [80] ▪ *Air Dispersion Modeling Guideline for Ontario (Guideline A-11)* [81]
QC	▪ *Guide de la modélisation de la dispersion atmosphérique* [82]
NB	▪ *Guideline for Plume Dispersion Modelling* [83]

At the federal level, the *CER Filing Manual* [73] requires a description of existing background concentrations and baseline concentrations, identification of sources of emissions, and a quantitative assessment of any potential air emissions. The applicant also needs to describe maximum discharge limits and mitigation measures. Although air dispersion modeling is not explicitly specified as a requirement, air dispersion modeling is among the tools and methodologies in determining potential effects. The guidance also states that modeled changes to ground-level and receptor-level concentrations during various normal and abnormal operations need to be considered, and this implies air dispersion modeling.

The Flaring and Venting Reduction Guideline (FVRG) [76] addresses flaring, incinerating and venting activities and it sets specific dispersion modeling requirements for sour gas combustion. The FVRG [76] refers to the *British Columbia Air Quality Dispersion Modeling Guideline* [74] as a source for dispersion modeling methodology.

Alberta Energy Regulator (AER) Directive 60, which is specific to upstream activities, provides guidance in carrying out dispersion modeling, with the Alberta Ambient Air Quality Objectives (AAQO) used as the criteria for compliance. Directive 60 also refers to the *Alberta Air Quality Model Guideline* [78] for acceptable modeling methods.

In Ontario, the *Air Pollution – Local Air Quality regulation* [80] contains a set of provisions that specifically identify the approved dispersion models. All jurisdictions provide air quality modeling guidelines that set out approved air dispersion modeling tools that can be used to assess performance against air quality objectives or standards.

The *Quebec Clean Air Regulation* [40] applies to all PNG activities in the province. Emissions standards are explicitly set out for petroleum refineries for different processes (e.g., catalyst regeneration process in a refinery) for carbon monoxide and particles.

In New Brunswick, the application form requesting an approval under the *Air Quality Regulation* [41] requires the applicant to provide data with respect to the attributes of air emissions. This data includes the exhaust gas volumetric rate, stack height and diameter, mass flow rate of air contaminants, and details on pollution control devices – all inputs that are necessary for air dispersion modeling. However, there is no explicit requirement to provide air dispersion models.

3.2.1.2 Operational Requirements

3.2.1.2.1 Instruments for Managing Ambient Air Quality Impacts

The approach to managing ambient air quality impacts of industrial activities, including PNG activities, varies across Canada, depending on the nature of the mandated instruments or soft law instruments developed by each AHJ. Facilities that are regulated by the CER need to comply with the relevant regulatory air criteria, which include federal and provincial requirements. These include guidelines issued by the Canadian Council of Ministers of the Environment (CCME), which are based on ambient air quality objectives, as well as provincial guidelines and permit requirements.

British Columbia's Waste Discharge Regulation [36] applies to prescribed industries, including facilities that explore, produce, transport and process PNG that meet thresholds for total sulphur or volatile organic compound (VOC) discharge or removal. Smaller PNG facilities are also subject to the *Waste Discharge Regulation* [36], which prescribes the industries that are prohibited under the *Environmental Management Act* (BC) [10] from discharging pollution to the environment without a permit or approval. British Columbia, however, does not have a mandated instrument that directly manages impacts to ambient air quality.

Alberta's Ambient Air Quality Objectives (AAAQOs) and Guidelines (AAAQGs) were developed under the authority of the Environmental Protection and Enhancement Act and are used as part of regulatory applications and approval conditions, including approvals for PNG facilities. However, unlike AHJs such as Ontario and Quebec, the AAAQOs and AAAQGs do not directly constitute mandated compliance requirements.



"The differences in regulatory and permitting regimes across provinces in relation to air quality was noted by some participants during the consultation sessions."

As noted, while the Saskatchewan Environmental Code has a chapter on industrial sources of emissions and air quality, the chapter does not apply to PNG activities regulated by the *Oil and Gas Conservation Act and the Pipelines Act,* 1998. The chapter does apply to petroleum refineries and petroleum upgraders. As part of the results-based objective set out in the Code, facilities are required to ensure that the Saskatchewan Ambient Air Quality Standards (SAAQS) are met. The SAAQS sets out ambient air concentrations for fine particular matter (PM2.5), coarse particulate matter (PM10), total suspended particulates, nitrogen dioxide, sulphur dioxide, hydrogen sulphide, ozone and carbon monoxide.

Ontario's *Air Pollution – Local Air Quality Regulation* [80] establishes concentration limits at the point of impingement (POI), which is the point at which a contaminant contacts the ground or building [84]. This Regulation is a Layer 2 mandated instrument and regulates industrial activities, including PNG activities.

Quebec's *Clean Air Regulation* [40], also a Layer 2 instrument, includes air quality standards that apply across Quebec. A new source of contamination or an increase in production is prohibited if it is likely to result in an ambient concentration of a contaminant higher than the concentration limit set out in the Regulation. Quebec's *Clean Air Regulation* [40] also has specific emissions standards for petroleum refineries that cover particles, carbon monoxide and opacity.

The approach of defining concentration limits at the source of emissions is used in Quebec's *Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere* [85], also a Layer 2 instrument. It applies to every operator whose facility emits a listed contaminant into the atmosphere at a level that is equal to or exceeds a prescribed threshold.

New Brunswick's *Clean Air Act* [42] has the broad purpose of controlling the release of contaminants to the atmosphere and establishes authority for the development of regulations regarding the release of contaminants to the atmospheric environment. The *Air Quality Regulation* [41] issued pursuant to the *Clean Air Act* (NB) [41] sets out maximum permissible ground level concentration limits for carbon monoxide, hydrogen sulphide, nitrogen dioxide, sulphur dioxide and total suspended particulate.

The differences in regulatory and permitting regimes across provinces in relation to air quality was noted by some participants during the consultation sessions. In Ontario, air emissions modeling often employs a worst-case scenario approach, to ensure emissions are not underestimated [81]. This conservative method, while safeguarding public interest, may not accurately reflect day-to-day emissions. It is also a different approach from other regions that do not require worst-case scenario compliance assessment. Table 4 summarizes the approach used across jurisdictions for management of ambient air quality impacts from industrial sources.

Table 4: Ambient air quality instruments across Canada

Approach	Federal	BC	AB	SK	ON	QC	NB
Layer 2 Ambient Air Quality Instrument	Needs to comply with provincial requirements				√	√	√
No Layer 2 Ambient Air Quality Instrument		√	√	√			

3.2.1.2.2 Instruments for Managing PNG Pollutants of Concern

Layer 4 instruments specific to the PNG sector tend to target emissions that are of particular concern to that sector. Hydrogen sulphide (H_2S) is a naturally occurring substance in PNG reservoirs that can be released through extraction and processing, leakage in containment systems or through emergency venting procedures. Combustion of fuel that contains H_2S creates sulphur oxides (SO_x), which have adverse environmental impacts, including contributing to acid rain [86]. Given the prevalence of naturally occurring H_2S in Canadian PNG reservoirs, jurisdictions have implemented regulations or provisions within regulations that are specific to managing sulphur emissions.

British Columbia's *Oil and Gas Waste Regulation* [60] requires operators to ensure that the one-hour average ambient ground-level concentration of H_2S does not exceed a limit of 10 parts per billion volume (ppbv) at the perimeter of the property. When filling, cleaning or using a storage tank, the Regulation requires that emitted vapours do not present objectionable odours at the perimeter of the property.

The Alberta *Substance Release Regulation* [87] sets limits on the concentration of particulates in an effluent stream from the combustion of solid and liquid fuels, and from the processing of petroleum products. The Alberta *Sulphur Recovery Guidelines* [88] require sour gas plants to recover a given percentage of the sulphur that flows through the inlet, based on the mass flow rate of sulphur at the inlet (a higher recovery rate is required for a higher mass flow rate). The higher recovery rate required for streams with higher flow rates recognizes that the absolute amount of sulphur emitted into the atmosphere is higher without more stringent controls. Environmental approvals pursuant to Alberta's *Environmental Protection and Enhancement Act* may also lay out specific emissions limits from certain sources that are facility-specific.

Ontario has established the *Air Pollution – Discharge of Sulphur Dioxide from Petroleum Facilities Before 2029* regulation [89]. A Layer 4 instrument applicable to specific downstream facilities in the province, it sets discharge limits of sulphur dioxide from acid gas combustion equipment. The *Air Pollution – Discharge of Sulphur Dioxide from Petroleum Facilities* regulation [90] applies to the same set of five downstream facilities that the *Air Pollution – Discharge of Sulphur Dioxide from Petroleum Facilities Before 2029* [89] applies to, and sets out specific concentration limits for hydrogen sulphide (H_2S) and sulphur dioxide (SO_2) is emissions streams from specific process units.

3.2.1.2.3 Fugitive and Vented Gas Emissions

Flaring and venting are two ways of managing waste gases during PNG activities [91]. Flaring involves controlled burning during production and processing, while venting is a controlled release of gas to the atmospheric environment [91]. Flaring and venting can be used during drilling operations, well testing to estimate reserves and assess well productivity, planned and unplanned depressurizing of equipment and pipelines, and as part of oilfield waste management [91].

Fugitive and vented gas emissions from PNG activities are a concern because of the immediate and long term impacts that methane emissions and certain VOCs have on the environment [92]. According to Canada's 2024 *National Inventory Report* [93], of Canada's total

117 Mt CO_2 of methane emissions in 2022, fugitive emissions from PNG systems accounted for 56 Mt CO_2e or 48%. At the same time, fugitive and vented emissions represent an opportunity to better manage methane, resulting in a more saleable product. As noted, fugitive and vented gas emissions are priced under industrial carbon systems (see Section 3.2.1.2.6).

The National Inventory Report notes that the decrease in methane emissions between 2019 and 2020 coincides with implementation of federal and provincial regulations in British Columbia, Alberta and Saskatchewan to reduce methane emissions from upstream PNG activities [92].

The Regulations Respecting Reduction in the Release of Methane and Certain Volatile Organic Compounds (Upstream Oil and Gas Sector) [95] were issued under the authority of the *Canadian Environmental Protection Act, 1999* [9] and target methane and certain VOCs from the upstream PNG sector. The *Regulations* require certain types of hydrocarbon gas flows be captured and routed to hydrocarbon gas conservation equipment with at least a 95% recovery rate of the hydrocarbon gas [95]. The regulations set out a maximum venting limit of 15,000 standard m^3 per year, requirements for leak detection and repair (LDAR), requirements for a fugitive emissions plan, and monitoring and reporting requirements [95].

The Canadian Environmental Protection Act, 1999 [9] allows the federal government to enter into an equivalency agreement with a province or territory if the two levels of government agree there are provincial laws in place equivalent to the regulation issued under the Act. Agreements on the equivalency of federal and provincial regulations respecting the release of methane and VOCs from the oil and gas sector exist for British Columbia, Alberta and Saskatchewan [94], [96], [97], [98]. Table 5 shows the regulations in British Columbia, Alberta and Saskatchewan for which equivalency has been agreed. All other provinces are subject to the federal regulations.

British Columbia's *Drilling and Production Regulation* [99] prohibits venting of gas unless the heating value is too low to support stable combustion. If venting must occur, the quantity of vented gas and the duration of venting must be minimized. The regulation also sets out flaring limits, flaring performance requirements, and requirements in relation to notification and reporting when flaring occurs [99].

Table 5: Summary of instrument creating equivalency [96], [97], [98]

Province	Regulatory Framework
British Columbia	*Oil and Gas Activities Act (replaced by the Energy Resources Activities Act)* [43] *Drilling and Production Regulation* [99]
Alberta	*Environmental Protection and Enhancement Act* (AB) [11] *Methane Emission Reduction Regulation* (AB) [100] Directive 017: *Measurement Requirements for Oil and Gas Operations* [101] Directive 060: *Upstream Petroleum Industry Flaring, Incinerating, and Venting* [102]
Saskatchewan	*The Oil and Gas Conservation Act* [36] *The Oil and Gas Emissions Management Regulations* [103] Directive PNG017: *Measurement Requirements for Oil and Gas Operations* [104] Directive PNG036: *Venting and Flaring Requirements* [105]

Alberta's AER Directive 060 [102] sets daily limits on the volume of gas that can be flared, incinerated and vented at a facility. The AER Directive 060 [102] duration limits are the same as the duration limits in British Columbia's *Flaring and Venting Reduction Guideline* [76]. Volumetric daily limits for methane emissions also exist in provincial policies such as AER Directive 060 [102] and Saskatchewan's *Oil and Gas Conservation Regulations* [106].

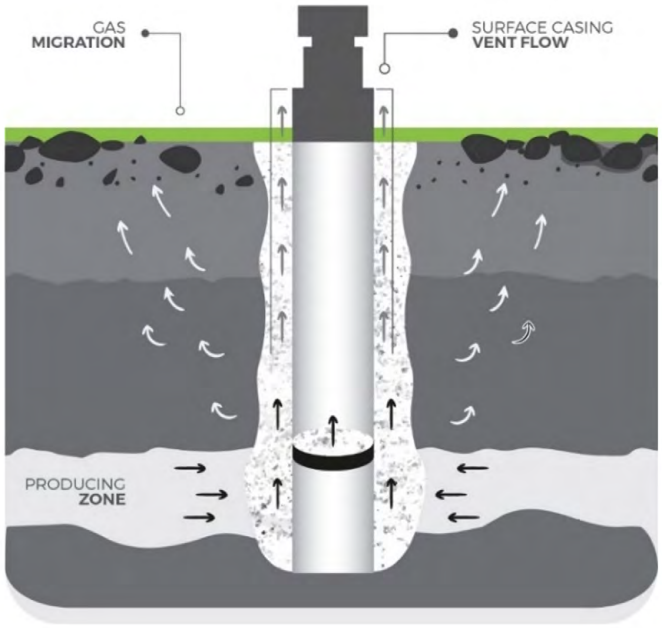
PNG upstream activities in Ontario, Quebec and New Brunswick are required to comply with the *Regulations Respecting Reduction in the Release of Methane and Certain Volatile Organic Compounds (Upstream Oil and Gas Sector)* [95]. The Ontario *Oil, Gas and Salt Resources of Ontario Provincial Operating Standards* [107] sets out maximum monthly limits on flaring. The *Responsible Environmental Management of Oil and Natural Gas Activities in New Brunswick – Rules for Industry* notes that as part of their fugitive emissions plan, operators must ensure that venting or flaring does not take place as part of routine operations [108].

Starting from 2023, operators of facilities under the purview of the *Canadian Environmental Protection Act, 1999* [9], including facilities engaged in petroleum refining, upgrading and petrochemical production, must submit an annual report in accordance with the federal *Reduction in the Release of VOCs Regulations (Petroleum Sector)* [109]. The annual report must include information on the estimated VOCs released – by component and total and equipment components for which significant leaks were detected [109].

3.2.1.2.4 Surface Casing Vent Flow and Gas Migration

Surface casing vent flow (SCVF) and gas migration (GM) tests are performed to assess the integrity of a well and identify leaks (see Figure 7). SCVF tests determine the flow of liquid or gas containing hydrocarbons released out of the surface casing annulus (internal migration). GM tests determine the flow of gas or liquid detectable at surface outside of the outermost casing string (external migration or seepage). Although the tests can be conducted through the life of a well, operators are required to conduct the tests before commencing abandonment operations. The severity of leaks and the corresponding reporting requirements depend on the level of risk that the gas leak represents, as defined by each AHJ.

Figure 7: Gas migration and surface casing vent flow as atmospheric emissions



In British Columbia, the *Drilling and Production Regulation* [99] requires operators to check and report on SCVF to the regulator immediately after completion of a well, during routine maintenance throughout the life of the well, and before well abandonment. If SCVF is discovered with an immediate safety or environmental hazard, the operator is required to immediately take steps to eliminate the hazard and notify the regulator about the SCVF [99]. If there is no immediate hazard, then an operator has up to 30 days to report the discovery of SCVF. The *Drilling and Production Regulation* [99] also sets out a maximum daily SCVF flow rate. Similarly, upon discovery of an occurrence of GM, the regulator must be immediately notified and a risk assessment of the GM must be completed [99].

Alberta's AER Directive 087 – *Well Integrity Management* [110] requires a serious SCVF to be reported within 30 days of detection. In Alberta, licence holders are required to regularly test and confirm the integrity of the abandoned wells within their portfolio. The testing frequency, ranging from annually to every 10 years,

is based on a risk score for each well. The procedure for testing abandoned wells involves determining the background soil surface methane levels and conducting a gas detection survey using the approved methods. For any anomalies or integrity issues detected during testing, operators must submit an action plan with a timeline to repair the abandoned well.

In New Brunswick, Appendix 2 of the *Responsible Environmental Management of Oil and Natural Gas Activities in New Brunswick: Updated Rules for Industry* [108] sets out testing, reporting and repair requirements for SCVF and GM. Among other conditions, a SCVF is considered serious if hydrogen sulphide is present or if the flow rate is greater than 40 m^3/d [108]. GM is deemed serious if there is the potential for a fire or safety hazard or for environmental damage [108]. Appendix 2 of these *Updated Rules for Industry* sets out timelines for repair and mandatory reporting requirements [108].

3.2.1.2.4.1 Leak Detection and Repair Programs

Regulations in some jurisdictions have required the establishment of LDAR programs. Operators under the federal regulations are required to maintain an inventory of applicable equipment and components, and must inspect these for leaks at least three times a year [92]. Each component is to be inspected using the approved instrument, except heavy-oil components, which are to be inspected visually. The approved instruments are portable monitoring instruments or optical gas-imaging instruments that meet the required detection sensitivity.

British Columbia's *Drilling and Production Regulation* [99] requires as many as four comprehensive surveys to detect leaks using an organic vapour analyzer or a gas imaging camera, with the frequency of surveys dependent on the number of days the facility is pressurized in a year. Leaks, in general, must be repaired within 30 days of detection [99]. An LDAR report needs to be prepared annually, and the *Regulation* sets out the minimum information that must be included in the LDAR report [99]. Section 41.2 of the BC *Drilling and Production Regulation* [99] allows an operator to propose an alternative LDAR program. When proposing an alternative LDAR program for approval, the operator must provide to BCER a description of the proposed technology and the practices to be used to ensure reliable operation of the technology [99].

Alberta's AER Directive 60 requires fugitive emission surveys to be conducted using an organic vapour analyzer or a gas-imaging camera annually or triannually, depending on the type of equipment or facility [102]. Leaks must be repaired within 24 hours of identification if they have the potential to cause safety issues or odour issues. In all other cases, the repair must be completed within 30 days of identification [102]. If a major facility shutdown is required to undertake the repair and there is no safety issue posed by the leak, repair can be delayed until the next plant shutdown [102]. AER Directive 060 [102] explicitly notes that AER will consider innovative and science-based alternatives to what is prescribed in the Directive. These alternative programs may include continuous monitoring devices and vehicle-mounted sensors [102].

Saskatchewan's *Venting and Flaring Requirements Directive* [105] requires LDAR surveys to be conducted twice a year at gas facilities whose production exceeds the prescribed annual threshold [105]. Like the federal regulations, this Directive also requires, with a few exceptions, all equipment to be surveyed and prescribes specifications for approved inspection instruments. The Directive requires a leak repair to be performed either within 30 days of detection or immediately if the gas exceeds the prescribed H_2S concentration or causes off-lease odours. This requirement differs from the federal requirement for repairing significant leaks within 15 days of detection [95]. Despite the 30-day repair period in Saskatchewan, if the repair requires facility shutdown, the leak repair may be postponed until the next plant turnaround so long as there are no safety risks [105].

In Ontario, the *Oil, Gas and Salt Resources of Ontario Provincial Operating Standards* [107] require well operators to take precautions to prevent leakage of oil or gas from reservoirs, well tanks, containers, pipes or other works as part of the conservation requirements. The Ontario *Ministry of the Environment, Conservation and Parks* has also issued *Technical Standards to*



Manage Air Pollution [111] under the authority of the *Local Air Quality Regulation* [80]. Requirements are established for different industries, including the petroleum refining industry [111]. Part VI of Ontario's *Petroleum refining – Industry standard* concerns LDAR and requires a leak survey be undertaken at least three times a year [111]. The repair time once a leak has been detected depends on the concentration of VOCs measured at the site of the leak, and can range from 7 days after detection to 30 days after detection [111].

The Quebec *Regulation respecting petroleum exploration, production and storage on land* [112] has general requirements related to leak testing at various stages of a project, and requirements for maintenance of records regarding leak testing. Quebec facilities are subject to federal regulations regarding methane and VOC emissions from upstream PNG activities.

In New Brunswick, the *Petroleum Product Storage and Handling Regulation* [113] made pursuant to the *Clean Environment Act* [15] accords the Minister the authority to add conditions requiring systems be fitted with automatic leak detection systems as part of an environmental approval. The Government of New Brunswick has also issued the R*esponsible Environmental Management of Oil and Natural Gas Activities in New Brunswick Updated Rules for Industry* [108], which build upon provincial regulations and are implemented as conditions for approvals. Performing leak detection surveys and taking corrective actions during well design and drilling, and during well completion, are listed as examples of mitigation measures. However, these Rules for Industry do not have the detailed requirements in relation to LDAR that exist in other jurisdictions.

The lack of standardized approaches across different jurisdictions was noted as a problem by some interested parties. The absence of a unified standard related to leak detection and repair programs has the potential to create challenges for organizations that work across multiple jurisdictions. The federal requirements in relation to LDAR, as well as the requirements in British Columbia, Alberta and Saskatchewan, are largely aligned and have been developed in a coordinated manner, as noted in Canada's 2024 National Inventory Report [92]. During engagement sessions, some participants noted emissions monitoring and reporting to be an area for potential standardization, particularly using more advanced technologies and data analysis methods. Participants observed that provincial requirements and usage of technology varies across Canada, and that Alberta's requirements tend to support more advanced technologies compared to other jurisdictions.

3.2.1.2.5 Equipment Performance Requirements for NO_x

Some jurisdictions have regulations that set out performance requirements for air pollution technologies (equipment) used in PNG installations. These performance requirements are specific to equipment like boilers, heaters, flare stacks and engines. Both the federal Multi-Sector Air Pollutants Regulations (MSAPR) [33] and BC's *Oil and Gas Waste Regulation* [60] set limits for the NO_x emissions intensity of gas turbines and internal combustion engine drivers.

During engagement sessions with interested parties, the MSAPR [33] was noted as an example of a program that has been relatively effective at motivating capital investment in the PNG industry to reduce NO_x emissions. However, it was also noted that the MSAPR [33] is not an easy regulation to read and interpret. This observation is supported by a 2021 report by Environment and Climate Change Canada [115], which noted industry representatives identified the need for greater technical support and guidance to support implementation of and compliance with the MSAPR. In spite of the challenges, the MSAPR [33] was noted by interested parties to have provided the industry with a clear roadmap, enabling companies to plan for NO_x reductions and achieve compliance well in advance of compliance timelines. The MSAPR [33] includes coming-into-force provisions for different equipment types, so organizations can plan financially and operationally in advance for compliance with the regulations [116].

3.2.1.2.6 Greenhouse Gases

In 2022, the PNG sector contributed to Canada's national greenhouse gas (GHG) emissions, accounting for 31% of the total [117].

All provinces with substantial PNG activities have regulations that target GHG emissions. In general, GHG regulations apply to all industries where there are facilities producing emissions above a defined threshold. In all such schemes, the federal and provincial governments have established emissions intensity thresholds (e.g., tCO_2e per unit of production) for high-emitting sectors. The GHG emissions limits for individual facilities are then determined based on their production levels relative to these thresholds. Table 6 shows the approaches in place across Canada and the relevant legislation.

The federal *Greenhouse Gas Pollution Pricing Act* [118] sets out a pricing system for carbon pollution. The federal *Output-Based Pricing System (OBPS) Regulations* [119] maintains a price signal equivalent to the minimum national carbon pollution price and applies to industrial emitters. The OBPS mechanism, which sets limits on the amount of GHG emissions per unit of production across various industrial sectors, prescribes emissions limits relative to the output of a facility [118]. Emissions limits are expressed in terms of mass of CO_2 equivalent (CO_2e), which expresses the GHG emissions in terms of the amount of carbon dioxide emission that would have an equivalent effect on climate change as the emitted amount of the GHG or a mixture of GHGs [135]. The *OBPS Regulations* [119] apply to facilities that have annual emissions greater than or equal to 50,000 tonnes CO_2e. For petroleum and natural gas facilities, there are three greenhouse gases that are to be quantified – carbon dioxide, methane and nitrous oxide [119].

The *OBPS Regulations* [119] set out the types of emissions for which GHGs must be quantified – stationary fuel combustion emissions, industrial process emissions, industrial product use emissions, venting emissions, flaring emissions, leakage emissions, on-site transportation emissions, waste emissions and wastewater emissions [119]. Provinces and territories can implement their own instruments provided they meet the federal benchmark requirements.

The federal and provincial mandated instruments further detail the specific GHGs that must be accounted for and the process units for which reporting must be completed. For example, the *Greenhouse Gas Emission Reporting Regulation* (BC) [121], made pursuant to the *Greenhouse Gas Industrial Reporting and Control Act* [120] lists the types of process streams for which emissions must be reported [121].

British Columbia's *Greenhouse Gas Emission Reporting Regulation* [121] requires reporting for facilities that have annual emissions equal to or greater than 10,000

Table 6: Approaches to greenhouse gas emissions management across Canada

Jurisdiction	Approach	Mandated Instrument
Canada	**OBPS**	*Greenhouse Gas Pollution Pricing Act* [118] *Output-Based Pricing System Regulations* [119]
BC	**OBPS**	*Greenhouse Gas Industrial Reporting and Control Act* [120] *Greenhouse Gas Emission Reporting Regulation* [121] *Greenhouse Gas Emission Offset Project Regulation* [122]
AB	**OBPS**	*Emissions Management and Climate Resilience Act* [123] *Technology Innovation and Emissions Reduction Regulation* [124] *Specified Gas Reporting Regulation* [125]
SK	**OBPS**	*The Management and Reduction of Greenhouse Gases Act* [126] *Oil and Gas Emissions Management Regulation* [103]
ON	**OBPS**	*Greenhouse Gas Emissions Performance Standard* [127] *Greenhouse Gas Emissions: Quantification, Reporting and Verification* [128]
QC	**Cap-and-Trade**	*Environmental Quality Act* [14] *Regulation respecting mandatory reporting of certain emission of contaminants into the atmosphere* [85]
NB	**OBPS**	*Climate Change Act (NB)* [129] *Reduction of Greenhouse Gas Emissions Regulation* [130] *The Reporting and Reduction of Greenhouse Gas Emissions Standard* [131]

tonnes CO_2e. In relation to petroleum and natural gas activities, the reporting requirements are for carbon dioxide, methane and nitrous oxide [121]. In 2024, the BC Output Based Pricing System was implemented targeting industrial emitters that emit over 10,000 tonnes CO_2e through amendments made to the *Greenhouse Gas Industrial Reporting and Control Act* [120], [136]. The BC *Emission Offset Project Regulation* [122] sets out requirements for claiming offsets from an approved project. In order to have reductions recognized as BC Offset Units, projects must meet provincial regulations and requirements set out in a director-approved offset protocol. Independent validators and verifiers provide third-party reviews to ensure the resulting offsets are verifiable and incremental.

Alberta's *Emissions Management and Climate Resilience Act* [123] establishes authority for the creation of regulations to govern specified gas emissions and to set out reporting requirements in relation to GHGs. The *Specified Gas Reporting Regulation* [125] authorizes the creation of a *Specified Gas Reporting Standard* [137] to set the threshold for mandatory reporting of GHG emissions. The Standard sets the annual threshold for reporting at 10,000 tonnes CO_2e. The *Technology Innovation and Emissions Reduction (TIER) Regulation* [124] applies to facilities that have annual emissions equal to or greater than 100,000 tonnes CO_2e. It sets out maximum emissions thresholds beyond which compliance obligations are required to be made to a technology innovation fund. Offsets or emissions

performance credits (EPCs) up to a percentage can be used towards this compliance obligation. The *TIER Regulation* [124] sets out requirements for emission offset projects and registering such projects with the Alberta Emissions Offset Registry.

In Saskatchewan, *The Management and Reduction of Greenhouse Gases Act* [126] sets out authorities for the regulation of GHG emissions from regulated emitters in the province. It requires regulated emitters establish a baseline emission level for each facility owned or operated by a regulated emitter. Saskatchewan's *Oil and Gas Emissions Management Regulations* [103] apply to entities whose combined potential annual emissions are greater than 50,000 tonnes CO_2e. The regulations classify each oil facility based on its production class (i.e., the geographic location and the type of oil produced, either heavy or non-heavy). The emissions intensity limit established for each year is specific to each production class.

In Ontario, PNG activities are subject to the *Greenhouse Gas Emissions Performance Standards* regulation [127], which establishes a system of allocating an allowable quantity of GHG emissions to each facility on an annual basis. Facilities that emit more GHG emissions than their allocation must pay an amount per tonne of CO_2e. The allowable quantity becomes more stringent every year, requiring facilities to reduce their emissions or pay for their exceedances. The *Greenhouse Emissions: Quantification, Reporting and Verification* regulation [128] requires reporting of GHG emissions for facilities that emit 10,000 tonnes of CO_2e or more annually. The GHGs covered by the regulation include six gases identified in Ontario's *Environmental Protection Act* [13] and nitrogen trifluoride, which is added through the regulation [128].

Of the provinces reviewed, Quebec is the only province that uses a different approach than OBPS. The Quebec *Environmental Quality Act* [14] sets out the framework for GHG reporting and for the establishment of a cap-and-trade system. The Quebec *Environmental Quality Act* [14] defines GHG to mean carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride and any other gas determined by regulation.

In Quebec, the *Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere* [85] is prescriptive, with defined emissions thresholds and set methodologies for determining annual GHG emissions from different activities. The regulation adds nitrogen trifluoride to the list of GHG emissions and establishes mandatory reporting for any operator emitting 10,000 tonnes of CO_2e or more annually [85]. The GHG emissions report must include annual emissions from PNG exploration and production, and natural gas processing facilities, attributable to all the listed activities [85].

New Brunswick's *Climate Change Act* [129] sets GHG emissions reduction targets, establishes a climate change fund and allows for the setting of industrial emissions limits. This *Act* defines GHGs the same way as the Quebec *Environmental Quality Act* [14] and sets the threshold for industrial facilities subject to regulations at 50,000 tonnes CO_2e or more. The *Reduction of Greenhouse Gas Emissions* (NB) [130] sets the framework for establishing GHG emissions intensities for various regulated facilities and makes reference to standards with which regulated facilities need to comply. New Brunswick's *Reporting and Reduction of Greenhouse Gas Emissions Standard* [131] sets out detailed quantification and reporting requirements.

Most regulations for GHG emissions across Canada refer to the need for third-party verification of annual reporting. These verifications must meet the ISO 14064-3 [132] and ISO 14065 [133] standards as shown in Table 7.

The exception is Saskatchewan, which has no such requirements. However, it is worth nothing that amendments made in November 2024 to Saskatchewan's *The Management and Reduction of Greenhouse Gases (General and Electricity Producer) Regulations* [134], which applies to facilities that produce electricity using gas or coal, included reference to the ISO 14064-3 [132] and ISO 14065 [133] standards. Details with respect to these ISO standards are provided in Section 5 of this report.

Table 7: Provincial references to ISO greenhouse gas standards

Jurisdiction	Regulatory Framework	Referenced ISO Standards
Federal	*Output-Based Pricing System Regulations* [119]	ISO 14064-3
		ISO 14065
British Columbia	Greenhouse Gas Emission Reporting Regulation [121]	ISO 14064-3
		ISO 14065
	Emission Offset Project Regulation [122]	ISO 14064-3
		ISO 14065
Alberta	Technology Innovation and Emissions Reduction (TIER) Regulation [124]	ISO 14065
Ontario	Greenhouse Gas Emissions: Quantification, Reporting and Verification [127]	ISO 14064-3
		ISO 14065
Quebec	*Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere* [85]	ISO 14064-3
		ISO 14065
New Brunswick	*The Reporting and Reduction of Greenhouse Gas Emissions Standard* [131]	ISO 14064-3
		ISO 14065

During consultations with interested parties, the evolving regulatory landscape for GHG emissions reporting was noted to be a challenge. The lack of alignment among federal and provincial requirements was noted by some participants. While Quebec follows a cap-and-trade system, an OBPS approach is in place at the federal level and in other provinces. There is also some variability in the reporting thresholds as noted.

3.2.1.3 Decommissioning, Abandonment and Reclamation

Abandonment of PNG wells and pipelines presents air emissions challenges, particularly concerning the release of methane, VOCs and sometimes hydrogen sulphide.

In British Columbia, the *BCER Well Decommissioning Guidelines* [139] describe the process of decommissioning and abandoning wells. Surface casing vent flow (SCVF) testing must be undertaken prior to cutting and capping a completed or cased well after downhole abandonment activities have been completed, and the results reported to BCER [139]. GM testing prior to conducting surface decommissioning is recommended and if GM issues are detected, surface decommissioning activities cannot take place [139].

In Alberta, AER Directive 20: *Well Abandonment* [140] describes the process for well abandonment, including testing requirements. It recommends performing GM and SCVF tests prior to beginning downhole abandonment so that if an issue is found, the well does not need to be re-entered to correct the issue. GM testing must be completed on cased-hole well abandonments and in specific township areas [140]. If a GM issue is found, AER must be notified within 30 days of detection, and the GM issue must be repaired [140]. SCVF testing must also be completed to determine if there is any gas leakage from the casing vent assembly [140].

In Saskatchewan, PNG015: *Well Abandonment Requirements* [141] sets out the process for abandoning wells. It also requires GM and SCVF testing to be undertaken prior to cutting and capping a well. If the



"An environmental site assessment (ESA) can be conducted during the first stages of a project to assess the site conditions and existing environmental contamination and liability."

tests result in issues being identified, repairs must be undertaken before the well can be cut and capped [141]. The well must also be monitored for signs of wellbore problems until an acknowledgement of reclamation has been issued by the regulator [141].

In Ontario, the *Exploration, Drilling and Production* regulation [142] requires PNG wells be plugged as soon as practical and no later than 12 months after being decommissioned. The *Oil, Gas and Salt Resources of Ontario Provincial Operating Standards* [107] include requirements for plugging and capping of wells.

In Quebec, the *Regulation respecting petroleum exploration, production and storage on land* [112] sets out requirements for well closure. An operator that is permanently closing a well is required to conduct SCVF testing to ensure there are no emissions to atmosphere from the well [112]. As part of the application for permanent well or reservoir closure, the applicant must include information on the method used to demonstrate there have been no surface vent emissions over a period of 24 hours and no gas migration [112].

The *Responsible Environmental Management of Oil and Natural Gas Activities in New Brunswick Updated Rules for Industry* [108] notes that the Province of New Brunswick will enhance its requirements for well abandonment by adopting the latest version of AER Directive 020 [140].

3.2.2 Soil

3.2.2.1 Planning

3.2.2.1.1 Environmental Site Assessment (ESA)

During the planning stage, projects are generally required to undertake an assessment of land use impacts. The extent of the site assessment required varies from province to province. An environmental site assessment (ESA) can be conducted during the first stages of a project to assess the site conditions and existing environmental contamination and liability.

The regulations across Canada use different terminology for similar concepts related to environmental site assessments. Alberta, Saskatchewan and Quebec use terminology of "Phase I" and "Phase II" environmental site assessments, in alignment with the CSA standards. However, only Alberta and Saskatchewan directly reference CSA Z768, *Phase I Environmental Site Assessment* [143] and CSA Z769, *Phase II Environmental Site Assessment* [144]. The CER *Filing Manual* [73] suggests considering the guidance provided in these two CSA standards where contaminated soil is suspected. In Ontario, the terms used are "phase one" and "phase two" environmental site assessments, and in British Columbia the terms used are "Stage 1 Preliminary Site Investigation" and "Stage 2 Preliminary Site Investigation." The scope of the various types of assessments are similar, notwithstanding the differences in nomenclature.

At a minimum, Phase I environmental site assessment (ESA) is required across all jurisdictions. This involves non-intrusive investigation, such as a historical review of reports on spills, waste management and water management, and site inspection documented in a comprehensive report. Phase I ESA in Alberta and Saskatchewan must be conducted in accordance with CSA Z768 [143]. If evidence indicates that further investigation is warranted, or compliance cannot be concluded, then a Phase II ESA is required [33]. Phase II ESA in Alberta and Saskatchewan must be conducted in accordance with CSA Z769 [144]. A qualified third-party consultant must conduct the Phase II ESA and prepare a report on the extent of contamination present and follow-up work required for remediation. The interrelation between contaminant sources, pathways and receptors on a contaminated site must be clearly defined in ESA reports.

In Ontario, the Ministry of Environment, Conservation and Parks has developed guides for completing phase one and phase two ESAs to support the *Records of Site Condition regulation* [145], [146]. The latest version of these guides replaced cross-referencing to the CSA Z768 [143] and CSA Z769 [144] standards with detailed, stand-alone rules for ESAs to support the Ontario regulation.

In Quebec, the *Site Characterization Guide (Guide de caractérisation des terrains)* [147] provides guidance for Phase I and Phase II environmental site assessments. The guide describes requirements and methods for each type of environmental site assessment to a high level of detail, including technologies that can be used for site characterization and collection of data [147]. The Phase I and Phase II requirements in Quebec generally align to the requirements of other jurisdictions in Canada.

In New Brunswick, the *Guide to Environmental Impact Assessment in New Brunswick* [64] notes the requirement for a description of the existing site. This description includes physical and natural features, ownership of adjacent properties, a description of known previous uses of the site for the proposed project, and any known or suspected contamination [64]. While these concepts are similar to those identified in CSA Z768 [143], there is no reference to CSA Z768 [143] and the requirements in the New Brunswick guide are not as detailed as the requirements in CSA Z768 [143].

3.2.2.1.2 Land Use

Identifying land use during the planning stage facilitates prediction of impact assessment and the development of remediation and reclamation plans at the end of a project. The nature of land ownership – whether public or private – influences how land use is managed. On public lands, governments play a key role in permitting and regulating activities to safeguard the biophysical environment. On private lands, landowner agreements and surface rights negotiations become important to secure access for exploration and production while addressing landowner concerns. EIAs and alignment with zoning laws are often prerequisites to ensure compatibility with existing land uses, such as agriculture, forestry or residential development.

In British Columbia, land use planning for oil and gas activities emphasizes environmental management. The *Energy Resource Activities Act* [43] and the *Environmental Management Act* [10] set the requirements for these processes, with permits required for any activity impacting public or private lands. The Agricultural Land Commission established through the *Agricultural Land Commission Act* [148] restricts non-agricultural uses on designated lands, necessitating specific approvals for PNG projects. Additionally, the BCER *Oil and Gas Activity Application Manual* [149] sets out technical requirements for land use, emphasizing sustainability and the protection of ecosystems and water resources.

Alberta integrates land use planning into oil and gas operations through the *Alberta Land Stewardship Act* [150], which establishes regional plans that balance industrial development with environmental conservation. Alberta's *Public Lands Act* [151] governs access to Crown lands, requiring operators to obtain permits for activities such as drilling and infrastructure development. The *Environmental Protection and Enhancement Act* [11] requires projects align with sustainable land management practices and minimize conflicts with other land uses.

The requirements for impact assessment can vary based on different land classification schemes that may exist provincially. For example, in Alberta, the *Special Areas Act* [152] defines three special land areas (Special Area 2, Special Area 3 and Special Area 4) based on geographic location that are managed by the Special Areas Board as the governing authority. PNG activities in these special areas must align with the land-use priorities and conservation mandates managed by the Special Areas Board.

For the Alberta Oil Sands Project application, the relevant local and regional land-use plans (e.g., Lower Athabasca Region Plan, South Saskatchewan Regional Plan) are identified and assessed, and a new project must be assessed for compliance with applicable plans, policies, and approvals [153]. The environmental information required includes the evaluation of the project's potential impacts based on its location, setting and duration, with consideration for both the spatial and temporal scales of the activities involved.

In Saskatchewan, land use considerations under the *Oil and Gas Conservation Act* [38] and the *Environmental Management and Protection Act* [12] include measures to maintain soil integrity, especially in agricultural regions, to balance resource development with sustainable land management.

In Ontario, the *Oil, Gas and Salt Resources Act* [55] and *Ontario Planning Act* prioritize soil health within land use zoning and environmental assessments, particularly in agricultural regions where soil quality underpins economic and community well-being.

In Quebec, requirements under the *Petroleum Resources Act* [57] and the *Environmental Quality Act* [14] ensure soil protection by mandating comprehensive assessments, particularly in areas of high ecological value.

In New Brunswick, the *Clean Environment Act* [15] require soil assessments as part of environmental impact studies, focusing on protecting soil in forested and agricultural landscapes.

3.2.2.2 Operational Requirements

Legislative provisions to protect soil during PNG operational activities are primarily focused on spill prevention management, as well as management of drilling waste for upstream activities. Regulations across Canada mandate the use of spill containment systems to prevent soil contamination from hydrocarbons and other hazardous substances.

British Columbia's *Environmental Protection and Management Regulation* [65] sets out a broad objective of ensuring that soil does not become unstable and that any alternations to the natural surface drainage patters are minimized. The *Environmental Protection and Management Guideline* [154] sets out operational measures to achieve these objectives. They include requirements for storage of different types of soils, soil stockpile limits and requirements, monitoring requirements, and measures to be taken to stabilize soils. In British Columbia, the *Drilling and Production Regulation* [99] requires operators to implement measures to prevent spills and to have a contingency plan in place.

In accordance with British Columbia's *Oil and Gas Activity Application Manual* [149], sand erosion risks associated with sand fracturing are minimized through the development of a sand management plan. This plan must outline procedures for monitoring sand returns during cleanup, initial production and throughout the well's life, including after pressure build-ups [149]. It should also include strategies for using de-sanding equipment, controlling sand returns during well alterations, and optimizing piping to reduce erosion [149]. Regular reviews and updates of the plan are required, and it must be accessible to the Regulator upon request to ensure effective management and compliance [149].

In Alberta, operators of oilfield waste management facilities are required to establish a site-specific soil monitoring program, in accordance with the *Soil Monitoring Directive* [155]. A soil monitoring program must be implemented once every five years, and a soil monitoring report needs to be submitted. If there

is an exceedance in any soil quality parameter, a soil management program must be implemented and a soil management report provided to the regulator.

The Saskatchewan *Environmental Code* [16] sets out requirements for reporting discharges to the environment. The *Code* also sets out results-based objectives in relation to land, specifically limiting the probability of unacceptable adverse effects in an area of land. The *Code* requires the development of an environmental protection plan that describes how this objective is going to be achieved [17]. Once the environmental protection plan has been accepted by the environment ministry, the entity is required to comply with the environmental protection plan and any additional conditions imposed by the AHJ.

In Ontario, as part of the permitting process, the entity is required to describe any contaminants that may be discharged to any part of the natural environment other than water, and any contaminant monitoring programs. The Ontario government has created various environmental land use planning guidelines, including *Environmental Considerations for Gas or Oil Pipelines and Facilities* [156]. This guideline notes that considerations of interest to the environment ministry include sediment and soil contamination, including potential sources and appropriate containment, clean-up and disposal [156].

3.2.2.3 Decommissioning, Abandonment and Reclamation

The process of decommissioning, remediation and reclamation differ for upstream, midstream and downstream PNG activities due to variations in their operational scope, environmental impacts and regulatory requirements. Table 9 summarizes key differences, while the attributes of federal and provincial regulations are described in more detail below.

When an entity that falls under the jurisdiction of the CER is seeking to abandon or remove a pipeline or facility, it is required to file an application with the CER. As part of its application, it needs to assess the potential environmental and socioeconomic risks of abandonment in place or the risks of removal. A Phase I ESA in accordance with the CSA Z768 standard [143] needs to be completed. If the Phase I ESA indicates further assessment is required, a Phase II assessment must also be carried out in accordance with the guidance of the CSA Z769 standard [144].

Table 8: Key differences in decommissioning, abandonment and reclamation across the value chain

Activity	Primary Soil Impacts	Focus of Decommissioning	Focus of Remediation	Focus of Reclamation
Upstream 	Land disturbance, drilling waste, spills	Well abandonment, site removal	Hydrocarbon, chemical, and drilling waste cleanup	Restoration to equivalent land capability
Midstream 	Erosion, leaks from pipelines, tank spills	Pipeline removal or in-situ abandonment	Addressing pipeline and tank-related contamination	Restoration of pipeline right-of-way and facility sites
Downstream 	Soil contamination from refining byproducts, spills	Facility dismantling and hazardous waste disposal	Advanced techniques for heavy metals, hydrocarbons	Redevelopment for industrial or commercial use

The applicant needs to provide a reclamation monitoring plan that sets out the parameters that will be monitored, the monitoring methods, and when corrective actions will be implemented.

In British Columbia, the *Dormancy and Shutdown Regulation* [157] makes reference to the *Contaminated Sites Regulation* [158] in relation to criteria for dormant and former sites. The BCER *Site Remediation and Reclamation Manual* [159] also refers to requirements of the *Contaminated Sites Regulation* [158]. A Certificate of Restoration obtained from BCER can be applied for if a site has been effectively remediated. Whether or not a site is considered contaminated depends on the criteria set out in the *Contaminated Sites Regulation* [158].

The *Alberta Tier 1 Soil and Groundwater Remediation Guidelines* [160] and the *Alberta Tier 2 Soil and Groundwater Remediation Guidelines* [161] form part of the *Remediation Regulation.* The Tier 1 approach is premised on the assumption that all exposure pathways to receptors exist (i.e., direct contact, drinking water, inhalation). In Tier 2, certain exposure pathways may be able to be ruled out if it can be demonstrated that there is no realistic potential for the contaminant to reach a receptor through that pathway [160], [161]. While numerical targets have been provided for remediation of contaminated soils, the guidelines are clear that these targets are not "pollute-up-to" levels, i.e., levels to which pollution is permitted [160], [161]. The guidelines provide direction on ascertaining background concentrations, delineation of contamination, and risk assessment and exposure control [160], [161].

Under Alberta's *Oilfield Waste Management Requirements for the Upstream Petroleum Industry* [162], on site land treatment involves the controlled mixing of oilfield wastes with soil to biodegrade and assimilate waste constituents. The process must ensure that hydrocarbon concentrations are reduced within five years [162]. Land treatment is limited to shallow subsoils and should only occur on areas with a slope of 5% or less [162]. Before treatment, the waste and soil must be analyzed for pH, electrical conductivity, sodium absorption ratio, total metals, hydrocarbons, and bulk density to ensure suitability for land treatment [162].

In Saskatchewan, third-party ESA of at least first Phase is required upon abandonment of a well and decommissioning of a facility [163]. Records must be provided in relation to the history of any spills and clean-up activities, waste disposal practices and other site records [163]. A Phase II ESA may be required based on the amount, quality and nature of information available during the Phase I ESA [163]. Saskatchewan has a formal acknowledgement of reclamation process, in which the company or operator requests approval from the Saskatchewan Ministry of Energy and Resources (SK MER), or the Saskatchewan Ministry of Environment, to confirm the facility has been properly decommissioned, remediated and reclaimed.

In Ontario, the *Rehabilitation of Lands* [164] regulation made pursuant to the *Mining Act* [165] sets out requirements for rehabilitation for projects that are suspended, in a state of inactivity or being closed out. The requirements in the regulation are general, such as requiring soils to be tested for contamination. If contamination is found, a risk assessment and corresponding action plan to address the contamination needs to be developed. The regulation requires rehabilitation requirements in the *Mine Rehabilitation Code of Ontario* [166] be followed. The Code includes requirements for revegetation in the post-closure state and specific considerations related to soil preparation including soil assessments and pH correction, dust and erosion control soil amendment [166].

The *Records of Site Condition* [167] regulation in Ontario governs changes in land use, including from industrial use, including the production of petroleum or natural gas, to other land use categories. The *Record of Site Condition* [167] regulation sets out requirements for undertaking site assessments. The quantitative limits for contaminants in soil are set out in the *Soil, ground water and sediment standards* [168].

In Quebec, the *Regulation Respecting Petroleum Exploration, Production and Storage on Land* [112] sets out requirements for well closure and site restoration. The regulation defines the requirements for a closure and site restoration plan [112]. As part of the application for well closure authorization, the applicant is required to describe the site restoration work to maintain the

quality of the natural landscape and the rehabilitation of contaminated land [112].

Quebec's *Environmental Quality Act* [14] requires that when an industrial activity in a designated category ceases, a land characterization study must be completed to understand the extent of contamination. PNG activities are among the activities listed in the designated category pursuant to the *Land Protection and Rehabilitation Regulation* [169]. It sets out applicable limit values with respect to specific environmental contaminants in soil.

In New Brunswick, the *Contaminated Sites Regulation* [170] governs the process of a post-remediation closure report and a corresponding record of site Condition. The closure report confirms that the site meets the required environmental requirements in accordance with ministerial protocols. The record of site condition provides details of contaminants addressed, remediation methods employed, and confirmation that the site is suitable for its intended use [170]. The ministerial protocols established through the *Contaminated Sites Regulation* [170] provides detailed guidance on environmental site assessments and remediation requirements. The *Ministerial Protocol – Remediation, Risk Assessment and Monitoring* [171] refers to the Atlantic Risk-Based Corrective Action (Atlantic RBCA) model established by the Atlantic Partnership in Risk-Based Corrective Action Implementation (Atlantic PIRI) committee for criteria for petroleum-impacted sites.

3.2.3 Water

3.2.3.1 Planning

There are various acts and regulations across Canada that apply to the management of environmental impacts to water and that regulate all industry impacts, not just those stemming from the PNG sector. Water rights are vested in the Crown and, as a consequence, diversion and use of water is subject to regulation. This means that during the planning stage of any activity that has the potential to impact water, approvals, licenses or permits are required from the provincial government.

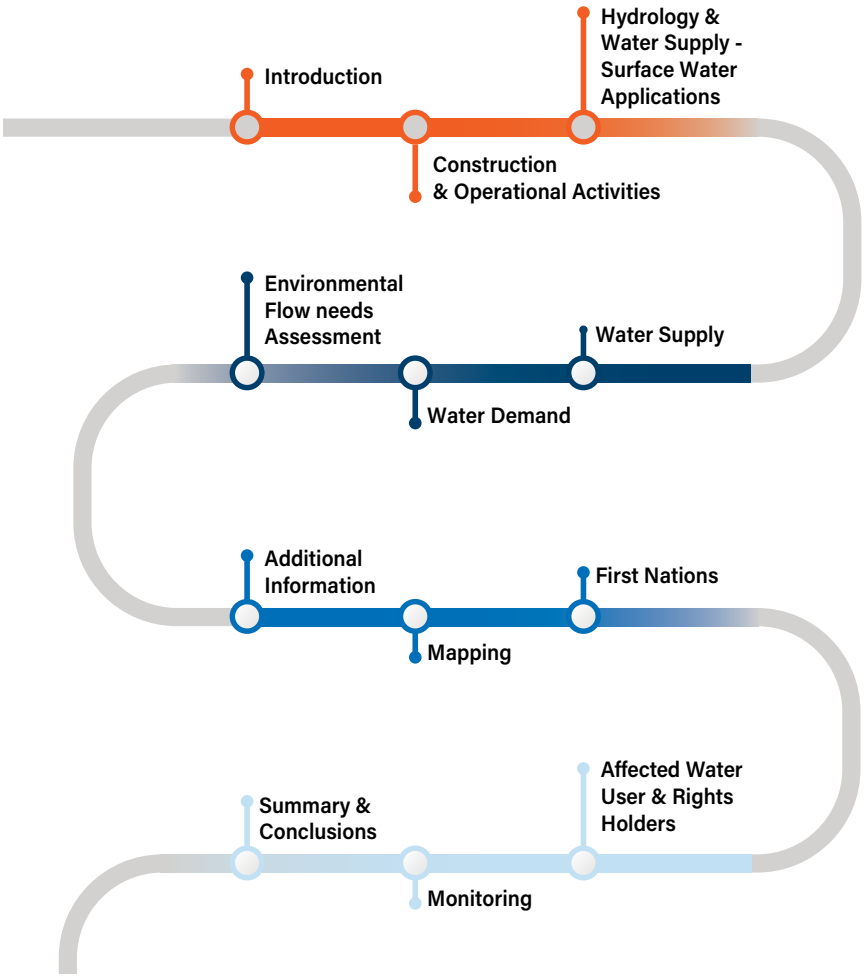
In British Columbia, a water licence or water use approval is required under the *Water Sustainability Act* [172] prior to diverting or using any surface water or ground water for PNG activities. Operators, including pipeline companies, can apply under the short-term use provision of the *Water Sustainability Act* [172] to use water for periods of up to 24 months without a formal water licence. This mechanism is generally intended for activities where water use is temporary and limited in scope, such as construction projects or initial operational phases of pipeline installations [139]. During this period, the operator is required to adhere to certain conditions to ensure the water use does not adversely impact water quality or hydrological systems [139].

The *Water Sustainability Act* [172] also allows for temporary water use without need for a formal water licence or water use approval under certain circumstances. For example, immediate action may be required to address emergency situations like spills, accidents, or unforeseen events that may pose a threat to public safety or the environment. In such cases, the operators must demonstrate that water use is necessary to address the emergency situation and that efforts will be made to minimize environmental impacts.

British Columbia's *Oil and Gas Activity Application Manual* [149] notes that if an application is being made for a short-term use approval with the intent of subsequently applying for a water licence under the *Water Sustainability Act* [172], then a full water management plan (WMP) must be submitted. The *Oil and Gas Activity Application Manual* [149] refers to the BCER *Water Licence Application Manual* [173], which includes a template for a WMP. Figure 8 summarizes the requirements of a WMP. If there is a requirement for water to be withdrawn from a riparian source, an environmental flow needs (EFN) assessment is required. An EFN considers the volume and timing of water flow essential to the proper functioning of the aquatic ecosystem [173].

The Alberta *Water Act* [174] and the Quebec *Environmental Quality Act* [14] similarly require government authorization for any project that entails the use of water or has impacts to water. Applications typically require information on the nature of the activities being undertaken, the source, quantity and concentration of contaminants likely to be discharged, and proposed mitigation and monitoring measures.

Figure 8: Requirements of a water management plan (BCER) [173]



The Alberta *Water Act* [174] sets out planning and environmental assessment requirements and the process for issuance of licences and approvals [174]. As part of the application process for PNG operations, an applicant needs to identify:

- The wetland types that are in the vicinity and the potential project effects on wetlands
- Water bodies in the area that are sensitive to changes in water chemistry or that have atypical attributes
- The potential effects of the project on water quality must be described together with the mitigation measures

In Saskatchewan, the *Water Security Agency Act* [175] establishes the framework for issuance of water licences to access water sources, including aquifers. It specifies that any entity intending to construct or operate works that affect water resources must obtain approval from the Water Security Agency.

In Ontario, a Permit to Take Water (PTTW) is required pursuant to the *Ontario Water Resources Act* [176] for any person taking more than 50,000 litres of water a day. PNG activities would require detailed ecological, hydrological and hydrogeological assessments. When determining whether to issue a permit, the Ontario government considers issues related to protection of

ecosystem functions, water availability, water use, the manner and location of water return, interested parties and international water agreements [176].

In New Brunswick, a water supply source assessment (WSSA) is required as part of the EIA process [177]. As part of the WSSA, a hydrogeological assessment is required to determine if the water supply source can provide adequate quantity and quality of water for the intended use [177].

3.2.3.2 Operations

3.2.3.2.1 Water Consumption

One of British Columbia's environmental objectives reflected in their *Environmental Protection and Management Regulation* [65] is to ensure that activities do not cause a material effect on the quality, quantity or natural timing of flow for aquifers. While British Columbia does not set out specific restrictions under the *Regulation* for water consumption, as part of the permitting process, an environmental flow needs (EFN) assessment is required. The *Water Sustainability Act* [172] charges the decision-maker with the responsibility of considering the EFN when making a decision regarding an application. If the activity is likely to have a significantly adverse impact on water quantity, the decision-maker can set terms and conditions on the project.

During engagement sessions with interested parties, water management was noted by some participants to have emerged as a critical focus in British Columbia's environmental management approach, particularly following the implementation of the *Water Sustainability Act* [172] in 2016. This Act resulted in updated regulations that emphasize EFN and sustainable water use. Participants noted that the province's heightened concern over water management has been driven by increasing public awareness of water management issues and the growing threat of drought. The Government of British Columbia has noted that the *Water Sustainability Act* [172] provides new tools for protecting, managing and using water efficiently.

BCER requires operators that hold water licences and short-term water use approvals report water withdrawal for the quarter [178]. On a quarterly basis, BCER publishes for a public report that shows the source of water, the corresponding water basin, the annual approval amount, and the water use for each operator holding a water withdrawal licence [178].

The industry is also piloting new, targeted mitigation strategies that further bolster water protection efforts. Challenges in water quality management, such as water turbidity and sedimentation, were noted by some interested parties during the engagement. Erosion and sediment control were noted as areas of opportunity for improvement during engagement sessions, particularly given that uncontrolled construction activities can exacerbate these issues and adversely impact water quality.

The AER has established indicators for environmental performance, and in the case of water consumption, tracks non-saline water use per barrel of oil equivalent. This measure allows standardization of production volumes from different energy resources, such as natural gas and different types of crude oils [179], as a metric of water use efficiency. Reports are required to be submitted by operators to AER with respect to water withdrawals, including volumes, sources and purposes of water taken [174].

Alberta's Directive 081 – *Water Disposal Limits and Reporting Requirements for Thermal In Situ Oil Sands Schemes* [180] addresses various elements of water management for thermal in situ oil sands operations, such as steam-assisted gravity drainage (SAGD). Directive 081 [180] notes the overall goal of minimizing the use of high-quality make-up water by recycling produced water efficiently.

Alberta's *Surface Water Quantity Management Framework for the Lower Athabasca River* [181] sets out water withdrawal limits to facilitate management of oil sands water withdrawals from the Athabasca River. These limits consider seasonal variability and become regulatory conditions through *Water Act* licences that must be complied with by oil sands operators on a daily basis [181].

In Ontario, once a PTTW has been obtained, the permit holder is required under the *Water Taking and Transfer* [182] regulation to record the volume taken

daily using a flow meter or another method acceptable to the authority. These daily consumption values are consolidated and submitted on an annual basis to the ministry [182].

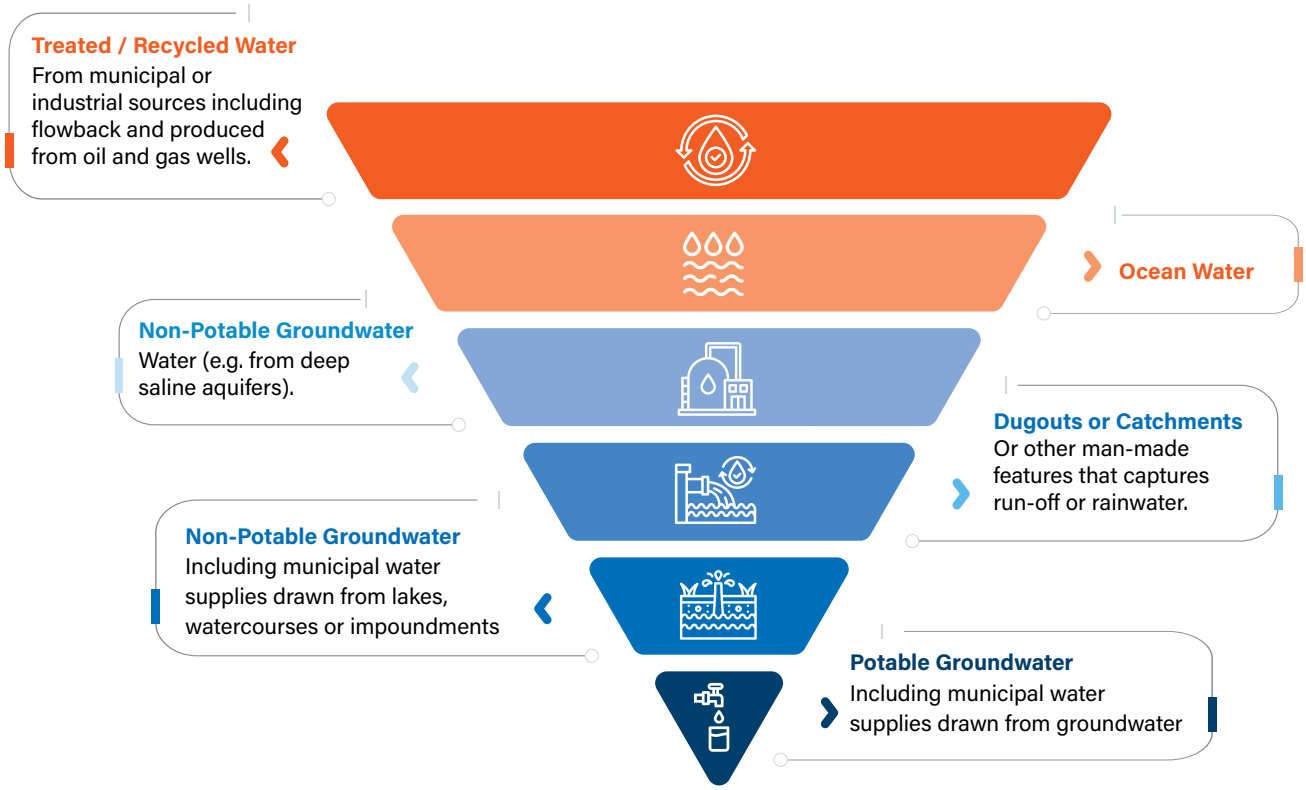
The Quebec *Environmental Quality Act* [14] sets out the requirement for an authorization prior to carrying out any withdrawal of water. The *Regulation* respecting the charges payable for the use of water [183] was recently introduced to establish charges for water use, including for oil and gas extraction. The charges apply to any activity that results in daily water consumption greater than or equal to 50,000 litres per day for any day in the year. A pre-established charge rate is set by the regulations and is intended to motivate protection of water resources [183].

In New Brunswick, the *Responsible Environmental Management of Oil and Natural Gas Activities in New Brunswick – Updated Rules for Industry* [108] notes that recycling and reuse are preferred methods for managing flowback water. Operators are required to prepare a water management plan that demonstrates the potential sources of water considered and the rationale for the proposed choice of water source [108]. The *Rules for Industry* articulate a hierarchy of preferred water source, (see Figure 9) [108]. If the withdrawal rate from groundwater is greater than 50m^3/d, then the operator is required to undertake a WSSA [108].

3.2.3.2.2 Contaminants of Concern and Effluent Discharge

Protection of inland fisheries and coastal waters fall under the jurisdiction of the federal government and the *Fisheries Act* [30], which regulates the release of deleterious substances. Under the *Fisheries Act,* the *Petroleum Refinery Liquid Effluent Regulations* [61]

Figure 9: Hierarchy of preferred water source [108]



(a Layer 4 instrument) prescribe maximum limits in relation to oil and grease, phenols, sulfide, ammonia nitrogen, total suspended matter and any substance that impacts pH. These Regulations prescribe limits on an intensity basis, i.e., in relation to the maximum rate, in barrels per day, that crude oil is processed in the refinery [61]. These prescriptive limits have also been translated directly in some provinces into provincial regulatory requirements, as in the case of Quebec's *Regulation respecting the liquid effluents of petroleum refineries* [184]. All other provinces, however, directly refer to the federal requirements.

In Saskatchewan, surface water must also be tested for pH levels, chloride content and hydrocarbon presence. Additional tests for oil and grease, conductance, total dissolved solids and Microtox® bioassays must be carried out if there is the possibility of the water containing contaminated materials as per the *Saskatchewan Upstream Petroleum Industry Storage Standards* [185] under the *Oil and Gas Conservation Act* [38].

3.2.3.2.3 Hydraulic Fracturing

Hydraulic fracturing involves the use of pressure from a fluid in a wellbore to crack or fracture the rock layer to facilitate petroleum or natural gas flow. Produced water (i.e., water produced as a byproduct when petroleum and natural gas are extracted), flowback fluids from hydraulic fracturing activities, and saline source water required effective management to prevent contamination of ground and surface waters [186].

Several jurisdictions have guidelines specific to the management of these saline fluids. They include BCER's *Management of Saline Fluid for Hydraulic Fracturing Guideline* [186] and the *Saskatchewan Hydraulic Fracturing Fluids and Propping Agents Containment and Disposal Guidelines* [187]. The BCER Guideline contains guidance for the development and implementation of containment ponds, as well as for their decommissioning [186]. The Saskatchewan Guidelines provide guidance in relation to containment and disposal of flowback fluids. In both cases, the guidelines are general in their approach and reflect principles of prevention pollution, waste hierarchy and environmental protection.

In Alberta, Directive 083 – *Hydraulic Fracturing – Subsurface Integrity* [188] sets out requirements intended to manage the environmental impacts associated with hydraulic fracturing. Hydraulic fracturing operations are prohibited from having adverse effects on water well water quality or quantity [188]. Directive 083 [188] defines minimum distances between a well used for hydraulic fracturing, the surface location of a water well and the vertical depth of a water well. The Saskatchewan hydraulic fracturing requirements [189] similarly require the licensee to ensure there are no adverse impacts to water wells.

The CER has established filing requirements for drilling operations involving hydraulic fracturing [190]. Applications for authorization for hydraulic fracturing operations must include an environmental protection plan that articulates the procedures, practices and monitoring mechanisms to protect the environment from adverse impacts, including impacts to groundwater [190]. The environmental protection plan is to be developed in accordance with the federal *Environmental Protection Plan Guidelines* [71], [190].

Ontario and Quebec currently do not have any hydraulic fracturing activities. Quebec has implemented a moratorium on hydraulic fracturing [56]. Ontario has proposed an amendment (Bill 130) to the *Oil, Gas and Salt Resources Act* to prohibit hydraulic fracturing for the production of oil or gas trapped in shale [191]. New Brunswick has also prohibited hydraulic fracturing through the *Prohibition Against Hydraulic Fracturing Regulation – Oil and Natural Gas Act* [192].

3.2.3.2.4 Water Disposal in Disposal Wells

Upstream PNG activities create produced water as a byproduct of extraction. Flowback water returning to the surface after hydraulic fracturing also requires careful disposal, as do wastewater generated during drilling activities and during well completion and testing. These wastewaters are typically disposed of through deep well injection.

In British Columbia, the *Oil and Gas Waste Regulation* [60] authorizes the discharge of produced water or wastewater from well completion to an underground formation. BCER's *Water Service Wells – Summary Information* [193] provides guidance regarding the regulation of disposal wells and describes approval conditions for a disposal well. These conditions include parameters related to injection and formation pressure, pressure monitoring, and wellbore integrity and logging [193]. Understanding the hydrogeological risk is a key consideration and approvals may include conditions for the protection of groundwater [193]. BCER's *Water Service Wells – Summary Information* [193] refers to AER Directive 051 [194] for additional guidance in relation to logging.

In Alberta, AER Directive 051 [194] addresses deep well disposal of wastewaters, including produced water and water from pipeline maintenance and refining activities. It sets out a classification system for disposal wells that considers the characteristics of the wastewater being disposed. AER Directive 081 [180] addresses water disposal requirements for thermal in situ oil sands operations. Disposal limits are established as a percentage of the total inlet volume [180]. This disposal factor can range from 3% in the case of high-quality nonsaline (HQN) water, to 100% in the case of wastewater that would otherwise be sent to disposal wells [180].

In Saskatchewan, Directive PNG008 – *Disposal and Injection Well Requirements* [195] sets out requirements for the licensing and operation of disposal and injection wells. Directive PNG008 [195] refers to CSA Z341 [196] in relation to requirements for design, construction, testing, operation, maintenance and repair of underground hydrocarbon storage. Operators are required to ensure the hydraulic isolation of fluids being disposed to prevent migration and contamination [195].

In Ontario, the *Oil, Gas and Salt Resources of Ontario Provincial Operating Standards* [107] set out requirements and recommended practices for the disposal of fluids in disposal wells. As part of the requirements, the operator is required to identify all known wells and water wells within 750 metres of the disposal well [107]. Operators need to be permanently isolated, protect potable water from contamination and ensure that the disposal fluids are compatible with the disposal formation [107].

3.2.3.3 Decommissioning, Abandonment and Reclamation

The CER *Remediation Process Guide* [197] establishes a framework for mitigating adverse effects of contamination related to their facilities. If there is the potential for contamination to reach water bodies or groundwater, or if there is a wetland or water body within 30 m of a contaminated area, a remediation action plan is required [197]. The remediation action plan sets out how the remediation of the site will be undertaken [197].

In British Columbia, the *Environmental Protection and Management Regulation* [65] sets out requirements for restoration of an area upon which energy resource activities had been carried out. Among the requirements is restoring drainage patterns to their prior condition if the natural surface drainage pattern was altered as part of the activities. Any structure that was constructed to cross a stream, wetland or lake also needs to be removed. The *Contaminated Sites Regulation* [158] establishes the framework for application of numerical standards for determination of when a site has been effectively remediated.

The *Alberta Tier 1 Soil and Groundwater Guidelines* [160] and the *Alberta Tier 2 Soil and Groundwater Guidelines* [161] establish the framework for management of contaminated sites, including protection of groundwater quality. Where contamination of groundwater exceeds the Tier 1 or Tier 2 guidelines, it must be remediated to protect human health and restore beneficial use [160], [161]. The guidelines provide direction with respect to background groundwater quality, risk assessment and risk management [160], [161].

The *Mine Rehabilitation Code of Ontario* [166] sets out surface and groundwater monitoring requirements and concentration limits of contaminants from rehabilitated sites. The concentration limits must be in accordance with existing environmental compliance approvals. If no such environmental compliance approvals exist, then the Code sets out daily and monthly concentration



limits for total cyanide, total suspended solids and specific metals [166]. The *Ontario Soil, ground water and sediment standards* [168] sets out maximum concentration limits for potable groundwater and non-potable groundwater. These standards are used in conjunction with the requirements of the *Ontario Records of Site Condition* [167] regulation.

As noted, PNG activities are among those listed in the designated category pursuant to the *Land Protection and Rehabilitation Regulation* [169]. It sets out monitoring requirements for groundwater quality and concentration limits for contaminants in groundwater.

In New Brunswick, the ministerial protocols established through the *Contaminated Sites Regulation* [170] provides detailed guidance on environmental site assessments and remediation requirements, including in relation to groundwater. As noted, a closure report and a record of site condition are required pursuant to the regulation. The *Ministerial Protocol – Remediation, Risk Assessment and Monitoring* [171] also covers requirements in relation to groundwater.

3.2.4 Vegetation

3.2.4.1 Planning

Management of environmental impacts to vegetation is generally performed through Layer 1 and Layer 2 instruments. For example, to facilitate the cutting of trees as part of the construction of proposed PNG activities, forestry permits are typically required. In the case of British Columbia, BCER has authority pursuant to the *Energy Resource Activities Act* [43] to issue cutting permits under a Master Licence to Cut (MLTC) as part of the *Forest Act* [198]. Permit holders are required to pay stumpage.

Assessing vegetative impacts is a requirement of receiving permits for PNG activities and, in some instances, Layer 4 instruments provide requirements or guidance. The CER *Filing Manual* [73], for example, requires identification of pre-project vegetative diversity, the relative abundance and distribution of vegetation species and communities of importance, the conservation status, and the current level of disturbance associated with vegetation. The CER *Filing Manual* [73] also notes that identified impacts need to include change in vegetation cover cause by the project, alternatives to clearing any right of way, weed control measures, and any vegetation control measures including operation controls.

As part of oil sand project applications in Alberta, applicants are required to identify vegetation species that are of management concern, rare ecological communities and culturally important vegetation species. Species at risk (which are species of management concern and rare ecological communities) need to be documented, and the

application process needs to include baseline surveys and site-specific vegetation assessments. In Alberta, Directive 023: *Oil Sands Project Applications* [199] requires an applicant to identify vegetation types at the ecosite phase level and using the Alberta *Ecological Land Classification* guides [200]. The applicant also needs to identify any species of concern, as well as culturally significant vegetation species [199].

The Ontario *Endangered Species Act* [201] prohibits any person from damaging or destroying the habitat of a species at risk unless a permit has been obtained. The *Endangered Species Act* [201] sets out the conditions under which such a permit can be issued for an activity that has the potential to adversely impact the habitat of a species at risk. The *Environmental Assessment Act* (Ontario) [26] requires the environmental assessment to include a description of the environment that will be affected or that is anticipated to be affected. The definition of "environment" under the Act includes plant life.

In Quebec, the *Guideline for Conducting an Environmental Impact Assessment (Directive pour la réalisation d'une étude d'impact sur l'environnement)* [202] notes that if a project involves deforestation, a detailed description of the project's impacts on the forest environment and the approach to forest management must be provided as part of the environmental impact assessment (EIA). Quebec's *Act respecting threatened or vulnerable species* [203] has a general prohibition on undertaking activities that pose a risk to the habitat of a threatened or vulnerable plant species, unless the activity is authorized by the Minister of Sustainable Development, Environment and Parks or the Government of Quebec. The Quebec *Guideline for Conducting an Environmental Impact Assessment* [202] notes that as part of the EIA submission, the vegetation in areas likely to be affected by the project must be presented, and the main wildlife and plant species must be identified. The Guideline [202] also notes that the issue of threatened or vulnerable plant species must be addressed, and avoidance of the impact is the only solution possible. This may require modifications to the project to ensure compliance with legal requirements in relation to protection of threatened or vulnerable plant species.

In New Brunswick, guidance provided in relation to EIA notes that existing vegetation should be included in the description of the existing environment, including vegetation type, forest cover, species, etc. Any critical or sensitive habitat such as old growth forest should also be included. Once these natural features have been identified, the applicant needs to assess the impact of its activities at each stage (construction, operation and maintenance) on the environmental features. The *Responsible Environmental Management of Oil and Natural Gas Activities in New Brunswick – Updated Rules for Industry* [108] notes as part of the pre-construction site assessment that the vegetation of the site must be assessed systematically, and this information must then guide site restoration activities at the end of the project.

3.2.4.2 Operations

Management of operational impacts on vegetation are outlined through the terms and conditions of permits received for PNG activities, including implementation of vegetative management plans.

British Columbia's *Environmental Protection and Management Regulation* [65] notes that energy operators in areas occupied by insects that are harmful to forest health must not create conditions for the spread of these insects. Any activities that are located in an old-growth management areas must not have a material effect on the old-growth forests. The *Environmental Protection and Management Guideline* [154] includes planning and operational measures to reduce vegetative impacts. These include using natural openings or recently harvested areas for siting of activities, minimizing widths for new linear disturbances, limiting removal of vegetation and any disturbance to root mat.

3.2.4.3 Decommissioning, Abandonment and Reclamation

The BCER *Ecologically Suitable Species Guideline* [204] provides guidance in relation to reclamation of sites to support ecologically suitable species. This Guideline provides performance metrics for site closure to meet the intent of the *Environmental Protection and*

Management Regulation [65] made under the *Energy Resource Activities Act* (BC). The term "ecologically suitable species" for the purpose of the Guideline is defined as "vegetation species which are ecologically relevant to the surrounding conditions and do not hinder the benefits of natural vegetation processes" [204].

When undertaking reclamation activities, incorporation of Indigenous Knowledge into the planning processes for revegetation needs to be demonstrated [204]. The *Ecologically Suitable Species Guideline* [204] provides guidance on the establishment of ecologically appropriate species, including considerations for their selection, such as soil characteristics, surrounding habitat, traditional knowledge and potential for natural regeneration. Reference is made to the *Best Practices for Managing Invasive Plants on Oil and Gas Operations* developed by the Invasive Species Council of BC [205].

In the case of pipelines in British Columbia, the *Pipeline Regulation* requires the pipeline permit holder to restore the surface of the land in accordance with CSA Z662 [206] and in accordance with the requirements of British Columbia's *Environmental Protection and Management Regulation* [65]. CSA Z662 [206] states that vegetation on rights of way is to be controlled to maintain clear visibility from the air. The *Environmental Protection and Management Regulation* [65] states that revegetation should promote the restoration of the pre-existing wildlife habitat.

British Columbia mandates submission of an Annual Reclamation Progress Tracking Report that details revegetation activities. This includes information on species selection, seed and plant stock origin, propagation of native plants, provincial tree seed registration identification number, stocking standards, distribution of species, fertilization, infill planning and planned revegetation research.

In Alberta, the *Environmental Protection and Enhancement Act* [11] sets out approval conditions for reclamation. One of the conditions for reclamation of oil sand mines is the requirement for the approval holder to reclaim the land so that the land is capable of supporting self-sustaining, locally common boreal forest ecosystems, regardless of the end land use [11].

The *Alberta Regeneration Standards for the Mineable Oil Sands* [207] applies to reclaimed areas targeting commercial forestry as the end land use, and sets out survey requirements to reclaim areas. Establishment surveys determine the level of early reforestation success and must be conducted during the period between four and eight years after the first reforestation treatment [207]. Performance surveys determine if established trees have continued to grow, and if they are healthy, vigorous and can expect to survive to maturity [207]. Performance surveys must be conducted between 11 and 12 years after the reforestation treatment [207].

The *Mine Rehabilitation Code of Ontario* [166] sets out objectives and requirements as part of site reclamation. Among the objectives is the enhancement of natural vegetation growth and establishment of self-sustaining cover [166]. The Code provides considerations for appropriate revegetation measures, including likelihood of success for natural revegetation given the species characteristics, the use of native species, soil characteristics, climatic conditions and ecosystem considerations. Requirements for inspection and maintenance, and criteria for ending monitoring and inspection, are also defined in the Code [166].

In New Brunswick, the *Responsible Environmental Management of Oil and Natural Gas Activities in New Brunswick – Updated Rules for Industry* [108] sets out general requirements for site restoration. Site restoration is to be undertaken with the intent of re-establishing site conditions as they were documented in the preconstruction site assessment [108]. These industry guidelines note a need for re-establishing healthy, self-sustaining and ecologically appropriate vegetative cover on sites that were vegetated prior to the commencement of the activity [108]. Species that are invasive or non-native to the site cannot be used [108]. The process must be documented to verify the effectiveness of site restoration, and the Government of New Brunswick points to the tools developed by the Government of Alberta as acceptable methodologies for documenting restoration [108].

In terms of vegetation management, it was noted by interested parties during engagement sessions that significant progress has been made in reclamation

practices, and this progress has been driven by regulation. The industry has moved away from using non-native species in reclamation efforts, instead focusing on restoring native vegetation that supports local ecosystems. This shift reflects a more comprehensive approach, with vegetation management now considered a priority in reclamation standards. This is supported by the site restoration requirements in the instruments described above.

One specific challenge noted in aligning ecological goals with regulatory requirements was the conflict between CSA Z662 [206] and the requirements of British Columbia's environmental guidelines aimed at reducing linear disturbances and promoting habitat-friendly vegetation. The CSA Z662 [206] requirement for controlling vegetation on rights-of-way to maintain clear visibility from the air may contradict guidelines for habitat-friendly vegetation, as such vegetation may not provide the required visibility. This example underscores the importance of aligning practices with both reference standards and regulations to meet multiple objectives, such as ensuring safety and supporting environmental conservation.

Development and adoption of outcome-based standards was suggested as an approach that allows flexibility in achieving specific environmental goals. For example, free-growing criteria used in forestry features requirements for healthy, well-spaced acceptable tree species that are of a minimum height and have been on site for a minimum of five years. However, care needs to be taken in the development of standards related to biodiversity to avoid unintended consequences, such as the promotion of monocultures. Biodiversity was noted as an area where the industry is still not yet at full maturity, and where strategies need to be developed to ensure alignment of activities to conservation goals.

3.2.5 Wildlife and Biodiversity

3.2.5.1 Planning

3.2.5.1.1 Wildlife

Wildlife protection is generally accomplished through Layer 1 and Layer 2 legislative instruments. The assessment and mitigation of impacts to biodiversity is a mandatory requirement of applications for permits across all jurisdictions. Applications must typically include three steps. The first step is identification of the species, feature or value that could be impacted by the PNG activity. The next step is to determine modifications that can be made to the project to minimize, mitigate and restore impact to biodiversity. The third step is development of a monitoring plan that includes benchmarks, contingency plans and reporting timelines.

The CER *Filing Manual* [73] requires identification of wildlife in the project area, including its diversity and distribution, population status, details about life cycle and seasonal ranges, movements, and any sensitive periods. The habitat type needs to be described and quantified, and any lands that may constitute sensitive areas for wildlife need to be identified. The applicant needs to identify existing disturbances and the location where cumulative effects on wildlife could happen as a consequence of the project. Any species at risk also need to be identified. The *Tailored Impact Statement Guidelines Template* [208] for designated projects under the *Impact Assessment Act* provides guidance for establishing baseline conditions. For example, the Guidelines provide bird groupings and attributes of bird communities likely to be affected, and types of terrestrial wildlife and habitat impacts to consider that may arise from designated project activities, including PNG activities [208].

The approach to wildlife protection, in general, is focused on the protection of wildlife habitat and fisheries sensitive waters. Layer 4 instruments are focused on providing guidance on undertaking wildlife assessments as part of the planning process for PNG activities. For example, in Alberta, the AER requires wildlife sweeps be undertaken as part of the planning process prior to undertaking activities that risk disturbing wildlife species and their habitats [209]. A wildlife sweep is a search on the proposed site for key features, with the intent of avoiding protected features. The *Wildlife Sweep Protocols* sets out guidelines for undertaking wildlife sweeps [209]. A wildlife sweep does not replace the requirement for detailed wildlife surveys, and the AER notes that if an important wildlife feature is destroyed after a poor-quality sweep, investigation



"The assessment and mitigation of impacts to biodiversity is a mandatory requirement of applications for permits across all jurisdictions."

and enforcement may be pursued through the *Wildlife Act* [209]. Directive 023: *Oil Sands Project Applications* also provides guidance in relation to assessment of wildlife. It recommends identification of important wildlife species habitats, a map illustrating potential locations of identified wildlife species and their habitats, classification of species based on their risk status, and identification of impacts and mitigation measures to protect wildlife and their habitats [199].

In Saskatchewan, applicants are provided with an *Environmental Evaluation Checklist for Oil and Gas Development Project on Private Land,* which includes questions about baseline assessments of species of concern and conformance with the *Saskatchewan Activity Restriction Guidelines for Sensitive Species* [210] [211]. Wildlife habitat cannot be disturbed without an approval.

In Ontario, the *Endangered Species Act* [201] is designed to protect and promote stewardship of species at risk and their habitats. The *Endangered Species Act* [201] has a general prohibition on harming any species that is on the Species at risk in Ontario [212] list or its habitat, although an activity can be undertaken if a permit has been received pursuant to the Act. The permit itself typically establishes time limits for the activities. It requires the permit holder to follow specific steps defined in the permit, to monitor activities, and to rehabilitate damaged area or enhance another area to be suitable for the affected species.

Quebec's *Act respecting threatened or vulnerable species* [203] sets out authorities in relation to designation of threatened or vulnerable wildlife, and protection of their habitats. The *Regulation respecting threatened or vulnerable wildlife species and their habitats* [213] defines specific species designated as threatened or vulnerable, and the characteristics used to identify their habitats. The *Guideline for Conducting an Environmental Impact Assessment (Directive pour la réalisation d'une étude d'impact sur l'environnement)* [202] notes that as part of a permit application, the main wildlife species affected must be identified, taking into account their life cycle (e.g., migration, feeding, reproduction), the communities they form and their habitats. Particular attention needs to be given to wildlife species that have been identified as threatened or vulnerable, for whom avoidance of impact is noted as the only solution, even if it requires modification of the project [202].

In New Brunswick, the provincial guide on EIAs [64] is applicable to all sectors of activities for which an EIA is required. In relation to wildlife, the guide provides a sample list of terrestrial biological and ecological attributes. This list includes size and distribution of populations/communities of animals, birds, reptiles, amphibians and insects. It also includes species at risk, species diversity and variety, and species that are used for subsistence or non-subsistence (e.g., recreational) purposes. The applicant needs to identify potential

impacts to these biological and ecological attributes, and the mitigations measures to be implemented. The *Petroleum Product Storage and Handling Regulation* [113] in New Brunswick states that the presence of animal, bird or aquatic life that requires special pollution prevention is factored into decisions regarding approvals.

3.2.5.1.2 Fisheries

Under Section 91 of the *Constitution Act, 1867,* matters relating to seacoast and inland fisheries rests with the federal government [1]. Prior to undertaking activities, if there is the potential to impact fish or fish habitat, a fisheries habitat assessment is required as part of the process to apply for an authorization in accordance with the *Fisheries Act* [30]. The *Authorizations Concerning Fish and Fish Habitat Protection Regulations* [214] sets out the information and documents to be provided by an applicant. An assessment of fish and fish habitat is required, including a detailed description of the fish and fish habitat at the location of the proposed activity, and details with respect to the effects of the activity on fish and fish habitat [214]. The applicant needs to also provide a description of the measures to be implemented to mitigate the adverse impacts to fish and fish habitat [214]. The Regulations also require details with respect to any habitat credits, and a plan to offset the death of fish or habitat disruption resulting from the activity undertaken [214].

In British Columbia, this assessment must include classification of the stream, a list of the fish species and fisheries habitats that may be impacted, the applicable least-risk fisheries timing window, and mitigation measures to be implemented [149]. AER's Directive 023 [199] requires applicants to describe fish-bearing water bodies, provide a map of the fish habitat overlaid with the project area, classify potential affected fish species based on their status, and identify potential impacts and mitigation measures.

Saskatchewan's *Environmental Review Guidelines for Oil and Gas Activities* [63] notes that as part of the submission to the Ministry of Environment for a new PNG project, an evaluation of the habitat value of the affected area must be completed, including the fish habitat potential of affected streams and water bodies. These Guidelines also note that activities that may affect fish habitat may be subject to review and permitting requirements pursuant to the *Fisheries Act* [30], [63]. The Guidelines contain a checklist for the Ministry of Environment for new projects, which includes questions relating to whether the project will cause a surface disturbance within 90 metres of fish bearing or potentially fish bearing waters, and whether the project will cross fish-bearing, or potentially fish-bearing, waters [63].

In New Brunswick, the EIA guide includes a sample list of aquatic biological and ecological attributes of the environment. This list includes populations and communities of aquatic species, species diversity and variety, species at risk and of conservation concern, various types of fisheries, and spawning, feeding and breeding sites. Once the relevant biological and ecological attributes of the aquatic environment have been defined, then the potential impacts to these components of the environment need to be assessed and mitigation measures identified.

3.2.5.2 Operations

3.2.5.2.1 Wildlife

Requirements during the operations phase of a project as it relates to wildlife is generally governed by the terms and conditions of the permits and other authorizations obtained by the organization.

The BC *Wildlife Act* [215] contains general prohibitions against damaging wildlife habitat or contaminating water or land in a manner that is harmful to wildlife or wildlife habitat, subject to what is allowed by regulations or a permit. The *Wildlife Act* [215] refers to the *Energy Resource Activities Act* [43] as having authority for the establishment of regulations for the protection of wildlife. The BC *Environmental Protection and Management Regulation* [65] further elaborates on the government's environmental objectives related to wildlife. In relation to wildlife and wildlife habitat, the regulations include amongst its objectives that energy resource activities operating outside of a wildlife habitat be carried out in such a manner so as not to disturb high priority wildlife or their habitat, particularly during sensitive seasons and critical life-stages [65]. Section 6 of the regulation

sets restriction on operating areas within wildlife habitat areas, ungulate winter ranges, and fisheries sensitive watersheds [65]. Activities must not be damaging to any wildlife habitat feature [65].

The BCER *Environmental Protection and Management Guideline* [154] includes reference to operational measures and guidance documents, including in relation to identified Boreal caribou habitat in British Columbia. BCER has established an Environmental Information Management System (EIMS), which sets out planning and operational measures for the petroleum and natural gas sector for the protection of wildlife habitat, high priority wildlife, and ungulate winter ranges.

The Alberta *Wildlife Act* [216] vests responsibility for wildlife in Alberta with the provincial crown. Although provisions in the *Wildlife Act* [216] are primarily related to hunting activities, the act allows for the designation of endangered species. In Alberta, guidelines for specific wildlife species, such as mountain goat and bighorn sheep, set out minimum requirements for activities. The guidelines for mountain goat and bighorn sheep, for example, include recommendations for open windows for geophysical exploration activity, zones for helicopter and fixed-wing flights, and control of accesses and monitoring.

In Ontario, the Ministry of Natural Resources and Forestry publishes best management practices for specific species and species habitat such as Woodland Caribou and Bank Swallow [217]. Guidance documents also exist specific to habitat. These best management practices include measures such as awareness and education to staff working in sensitive areas, minimization of sensory disturbances and undertaking activities in the shortest time possible.

3.2.5.2.2 Fisheries

The federal *Petroleum Liquid Effluent Regulations* note that liquid effluent or once-through cooling water treated in a manner approved by the Minister is no longer considered liquid effluent or once-through cooling water [61]. A similar provision exists in regulations specific to stormwater [61]. These provisions underscore the role of approvals in managing operational impacts.

The limits established in the *Petroleum Liquid Effluent Regulations* [61] for the release of deleterious substances is intended to protect fish habitat. Refineries that are subject to the Regulations are required to install sampling connections and measuring devices to enable assessment of compliance with the Regulations [61]. As noted in Section 3.2.3.2.2, Quebec regulations for liquid effluents from refineries are a direct copy of the federal *Petroleum Liquid Effluent Regulations.* Quebec's approach is unique – while the related federal regulations apply in other provinces, Quebec is the only province of those reviewed to do a direct adoption of the federal regulations.

3.2.5.3 Decommissioning, Abandonment and Reclamation

3.2.5.3.1 Wildlife

Reclamation of sites to support wildlife and biodiversity is generally focused on restoring wildlife habitat and use. The *Ecologically Suitable Species Guideline* [204] notes the importance of establishing vegetation sites that can support wildlife habitat. Among the required reporting categories is signs of wildlife, such as scat, tracks and sightings. While specific targets for site reclamation may not be established, wildlife use is an indicator of the re-establishment of wildlife habitat.

The Alberta *Criteria and Indicators Framework for Oil Sands Mine Reclamation Certification* [218] sets out wildlife habitat targets for reclamation certification. The criterion of "The reclaimed landscape provides for fish and wildlife habitat" is used for several wildlife objectives. Alberta also requires reclaimed landscapes to support biodiversity, and ecosystems to be resilient to natural disasters and climate variability [218].

In Ontario, O.Reg. 242/08 *General* [219] issued under the *Endangered Species Act* [201] sets out requirements for removal of infrastructure, including oil or gas pipelines. In addition to giving notice to the Minister of the activity, a mitigation plan must be developed for the species at risk using best available information pursuant to the *Endangered Species Act* [219]. The mitigation plan must also include details about the times during which the species is likely to be carrying out life processes, such as hibernation and reproduction [219].

Complexity of ecosystems was noted to introduce inherent challenges in the development of quantitative metrics for vegetation, wildlife and biodiversity. Current regulatory frameworks offer high-level protection requirements, but parties indicated there is limited specificity on determining the end point for assessments and restoration activities. The need for clearer guidance was noted as particularly important given the limited pool of expertise, especially biologists, in developing specialized environmental reports. This observation is supported by labour market studies. For example, the 2023 edition of the British Columbia *Labour Market Outlook* [220] predicts 1,790 job openings for biologists and related scientists over the subsequent decade as a consequence of retirements and expanded needs.

Current site-specific assessments are typically aimed at identifying the presence of wildlife or significant habitat features within a project's immediate area of impact. The variability in these assessments can be significant, depending on the methodology used, such as on-the-ground evaluations or desktop reviews. It was noted that fish surveys have benefited from well-established frameworks and standards that ensure consistency of data collection, but standardized approaches are lacking for other wildlife species.

3.2.5.3.2 Fisheries

Sections 35 and 36 of the *Fisheries Act* [30] prohibits deposition of deleterious substances in waters frequented by fish throughout all stages of a project life cycle, including during end-of-life activities. In May 2023, the Department of Fisheries and Oceans Canada published a position statement on the management of existing facilities and structures under the *Fisheries Act and the Species at Risk Act* [221]. This position statement reinforces that the fish and fish habitat provisions of the Fisheries Act apply to decommissioning work of an existing structure in or near water frequented by fish. The position statement points to *The Measures to Protect Fish and Fish Habitat* [222] as applicable best practices for existing facilities and structures.

The *Measures to Protect Fish and Fish Habitat* [222] identify practices aimed at preventing adverse impacts to fish habitat when carrying out works related to existing facilities or structures, including decommissioning activities. These practices include maintaining fish passage, ensuring proper sediment control, and preventing entry of deleterious substances in water through managing spills and equipment to reduce the risk of releases [222].

3.3 Environmental Standards used in the Canadian PNG Sector

3.3.1 Identification of Relevant Environmental Standards

Environmental standards used by the PNGs industry were identified through a review of a selection of corporate sustainability reports. These reports were reviewed prior to the Government of Canada's amendments to the *Competition Act* which came into effect on June 20, 2024 [223]. The *Competition Act* amendments placed additional obligations on any entity making representations in relation to environmental protection, and mitigation of the environmental and ecological impacts of climate change [223]. Although further direction is anticipated from the federal government in relation to the *Competition Act* amendments, the environmental standards identified as being used by the PNG industry were also validated during discussions with interested parties. Standards that have been referenced in mandated or soft law instruments are described in the following sections. Standards that are used in the PNG industry but are not referenced in mandated or soft law instruments are described in Appendix C. Some interested parties also noted that applications made as part of an EA process do make use of standards to compare predicted impacts to relevant standards.

3.3.2 CSA Standards

3.3.2.1 CSA Environmental Site Assessment Standards

CSA Z768 [143] sets out principles and practices for Phase I ESAs. It outlines procedures for identifying potential or existing environmental contamination on a property through records review, site inspection and interviews, without conducting physical sampling. CSA Z769 [144] sets out principles and practices for Phase II ESAs. It provides guidelines for investigating

and characterizing potential contamination identified in a Phase I ESA through techniques such as soil and groundwater sampling, laboratory analysis and data interpretation. The standard can be used to assess the extent and severity of contamination and to inform decisions on remediation or risk management.

3.3.2.2 CSA Z767

CSA Z767 [69] establishes a process safety management (PSM) framework for identifying, understanding, avoiding and controlling process hazards. The standard notes that the principles and techniques are applicable across industry sectors, and the petroleum sector is noted as one of the sectors in which companies or organizations using the principles are known. CSA Z767 [69] sets out requirements for a PSM system, which includes environmental management components. For example, the category of environmental regulations is listed among the examples of legislation, regulations and standards that should be considered in monitoring and responding to changes in legislative and regulatory frameworks, codes and standards [69]. CSA Z767 [69] also requires the establishment of health, safety and environmental risk criteria for risk evaluation.

3.3.2.3 CSA Z662

CSA Z662 [206] is specific to the life cycle of PNG pipeline systems and covers the full life cycle of pipeline systems, including design, construction, operations and maintenance, decommissioning and abandonment. It requires operating companies to establish prevention and control measures to manage the environmental impacts of pipeline system operations to within acceptable levels. The management of environmental risks is a concept that is reflected in numerous provisions in CSA Z662 [206]. Explanatory notes in the standard give examples of potential environmental matters that should be considered, such as protection of vegetation, protection of fish and wildlife, and containment of spills. The standard has an informative annex that provides guidelines for risk assessment of pipelines (Annex B). It includes a detailed methodology for undertaking an environmental and societal risk assessment for liquid releases from a pipeline system [206].

3.3.3 ISO Standards

3.3.3.1 ISO 14001 – Environmental Management Systems

ISO 14001 [70] is the international standard for environmental management systems (EMS). It provides a framework for organizations to manage their environmental responsibilities systematically and sustainably. The standard is applicable across industries, including the PNG sector. It requires organizations to identify environmental aspects and impacts, specifically activities that interact with the biophysical environment. For the PNG sector, these include air emissions from flaring or refining, water pollution risks from drilling operations, and habitat disturbance during pipeline construction.

ISO 14001 [70] also requires organizations to develop operational controls, such as emission reduction technologies and spill prevent technologies, to mitigate impacts and to use environmental performance indicators to track progress. The method of demonstrating conformance, however, varies from company to company. It can range from self-determination of alignment, to third-party confirmation of conformance with ISO 14001 [70], to full certification by an accredited certification body. Some companies in the PNG sector report conformance with their ISO 14001 standard in their corporate sustainability reports.

The use of ISO 14001 [70] was discussed during the consultations with interested parties. Some acknowledge that ISO 14001 [70] is an effective approach to environmental management. The potential to implement an ISO 14001 [70] EMS spanning multiple facilities across Canada was suggested as a benefit. However, a significant challenge in EMS implementation within the PNG industry is the lack of recognition for ISO 14001 [70] across provincial jurisdictions. Consequently, if companies conduct comprehensive ISO 14001 [70] audits and implement certified systems, these audits are generally not accepted by regulators as meeting compliance requirements. CSA Z767 [69] and ISO 14001 [70] are the two management system standards referenced in mandatory or soft law instruments applicable to the PNG sector.

3.3.3.2 ISO 14060 Series – Greenhouse Gas Standards

The ISO 14060 family of standards addresses GHG reporting at the organizational level, and validation and verification of GHG statements. Table 9 summarizes the standards in the ISO 14060 family and, as noted, a number of these standards have been adopted in Canada as National Standards of Canada. Some interested parties were aware of or using the ISO 14064-1 standard [224] for the calculation of GHG emissions and development of organizational inventories. Both ISO 14064-1 [224] and ISO 14064-2 [225] are referenced in the CER *Filing Manual* [73] among the additional guidance documents for describing GHG emissions.

Two standards in the ISO 14060 family of standards have been referenced in regulations across all jurisdictions as part of the requirement for third-party verifications of GHG reporting, as noted in Section 3.2.1.2.6 of this report. ISO 14064-3 [132] is a standard that specifies principles and requirements for validating and verifying GHG assertions, ensuring their accuracy and reliability. It provides a framework for independent evaluation, enhancing confidence in GHG reporting for compliance, voluntary commitments and market-based mechanisms. ISO 14065 [133] specifies requirements for bodies that validate or verify environmental information, including GHG statements. This standard sets out requirements relating to competence, consistency and impartiality.

3.3.4 GHG Protocol

GHG Protocol is an initiative managed by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD) that provides standards for the measurement and management of GHG emissions [227] [228]. As noted in Table B.4 of Appendix B, the *GHG Protocol Corporate Accounting and Reporting Standard* [228] is referenced in the CER *Filing Manual* [73]. The ISO 14068-1 standard [229] contains an annex on how criteria in the GHG Protocol standard can be consistent with those in the ISO 14064-1 standard [224]. The Global Reporting Initiative (GRI) standards also refer to GHG Protocol.

Table 9: ISO 14060 family of standards and documents

ISO Standard	CSA Adoption
ISO 14064-1:2018, *Greenhouse gases – Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals* (Note 1)	**Y**
ISO 14064-2:2019, *Greenhouse gases – Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements* (Note 1)	**Y**
ISO 14064-3:2019, *Greenhouse gases – Part 3: Specification with guidance for the verification and validation of greenhouse gas statements* (Note 1)	**Y**
ISO 14065:2020, *General principles and requirements for bodies validating and verifying environmental information*	**N**
ISO 14066:2023, *Environmental information – Competence requirements for teams validating and verifying environmental information*	**N** (Note 2)
ISO 14067:2018, *Greenhouse gases – Carbon footprint of products – Requirements and guidelines for quantification* (Note 1)	**N**
ISO 14068-1:2023, *Climate change management – Transition to net zero – Part 1: Carbon neutrality*	**N**
ISO/TR 14069:2013, *Greenhouse gases – Quantification and reporting of greenhouse gas emissions for organizations – Guidance for the application of ISO 14064-1* (Note 1)	**N**

Note 1 – These international standards are currently being revised by ISO (see [226])
Note 2 – CAN/CSA-ISO 14066:12 (R2022) exists as an adoption of ISO 14066:2011

GRI 305: Emissions 2016, for example, explicitly notes that the requirements of the GRI standard are based on the requirements of the *GHG Protocol Corporate Accounting and Reporting Standard* [230].

4 Analyses and Recommendations

4.1 Comparison of Regulatory Approaches

The regulatory landscape governing environmental management of the Canadian PNG sector varies significantly across jurisdictions. Differences in the mandated and soft law instruments developed by AHJs across Canada is a function of the division of powers set out in the *Constitution Act, 1867* between the Parliament and provincial legislatures, as well as the extent to which AHJs have established a centralized energy regulator.

Across Canada, Layer 1 instruments – environmental protection and environmental assessment acts – have similar, broad objectives of environmental protection and ensuring projects with the potential of significant environmental impact are subject to EIAs and approval processes. All six provincial jurisdictions have Layer 2 regulations and corresponding guidelines that address contaminated sites and contaminated ground water. These mandated and soft law instruments provide quantitative definitions for contaminated soil and groundwater, and these numerical criteria are used by AHJs to determine when sites have been effectively remediated.

All jurisdictions have mandated instruments aimed at the protection of species at risk, including both vegetation and wildlife. These instruments have general prohibitions on activities that pose a risk to species at risk or their habitat, unless authorization has been obtained from the responsible ministry for such activities. Species-specific protocols, based on priority species in each province, also exist. They set out best practices to mitigate disturbance to vulnerable species.

The approach to managing ambient air quality varies by province. Ontario, Quebec and New Brunswick have regulations that establish concentration limits for pollutants, with the objective of protecting human health. While ambient air quality objectives have been adopted in other provinces, they are used for the purposes of permitting, not for direct regulation of industrial activities.

The differences in approach in Layer 3 instruments is a function of the significance of the PNG sector in each province. The CER, BCER, AER and SK MER are unique authorities for oversight and regulation of the PNG sector. While other ministries, such as environmental ministries, still play a role, the centralized oversight that these entities have over the industry is reflected in the Layer 4 instruments that have been created in their jurisdictions. Layer 3 instruments generally do not refer to standards, but they accord authority to the regulator and the relevant AHJ to establish directives and standards that are legally binding.

Alberta, which has the most significant PNG activity in Canada, has many Layer 4 instruments, developed under the authority of AER. British Columbia and Saskatchewan also have many Layer 4 instruments developed under the authority of the provincial energy regulator. The CER has also developed some Layer 4 instruments for the management of environmental impacts from PNG activities. It has also made references to provincial instruments such as AER Directives in its Layer 4 instruments. In contrast to the jurisdictions with a centralized energy regulator, Ontario, New Brunswick and Quebec have Layer 4 instruments developed under the authority of environmental laws (Layer 1 and Layer 2 instruments). However, the number of such instruments is limited compared to the other provinces, which have developed Layer 4 instruments under the authority of Layer 3 instruments.

4.2 Opportunities for Standardization

Some interested parties noted there may be a role for management system standards to support regulatory requirements. Although CSA Z767 [69] on process safety management is not specific to the PNG sector, multiple Layer 4 instruments reference CSA Z767 [69]. Process safety as articulated in CSA Z767 [69] includes environmental management components.

ISO 14001 [70] on environmental management systems has also been referenced in Layer 4 instruments. An EMS can be implemented for a single facility, or it can be implemented for a single organization and apply to multiple facilities.

All jurisdictions across Canada have incorporated into regulation the ISO validation and verification systems for GHG reporting through the adoption of ISO 14064-3 [132] and ISO 14065 [133]. These international standards are used to ensure annual reporting of GHG emissions and of GHG offsets is robust, and the third-party verifier has sufficient technical expertise relevant to the industrial activity to verify GHG reports. While ISO 14065 is being used for bodies verifying GHG information, the standard is not specific to GHG information and includes environmental information more broadly. Given there is precedence across all jurisdictions for the use of international standards to support third-party verification, further investigation and consultations are recommended to explore the extent to which international standards can support verification activities for regulators beyond GHG statements.

Given the significance of, and increased focus on, methane emissions from the PNG sector and the federal regulations targeting the control of methane emissions from the sector, there may be an opportunity for standards to support regulatory requirements in this area. Differences were noted in the approach to management of fugitive and vented gas emissions across jurisdictions, with some jurisdictions having more detailed requirements than others. The federal regulations targeting methane and VOCs from upstream PNG activities create a minimum level of environmental management for these emissions. An important topic to explore with interested parties – and regulators in particular – is whether there is differential value to AHJs to such standards, given that work that has already been done by regulators such as BCER, AER, and SK MER to create Layer 4 instruments.

The incorporation of biodiversity considerations into regulatory regimes for restoration and reclamation of sites at the end of a project's life may be another opportunity that warrants more detailed investigation.

As noted, regulations and guidelines with respect to contaminated sites establish numerical criteria for chemical contamination. The process of determining whether the site has been effectively restored from a contamination perspective is easily ascertained. When it comes to biodiversity, regulations and Layer 4 instruments generally use high-level concepts such as supporting biodiversity and ecologically appropriate vegetative cover. Restoration of biodiversity is a function of time and determining what constitutes success and the corresponding endpoints can be challenging. Therefore, standardization of approaches for habitat restoration, species reintroduction and long-term ecological monitoring is an area recommended for further detailed investigation.

5 Conclusion

This report highlights the complexity of achieving national consistency in environmental management across Canada's PNG sector, stemming from the constitutional division of powers and the extent to which each province has established a centralized regulator for the sector. When considering how EM standards can support regulatory objectives in the PNG sector, it is important to understand the role of different layers of instruments in each jurisdiction. EM standards are most likely to be relevant in supporting gaps in Layer 4 instruments or in harmonizing approaches where there are differences across jurisdictions.

Several opportunities for the development and application of EM standards, particularly within Layer 4 instruments, have been identified. Third-party standards may exist to further support validation and verification of environmental information, the management of methane emissions from PNG activities, and biodiversity considerations in site restoration. An in-depth review of standards related to these areas are recommended.

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Appendix A – Tools Used for Engagement with Interested Parties

A.1 Interview – Company/Industry Representatives

Three representatives from industry, including employees of oil and gas companies and consultants, are to be interviewed. Interview duration should be 30 minutes in length. These questions are intended to be guiding questions only, and interviewer should probe additional concepts based on responses of interviewees.

Read the "Informed Consent Sheet" or reconfirm consent at start of conversation.

This interview is part of a study commissioned by the CSA Group to understand the regulatory landscape as it pertains to environmental management in the oil and gas sector. All of the information you provide will be kept confidential and there will be no attribution of comments to any individual. We will only be dealing with information in aggregate, based on themes that emerge through the interviews and focus groups we are conducting. Through our study, we aim to identify gaps in environmental management within the oil and gas industry.

1. What are some of your areas of concern for environmental impact management in the oil and gas industry?

2. What are some areas of challenges in environmental management in your company?

> *Take note of which biophysical elements they cover in their initial response and ask follow-up questions on remaining biophysical elements. For example, ask whether they have any challenges in managing impacts to water.*

3. What are the key challenges you face with maintaining compliance?

4. How would you rate how well impacts on each element of the environment are currently being managed? In other words, how well do current practices cover or address the impacts of activities on each element of the environment? *(Ask for a rating for each element and note down any comments or explanations.)*

1 Very Poor	2 Poor	3 Average	4 Good	5 Very Good

Biophysical Element	Rating	Any Comments
Atmospheric Environment		
Soil		
Water		
Vegetation		
Wildlife / Biodiversity		
Multi-element practices – waste management, spill response, etc.		

5. What are some of the environmental regulations or requirements that have been difficult to follow or implement? What elements have been challenging?

6. Do you think there is sufficient guidance to support the implementation of measures in accordance with regulatory requirements? *(Take note of which biophysical element they address.)*

7. How does your company stay informed about environmental standards that may be of value in the oil and gas sector? *(Or)* **What sources of information does your company use to learn about best practices for environmental management in the industry?** *(Select all sources they mention.)*

- ☐ Regulatory bodies (CER, AER, BCER, etc.) or government publications
- ☐ Canadian industry associations (CAPP, PTAC, PSAC, etc.)
- ☐ International industry associations (IOGP, IPIECA, EI)
- ☐ Standards development organizations (CSA, API, ISO)
- ☐ Peer-reviewed journals and technical publications
- ☐ Trade shows, conferences or workshops
- ☐ Consultancies and market research
- ☐ Other (specify):

8. Can you describe your company's environmental management system? How does it help in meeting environmental objectives?

9. Are there opportunities for improving environmental performance you have identified, but have yet to implement? *(Or)* **What are some practices/standards/measures you plan to implement in the near future? Why do you think this is important to address?**

10. Do you have any practices that go above what is required by regulations?

11. In what ways do you think standards can facilitate or support your organization's environmental performance objectives?

> *Ask in terms of challenges they have identified.*

12. Are there any other thoughts you have with respect to the potential role of standards to support environmental objectives of the regulator in the oil and gas sector? Any questions you think I should have asked you?

A.2 Focus Group Discussion Moderator Guide – Company / Industry Representatives

Notes for moderator:

- Ninety minutes per focus group.
- Ideal size of focus group is between six and eight participants.
- Pre-discussion:
  - Double check you have the correct targets recruited.
  - Dress to match the respondent, i.e., smart for top-tier, etc.
  - Ensure appropriate permissions in virtual conference room platforms.
  - Have participants label their names appropriately.

1. Moderator introduction

We are very pleased you have agreed to join us today. Today, this focus group is an opportunity to discuss the role of standards in supporting the management of environmental aspects of the oil and gas sector.

My name is… I am a consultant with AirVironment Canada. We have been commissioned by the CSA Group to undertake a review of legislation across Cananda related to environmental management in the oil and gas sector to identify gaps and identify where there may be a role for standards.

There are no right or wrong answers, and this is not a test so please give your honest opinions.

The discussion is recorded to assist with reporting, but please be assured of the confidentiality of your responses. All of the information you provide will be kept confidential and there will be no attribution of comments to any individual. We will only be dealing with information in aggregate, based on themes that emerge through the interviews and focus groups we are conducting.

There are few rules we need to follow for the focus group to work:

- Please make sure you are on mute while other participants are speaking.
- We need to hear from everyone.
- We need to stick to the discussion agenda as there is a lot to cover, so please don't be offended at all if I must cut you off. There's time at the end for other points we don't cover.

> *Turn on recording.*

I think you will really enjoy the next 90 minutes. We have a lot to cover so let's jump right in.

2. Introductions

To start off, I would like you to scan the QR code on the slide here or click on this link (copy and paste link in chat) to answer questions throughout this session. Answers to some questions will be displayed on the screen, and answers to others will only be visible to AirVironment. Please start by writing the name of your organization.

> *Check that everyone has joined the survey.*

3. Current challenges related to environmental management

Now, without discussing it with the rest of the group, I want you to think about your experience in the industry. You can now move to the next question on your devices. Please write **the ONE element your company does well** related to management of environmental aspects.

Okay let's discuss: What does your company do well? What attributes make this an element that you think is well managed or well executed.

> *Probe fully on **three** responses. If not clear, clarify with: Why do you think that is?*

Again, without discussing, I want you to think about one element where you think there is need for improvement. Please move to the next question on your devices and write **the ONE area where improvements are required** in your company's environmental management. You can also respond with one area where improvements are required for environmental management in the industry as a whole.

Okay let's discuss: What does your company or the industry need to improve on? Why this particular area?

> *Probe fully on **two.** If not clear, clarify with: Why do you think that is?*

4. Application of standards

Please move to the next question, which lists different aspects of environmental standards. Please rate each characteristic in terms of how important it is to you.

> *Run through first couple of ratings making sure all know what they are doing. If they take too long tell them: Don't think too much about it and go with your initial gut feeling.*

> *While respondents are completing forms, check for common areas of most and least importance. Display the results after everyone has responded or after the time limit has been reached.*

Here are your responses. The majority have selected this attribute as important. Why is this aspect so important?

> *Probe fully on **three** essential areas.*

Is anything else particularly important? Why? Anything else?

> *Note down any other attributes.*

Again, without discussion, I want you to think about the three most important environmental standards that come to mind as being valuable standards for environmental management in industry.

Okay let's discuss: What do you think are the best environmental standards? Why do you think this is the best environmental standard? What attributes of the standard make it important? Any other reasons?

5. Wrap-up

Finally, are there any areas that we have not covered or anything else you would like to comment on?

Those are all the questions I have. Thank you for your time today.

> Thank participants for their time and conclude the session.

1 Less Important	2 Important	3 Very important	4 Extremely important	5 Absolutely essential

Attribute of Environmental Standard	Importance
International recognition of standard by other countries	
Extent to which it addresses regulatory gaps	
Consultation process with interested parties in development of standard	
Approach to risk management	
Potential for third-party certification or accreditation against standard	
Adaptability and flexibility of standard	
Approach to cumulative environmental effects	
Concentration or other quantitative emissions limits	
Extent to which the standard already has traction in industry	
Extent to which the standard aligns with international best practices	
Cost of conformance with the standard	
Ability to support technological advancements and innovation	
Alignment of standard to environmental protection goals of legislation	
Ability of standard to make administration of environmental goals easier	
Data and information systems required for standards conformance	
Application of standard across Canadian jurisdictions (e.g., across provinces)	
Monitoring requirements supported by standard	
Continuous improvement mechanism	
Accountability requirements set out in standard	
Life cycle approach to environmental impacts	
Capacity building and training available to support implementation of standard	

A.3 Interview Guide – Regulators

> *Three representatives from regulatory bodies are to be interviewed. Interview duration should be 30 minutes in length. These questions are intended to be guiding questions only, and the interviewer should probe additional concepts based on responses of interviewees.*

> *Read the "Informed Consent Sheet" or reconfirm consent at start of conversation.*

This interview is part of a study commissioned by the CSA Group to understand the regulatory landscape as it pertains to environmental management in the oil and gas sector. All of the information you provide will be kept confidential and there will be no attribution of comments to any individual. We will only be dealing with information in aggregate, based on themes that emerge through the interviews and focus groups we are conducting. Through our study, we aim to identify gaps in environmental management within the oil and gas industry.

1. What are some of your areas of concern for environmental impact management in the oil and gas industry?

2. Where can you identify any gaps or areas for improvement in the regulations within your jurisdiction for environmental management?

> *Take note of which biophysical elements they cover in their initial response and ask follow-up questions on remaining biophysical elements, such as: How about any gaps in regulating impacts to water?*

3. How would you rate how well impacts on each element of the environment are currently being managed/ regulated in your jurisdiction? In other words, how well do current regulations cover or address the impacts of activities on each component of the environment?

> *Ask for a rating for each component and note down any comments or explanations. Probe the areas rated high and low.*

1 Very Poor	2 Poor	3 Average	4 Good	5 Very Good

Biophysical Element	Rating	Any Comments
Atmospheric Environment		
Soil		
Water		
Vegetation		
Wildlife / Biodiversity		
Cumulative effects		

4. Based on your experience, what are the environmental regulations specific to the oil and gas industry that have been difficult to understand? What are the elements that have been challenging?

5. What are the most common environmental compliance challenges faced by companies operating in your jurisdiction? Why do you think that is?

6. What voluntary standards, either in legislation or in practice by industry, have been effective at supporting the environmental goals of regulation? What has made these standards valuable and effective?

7. In what areas do you think the development of national standards or the use of international standards can help support government regulation and environmental objectives in the PNG sector?

8. How does your organization stay informed about environmental standards that may be of value in the oil and gas sector? Or, What sources of information do you use to learn about best practices for environmental management in the industry?

> *Select all sources they mention.*

☐ Regulatory bodies (CER, AER, BCER, etc.) or government publications

☐ Canadian industry associations (CAPP, PTAC, PSAC, etc.)

☐ International industry associations (IOGP, IPIECA, EI)

☐ Standards development organizations (CSA, API, ISO)

☐ Peer-reviewed journals and technical publications

☐ Trade shows, conferences, workshops

☐ Consultancies and market research

☐ Other *(specify)*:

9. Are there any other thoughts you have with respect to the potential role of standards to support environmental objectives of the regulator in the oil and gas sector? Are there any other questions you think I should have asked you?

A.4 Focus Group Discussion Moderator Guide – Regulators

Notes for moderator:

- Ninety minutes per focus group.
- Ideal size of focus group is between six and eight participants.
- Pre-discussion:
  - Double check you have the correct targets recruited.
  - Dress to match the respondent, i.e., smart for top-tier, etc.
  - Ensure appropriate permissions in virtual conference room platforms.
  - Have participants label their names appropriately.

1. Moderator introduction

We are very pleased you have agreed to join us today. Today, this focus group is an opportunity to discuss the role of standards in supporting the management of environmental aspects of the oil and gas sector.

My name is… I am a consultant with AirVironment Canada. We have been commissioned by the CSA Group to undertake a review of legislation across Cananda related to environmental management in the oil and gas sector to identify gaps and identify where there may be a role for standards.

There are no right or wrong answers, and this is not a test, so please give your honest opinions.

The discussion is recorded to assist with reporting, but please be assured of the confidentiality of your responses. All of the information you provide will be kept confidential and there will be no attribution of comments to any individual. We will only be dealing with information in aggregate, based on themes that emerge through the interviews and focus groups we are conducting.

There are few rules we need to follow for the focus group to work:

- Please make sure you are on mute while other participants are speaking.
- We need to hear from everyone.
- We need to stick to the discussion agenda as there is a lot to cover, so please don't be offended at all if I must cut you off. There's time at the end for other points we don't cover.

> *Turn on recording.*

I think you will really enjoy the next 90 minutes. We have a lot to cover so let's jump right in.

2. Introductions

To start off, I would like you to scan the QR code on the slide here or click on this link *(copy and paste link in chat)* to answer questions throughout this session. Answers to some questions will be displayed on the screen, and answers to others will only be visible to AirVironment. Please start by writing the name of your organization.

> *Check that everyone has joined the survey.*

3. Current regulatory challenges related to environmental management

Now, without discussing it with the rest of the group, I want you to think about your professional experience with respect to regulation in the petroleum and natural gas industry.

You can now move to the next question on your devices. Please write **the ONE element your jurisdiction does well** related to management of environmental aspects of the petroleum and natural gas sector. Okay let's discuss: What does your jurisdiction do well? What attributes make this an element that you think is well managed or well executed.

> *Probe fully on **three** responses. If not clear, clarify with: Why do you think that is?*

Again, without discussing, I want you to think about one element where you think there is need for improvement. Please move to the next question on your devices and write **the ONE area where improvements are required** in petroleum and natural gas regulations.

Okay let's discuss: What does your jurisdiction need to improve on? Why this particular area?

> *Probe fully on **two items.** If not clear, clarify with: Why do you think that is? Identify if the area needing improvement is because of a lack of regulations or because of insufficient enforcement.*

4. Application of standards

Please move to the next question. This lists different aspects of environmental standards. Please rate each characteristic in terms of how important it is to you.

> *Run through the first couple of ratings making sure everyone knows what they are doing. If they take too long tell them: Don't think too much about it and go with your initial gut feel.*

> *While respondents are completing forms, check for common areas of most and least importance. Display the results after everyone has responded or after the time limit has been reached.*

Here are your responses, the majority have selected this attribute as important. Why is this aspect so important? *Probe fully on **three** essential areas.*

Is anything else particularly important? Why? Anything else?

> *Note down any other attributes.*

Again, without discussion, I want you to think about the three most important environmental standards that come to mind as being valuable for environmental management in industry.

Okay let's discuss. What do you think are the best environmental standards? Why do you think this is the best environmental standard? What attributes of the standard make it important? Any other reasons?

5. Wrap-up

Finally, are there any areas that we have not covered or anything else you would like to comment on?

Those are all the questions I have. Thank you for your time today.

> *Thank participants for their time and conclude the session.*

1 Less Important	2 Important	3 Very important	4 Extremely important	5 Absolutely essential

Attribute of Environmental Standard	Importance
International recognition of standard by other countries	
Extent to which it addresses regulatory gaps	
Consultation process with interested parties in development of standard	
Approach to risk management	
Potential for third-party certification or accreditation against standard	
Adaptability and flexibility of standard	
Approach to cumulative environmental effects	
Concentration or other quantitative emissions limits	

Attribute of Environmental Standard	Importance
Extent to which the standard already has traction in industry	
Extent to which the standard aligns with international best practices	
Cost of conformance with the standard	
Ability to support technological advancements and innovation	
Alignment of standard to environmental protection goals of legislation	
Ability of standard to make administration of environmental goals easier	
Data and information systems required for standards conformance	
Application of standard across Canadian jurisdictions (e.g., across provinces)	
Monitoring requirements supported by standard	
Continuous improvement mechanism	
Accountability requirements set out in standard	
Life cycle approach to environmental impacts	
Capacity building and training available to support implementation of standard	

Appendix B – Standards Referenced in Mandated and Soft Law Instruments

B.1 Standards referenced in Layer 1 instruments

Layer	Instrument	Referenced Standard	Requirement / Context of reference
1	*Canadian Environmental Protection Act, 1999*	None	N/A
1	*Impact Assessment Act*	None	N/A
1	*Environmental Management Act (BC)*	None	N/A
1	*Environmental Assessment Act (BC)*	None	N/A
1	*Environmental Protection and Enhancement Act (AB)*	None	N/A
1	*Environmental Assessment Regulation (AB)*	None	N/A
1	*Environmental Management and Protection Act (SK)*	None	N/A
1	*Environmental Assessment Act (SK)*	None	N/A
1	*Saskatchewan Environmental Code (SK)*	ASTM 52516-11	Standard for cost estimate classification system
		CAN/CSA-Z769-00 (R2013)	Adopted through "Adoption of Standards" chapter of Code. Requirement for site assessment to satisfy requirements of this standard
		ISO 14000 environmental management systems	Used as an example of the type of tools the Minister may use and require compliance with if there is a failure to meet obligations in the Code
		NSF/ANSI Standard 60	Requirement to ensure only chemicals listed in this standard are used to clean water mains
1	*Environmental Protection Act (ON)*	None	N/A
1	*Environmental Assessment Act (ON)*	None	N/A
1	*Environmental Assessment Regulation (ON)*	None	N/A
1	*Environmental Quality Act (QC)*	None	N/A

Layer	Instrument	Referenced Standard	Requirement / Context of reference
1	*Regulation respecting environmental impact assessment and review of certain projects (QC)*	None	N/A
1	*Clean Environment Act (NB)*	None	N/A
1	*Environmental Impact Assessment Regulation (NB)*	None	N/A

B.2 Standards referenced in Layer 2 instruments

Layer	Instrument	Referenced Standard	Requirement / Context of reference
2	*Land Act (BC)*	None	N/A
2	*Remediation Regulation (AB)*	None	N/A
2	*On-site and Excess Soil Management Regulations*	None	N/A
2	*Fisheries Act (Federal)*	None	N/A
2	*Water Sustainability Act (BC)*	None	N/A
2	*Water Act (AB)*	None	N/A
2	*Water Security Agency Act (SK)*	None	N/A
2	*Saskatchewan Environmental Code (Water Chapter)*	None	N/A
2	*Ontario Water Resources Act (ON)*	None	N/A
2	*Water Taking and Transfer Regulation (ON)*	None	N/A
2	*Water Withdrawal and Protection Regulation (QC)*	ASTM-53, ASTM A-589, ASTM A-312	Standard against which compliance is required for pipe casing
		ISO/CEI 17025	Acceptable accreditation for laboratories for sample analysis
		EPA 600/2 87-035	Method for assessing intrinsic vulnerability of groundwater
		CAN/BNQ 0413-200, CAN/BNQ0413-400, BNQ 419-090	Compliance requirement for certified sludge allowed to be spread or stored on the ground Compliance requirement for certified animal waste, compost and fertilizing waste
2	*Clean Water Act (NB)*	None	N/A
2	*Water Quality Regulation (NB)*	None	N/A

Layer	Instrument	Referenced Standard	Requirement / Context of reference
2	*Multi-Sector Air Pollutants Regulation*	ASTM D1945-03, ASTM D1946-90	Method for determining methane in gaseous fossil fuel
		ASTM D6522-1 / EPA Method 3A	Method for determining oxygen in flue gas
		ASTM D1945-03, ASTM D1946-90	Method for determining hydrogen in fuel
		ASTM D1826-94, ASTM D3588-98, ASTM D4891-89, GPA Standard 2172-09	Method for determining higher heating value (HHV) for gaseous fuels
		ASTM D240-09,	Method for determining HHV for liquid fuels
		ASTM D4809-09ae1	Method for determining calorific and ash value of solid fuels
		ASTM D5865-12, ASTM D5468-02	Method for determining carbon, hydrogen, nitrogen and sulphur for liquid fuels
		ASTM D5291-10, ASTM D4294-10	Method for determining carbon, hydrogen, nitrogen and sulphur in solid fuels
		ASTM E777-08, ASTM E778-08, ASTM E775-87(2008)e1	Method for determining concentration of carbon, hydrogen, nitrogen and sulphur in fuel derived from waste
		ASTM D6522-11	Method for determining concentration of NO_x and O_2 in flue gas
		EPA Method 1 / EPA Method 1A	Location of sampling port for flue gas
		EPA Method 7E, EPA Method 3A	Method for determining concentration of NO_x and O_2
		EPA Method 7, EPA Method 7A, EPA Method 7C, EPA Method 7E, EPA Method 320, ASTM D6348-12e1, ASTM D6522-1, EC Method AP-77-3	Acceptable method for determining concentration of NO_x in exhaust gas
		EPA Method 3 EPA Method 3A EPA Method 3B	Acceptable method for determining concentration of O_2 in exhaust gas
		ASTM D6522-1	Acceptable method for determining concentration of O_2 in exhaust gas
		ASME PTC 19.10-1981	Acceptable method for determining concentration of O_2 in exhaust gas
		EPA Method 4, EPA Method 320 ASTM D6348-12e1, EC Method D	Acceptable method for determination of moisture content in exhaust gas
		EPA Method 2 EPA Method 19 EC Method B	Acceptable method for determination of volumetric flow rate of exhaust gas

Layer	Instrument	Referenced Standard	Requirement / Context of reference
2	*Substances Release Regulation (AB)*	None	N/A
2	*Emissions Management and Climate Resilience (AB)*	None	N/A
2	*Management and Reduction of Greenhouse Gases Act (SK)*	None	N/A
2	*Local Air Quality Regulation (ON)*	ASHRAE Handbook	Method of calculation in Chapter 44 of Handbook
2	*Clean Air Regulation (QC)*	CAN/CGSB-3.2-2007	Fuel oil specification
		ASTM-D-2879-97 (2007)	Method for determining vapor pressure
		ISO/IEC 17025	Certification standard for laboratory
2	*Clean Air Act (NB)*	None	N/A
2	*Air Quality Regulation (NB)*	ASTM D5191-96	Method for determining vapour pressure of gasoline
2	*Species at Risk Act (Federal)*	None	None
2	*Regulation respecting threatened or vulnerable plant species and their habitats (QC)*	None	N/A
2	*Wildlife Act (BC)*	None	N/A
2	*Wildlife Act (AB)*	None	N/A
2	*Wildlife Habitat Protection Act (SK)*	None	N/A
2	*Endangered Species Act (ON)*	None	N/A
2	*Act respecting threatened or vulnerable species (QC)*	None	N/A
2	*Regulation respecting threatened or vulnerable wildlife species and their habitats (QC)*	None	N/A
2	*Protected Natural Areas Act (NB)*	None	N/A
2	*Fish and Wildlife Act (NB)*	None	N/A

B.3 Standards referenced in Layer 3 instruments

Layer	Instrument	Referenced Standard	Requirement / Context of reference
3	*Canada Energy Regulator Act (Federal)*	None	N/A
3	*Canada Oil and Gas Operations Act*	None	N/A
3	*Canada Petroleum Resources Act*	None	N/A
3	*Energy Resource Activities Act (BC)*	None	N/A
3	*Petroleum and Natural Gas Act (BC)*	None	N/A
3	*Responsible Energy Development Act (AB)*	None	N/A
3	*Oil Sands Conservation Act (AB)*	None	N/A
3	*Oil and Gas Conservation Act (AB)*	None	N/A
3	*Gas Resources Preservation Act (AB)*	None	N/A
3	*Pipeline Acts (AB)*	None	N/A
3	*Oil and Gas Conservation Act (SK)*	None	N/A
3	*The Energy and Mines Act (SK)*	None	N/A
3	*The Mineral Resources Act (SK)*	None	N/A
3	*The Pipelines Act (SK)*	None	N/A
3	*Oil, Gas and Salt Resources Act (ON)*	None	N/A
3	*Act respecting natural gas storage and natural gas and oil pipelines (QC)*	None	N/A
3	*Act ending exploration for petroleum and underground reservoirs and production of petroleum and brine (QC)*	None	N/A
3	*Act respecting transparency measures in the mining, oil and gas industries (QC)*	None	N/A
3	*Oil and Natural Gas Act (NB)*	None	N/A
3	*Bituminous Shale Act (NB)*	None	N/A
3	*Gas Distribution Act (NB)*	None	N/A

B.4 Standards referenced in Layer 4 instruments

Layer	Instrument	Enabling Instrument (Layer)	Referenced Standard	Requirement / Context of reference
4	*Petroleum Refinery Liquid Effluent Regulations (Federal)*	*Fisheries Act (Layer 2)*	APHA Standard Methods	APHA Standard Methods for the Examination of Water and Wastewater, 13th edition (1971) is the test method to demonstrate compliance
4	*Reduction in the Release of Volatile Organic Compounds Regulations (Petroleum Sector) (Federal)*	*Canadian Environmental Protection Act, 1999 (Layer 1)*	ASTM E260, ASTM E169	Method for determining VOC content in barrier fluid
			EPA Method 325A	Sampling equipment and tubes must meet specifications in this method
			EPA Method 325B	Compliance standard for sorbent
			EPA Method 21	Compliance requirement for portable monitoring instrument
4	*Regulations Respecting Reduction in the Release of Methane and Certain Volatile Organic Compounds (Upstream Oil and Gas Sector) (Federal)*	*Canadian Environmental Protection Act, 1999 (Layer 1)*	EPA Method 21	Compliance requirement for portable monitoring instrument
4	*Canada Oil and Gas Drilling and Production Regulations*	*Canada Oil and Gas Operations Act (Layer 3)*	None	N/A
4	*Canadian Energy Regulator Processing Plant Regulations*	*Canadian Energy Regulator Act (Layer 3)*	None	N/A
4	*Canadian Energy Regulator Onshore Pipeline Regulations*	*Canadian Energy Regulator Act (Layer 3)*	CSA Z246.1	Compliance requirement for all pipelines
			CSA Z276	Compliance requirement for pipeline transporting liquefied natural gas
			CSA Z341	Compliance requirement for underground storage of hydrocarbons
			CSA Z662	Compliance requirement for pipeline transporting liquid or gaseous hydrocarbons
4	*CER Filing Manual*	*Canadian Energy Regulator Act (Layer 3)*	CSA Z768-01	Consideration for site with soil contamination for Phase I ESA
			CSA Z 769-00	Consideration for site with soil contamination for Phase II ESA
			CSA Z662	Reference for risk assessment, Guidance for abandonment of pipeline systems
			CSA Z341	Requirements for abandonment of underground formations
			ISO 9000	Guidance for elements of a quality assurance program
			ISO 14064-1, ISO 14064-2	Reference documents for GHG assessment
			GHG Protocol Corporate Accounting and Reporting Standard	Reference document for GHG assessment
			CAPP Best Management Practice: Control of Benzene Emissions from Glycol Dehydrators	Compliance with respect to benzene emissions from processing facilities
			CAPP Best Management Practice: Facility Flare Reduction	Option for compliance with flaring and venting guidelines

Layer	Instrument	Enabling Instrument (Layer)	Referenced Standard	Requirement / Context of reference
4	*CER Filing Requirements for Onshore Drilling Operations Involving Hydraulic Fracturing*	*Canada Energy Regulator Act (Layer 3)*	None	N/A
4	*CER Environmental Protection Plan Guidelines*	*Canada Oil and Gas Operations Act (Layer 3)*	CAN/CSA-ISO 14004:04	May be useful in the development of environmental management systems and associated plans
			CAN/CSA-ISO 14001:2004	Reference for relevant elements in relation to the development of an EMS
			CAPP Canadian East Coast Offshore Petroleum Industry Standard Practice for the Training and Qualifications of Personnel	Guidance on minimum requirements for training, experience and certification for offshore personnel
			CAN/CSA-ISO 9000:05	Source of definition for “audit” and “document” used in guidelines.
4	*CER Remediation Process Guide*	*Canada Energy Regulator Act (Layer 3)*	None	N/A
4	*Drilling and Production Regulation (BC)*	*Energy Resource Activities Act (Layer 3)*	ASME B31.3, CSA Z662	Every portion of the piping system of production facilities must be designed and constructed in accordance with one of these two standards
			CSA Z341	Permit holder for a well or facility that is part of a special project for storage reservoirs must construct and operate in accordance with this standard
			CSA Z741	Permit holder for a well or facility that is part of a special project for storage of carbon dioxide must construct and operate in accordance with this standard
4	*Environmental Protection and Management Regulation (BC)*	*Energy Resource Activities Act (Layer 3)*	None	N/A
4	*Dormancy and Shutdown Regulation (BC)*	*Energy Resource Activities Act (Layer 3)*	None	N/A
4	*Oil and Gas Waste Regulation (BC)*	*Environmental Management Act (Layer 1)*	CAPP H2S Release Rate Assessment Guidelines	Estimation of H2S release rates for drilling and completions
4	*Oil and Gas Activity Application Manual (BC)*	*Energy Resource Activities Act (Layer 3)*	CAPP H2S Release Rate Assessment Guidelines	Estimation of H2S release rates for drilling and completions
			CSA Z662	If design and operation of pipeline continues to meet regulatory requirements and CSA Z662, no amendment is required. Engineering assessments to be completed in accordance with CSA Z662.
			CSA Z276	Facilities should be designed to meet these requirements.
			ASME B31.3	Facilities should be designed to meet these requirements.
			API Standard 521	Guidance for design and operation of flare and incineration systems
			NFPA 30	Containment for above-ground tanks
			API-650, API-651, API-652, API-653, API-620, API-2000, API-2350, API-2015, API-2550	Standards for atmospheric and low-pressure petroleum storage tanks in BC
			API-1604	Requirements on underground tank inspections and abandonments
			API RP 14E or NORSOK P-001	Standard for maximum velocity determination for erosion calculations
			API 2510	Spacing needs to meet the intent of API 2510 when storing liquefied petroleum gas (LPG)

Layer	Instrument	Enabling Instrument (Layer)	Referenced Standard	Requirement / Context of reference
4	*Oil and Gas Activity Operations Manual (BC)*	*Energy Resource Activities Act (Layer 3)*	Canadian Association of Oilwell Drilling Contractors (CAODC) Well Control Procedure, Energy Safety Canada (ESC) Blowout Prevention Manual	Rig crew must perform blowout prevention drill in accordance with CAODC procedure or ESC Manual
			ESC IRP Volume 1: Critical Sour Drilling	Regulator as fully sanctioned this ESC industry recommended practice (IRP)
			ESC IRP Volume 6: Critical Sour Underbalanced Drilling	Referral for special sour wells underbalanced
			ASME Section IX Welding procedure	Welding procedure for casing bowls
			IRP Volume 22	Underbalanced drilling and managed pressure drilling operations using jointed pipe for tripping with surface pressure
			IRP Volume 15	Tripping pipe with positive wellhead pressure
			API 14B	Guidance on acceptable leak rates for sub-surface disposal
			CSA Z662	Compliance requirement for designing, constructing, operating, maintaining or abandoning a pipeline
			CSA Z276, CSA Z662, ASME B31.3	Facility activities should meet these standards
			API-650, API-651, API-652, API-653, API-620, API-2000, API-2350, API-2015, API-2550	Standards for atmospheric and low-pressure petroleum storage tanks in BC
			CSA Z662, API-1604, NFPA 30	Refer to these standards for general requirements on underground tank inspections and abandonment
			CAPP Guiding Principles for Hydraulic Fracturing	Referenced as a responsible approach to hydraulic fracturing
			CAPP Best Management Practice for Fugitive Emissions Management	Reference for further guidance for fugitive emissions management program.
			API 53	Pressure testing for annular of surface casing
4	*Oil and Gas Processing Facility Regulation (BC)*	*Energy Resource Activities Act (Layer 3)*	API Standard 50, API Standard 521, API Standard 526, API Standard 527, API Standard 537, API Standard 570, API Standard 2000, API Standard 2510	Adopted for the purposes of the regulation
			ASME B31.3	Adopted for the purposes of the regulation
			CSA B149.1, CSA Z767	Adopted for the purposes of the regulation (except clause 7.4)
4	*BCER Environmental Protection and Management Guideline*	*Energy Resource Activities Act (Layer 3)*	CAPP Pipeline-Associated Water Crossing	Additional guidance for stream crossings
4	*BCER Flaring and Venting Reduction Guideline*	*Energy Resource Activities Act (Layer 3)*	API STD 537, API STD 521, CSA Standards (general)	Listed amongst necessary references for the design of gas combustion systems
			CAPP Guide for Estimation of Flaring and Venting Volumes from Upstream Oil and Gas Facilities	Guide is recognized by BCER as containing acceptable practices for estimating
			CSA Z620.2	Measurements for compressor vented seal gas should be completed in accordance with this standard

Layer	Instrument	Enabling Instrument (Layer)	Referenced Standard	Requirement / Context of reference
4	*BCER Management of Saline Fluid for Hydraulic Fracturing Guideline*	*Energy Resource Activities Act (Layer 3)*	None	N/A
4	*BCER Ecologically Suitable Species Guideline*	*Energy Resource Activities Act (Layer 3)*	None	N/A
4	*Site Remediation and Reclamation Manual (BC)*	*Energy Resource Activities Act (Layer 3)*	None	N/A
4	*British Columbia Air Dispersion Modeling Guideline*		None	N/A
4	*Guidance for NO2 Dispersion Modelling in British Columbia*		None	N/A
4	*BCER Well Decommissioning Guidelines*		None	N/A
4	*Methane Emissions Reduction Regulation (AB)*	*The Oil and Gas Conservation Act (Layer 3)*	None	N/A
4	*Substance Release Regulation (AB)*	*Environmental Protection and Enhancement Act (Layer 1)*	None	N/A
4	*Conservation and Reclamation Regulation (AB)*	*Environmental Protection and Enhancement Act (Layer 1)*	None	N/A
4	*Specified Gas Reporting Regulation (AB)*	*Emissions Management and Climate Resilience Act (Layer 2)*	None	N/A
4	*AER Directive 020 Well Abandonment*	*Responsible Energy Development Act (Layer 3)*	None	N/A
4	*AER Directive 058: Oilfield Waste Management Requirements for the Upstream Petroleum Industry*	*Responsible Energy Development Act (Layer 3)*	None	N/A
4	*AER Directive 060 Upstream Petroleum Industry Flaring, Incinerating and Venting*	*Responsible Energy Development Act (Layer 3)*	ANSI/API Standard 521, CSA Z620.1	Referenced as one of the standards necessary for design of gas combustion systems
			CAPP general references	Listed among references are the CAPP Sour Non-routine Flaring Framework, CAPP Best Management Practices for Facility Flare Reduction, CAPP Guide for Estimation of Flaring and Venting Volumes from Upstream Oil and Gas Facilities
4	*Directive 081: Water Disposal Limits and Reporting Requirements for Thermal In Situ Oil Sands Schemes*	*Responsible Energy Development Act (Layer 3)*	None	N/A
4	*Directive 083 – Hydraulic Fracturing – Subsurface Integrity*	*Responsible Energy Development Act (Layer 3)*	None	N/A
4	*AER Directive 087 Well Integrity Management*	*Responsible Energy Development Act (Layer 3)*	None	N/A
4	*AER Directive for the Assessment of Non-Saline Groundwater In Direct Contact with Bitumen for In Situ Operations*	*Responsible Energy Development Act (Layer 3)*	ISO/IEC 17025	Accreditation requirement for laboratories analyzing samples

Layer	Instrument	Enabling Instrument (Layer)	Referenced Standard	Requirement / Context of reference
4	*Continuous Emission Monitoring System (CEMS) Code (AB)*	*Environmental Protection and Enhancement Act (EPEA) (Layer 1)*	ASTM D6216	Design specifications for in-stack opacity analyzers
4	*Oil Sands Project Applications*	*Oil Sands Conservation Act (OSCA) (Layer 3)*	None	N/A
4	*Alberta Air Quality Modeling Guideline*		CAPP 2007-0003	Management of Fugitive Emissions and Upstream Oil and Gas Facilities: Best Management Practice
4	*AER Directive 20: Well Abandonment*	*The Oil and Gas Conservation Act (Layer 3)*	None	N/A
4	*The Oil and Gas Emissions Management Regulations (SK)*	*The Oil and Gas Conservation Act (Layer 3)*	None	N/A
4	*The Oil and Gas Conservation Regulations (SK)*	*The Oil and Gas Conservation Act (Layer 3)*	None	N/A
4	*Directive PNG008: Disposal and Injection Well Requirements*	*The Oil and Gas Conservation Act (Layer 3)*	CSA Z341	Standard referred to by the Saskatchewan Ministry of Energy and Resources (SK MER) for requirements for design, construction, testing, operation, maintenance and repair of underground hydrocarbon storage
4	*Directive PNG036: Venting and Flaring Requirements (SK)*	*The Oil and Gas Conservation Act (Layer 3)*	None	N/A
4	*PNG 048 - Hydraulic Fracturing Requirements*	*The Oil and Gas Conservation Act (Layer 3)*	None	N/A
4	*Directive S-01: Saskatchewan Upstream Petroleum Industry Storage Standards*	*The Oil and Gas Conservation Act (Layer 3)*	None	N/A
4	*Environmental Review Guidelines for Oil and Gas Activities*	*Environmental Assessment Act (Layer 1)*	None	N/A
4	*Environmental Evaluation Checklist for Oil and Gas Development Projects on Private Land in Saskatchewan*	*Environmental Management and Protection Act (SK) (Layer 1)*	None	*N/A*
4	*PNG015: Well Abandonment Requirements*		None	*N/A*
4	*Air Pollution – Discharge of Sulphur Dioxide from Petroleum Facilities Before 2029 (O.Reg. 530/18)*	*Environmental Protection Act (ON) (Layer 1)*	None	N/A
4	*Air Pollution – Discharge of Sulphur Dioxide from Petroleum Facilities (O.Reg. 88/22)*	*Environmental Protection Act (ON) (Layer 1)*	None	N/A
4	*Record of Site Condition Regulation (ON)*	*Environmental Protection Act (Layer 1)*	None	N/A
4	*Ontario Air Dispersion Modeling Guideline for Ontario (Guideline A-11)*	*Ontario Regulation 49/05 Air Pollution – Local Air Quality (Layer 2)*	None	N/A

Layer	Instrument	Enabling Instrument (Layer)	Referenced Standard	Requirement / Context of reference
4	*Oil, Gas and Salt Resources of Ontario Provincial Operating Standards*	*Oil, Gas and Salt Resources Act (ON) (Layer 3)*	API RP 651	Standards referenced as being adopted and referenced in provincial operating standards
			API Specification 6A	
			ASME B31.3	
			API Bulletin 5C4	
			API RP 500	
			API RP 5A5	
			API RP 5C1	
			API Specification 10A	
			API Specification 12B	
			API Specification 12D	
			API Specification 12F	
			API Specification 12P	
			API Specification 5CT	
			API Standard 521	
			API Standard 650	
			API Standard 653	
			API Technical Report 5C3	
			CSA B51	
			CSA Z341 Series	
			CSA Z662	
4	*Technical Standard (Petroleum refining-Industry standard) (ON)*	*Air Pollution – Local Air Quality (Layer 2)*	None	N/A
4	*Exploration, Drilling and Production regulation (ON)*	*Oil, Gas and Salt Resources Act*	None	N/A
4	*Regulation respecting liquid effluents of petroleum refineries (QC)*	*Environmental Quality Act (Layer 1)*	None	N/A
4	*Regulation respecting petroleum exploration, production and storage on land (QC)*	*Act respecting natural gas storage and natural gas and oil pipelines (Layer 3)*	CSA Z625, CSA Z341	Wellhead compliance requirements
		Act ending exploration for petroleum and underground reservoirs and production of petroleum and brine (Layer 3)	CSA Z731	Compliance requirement for emergency response plan

Layer	Instrument	Enabling Instrument (Layer)	Referenced Standard	Requirement / Context of reference
4	*Regulation respecting petroleum exploration, production and storage licences, and the pipeline construction or use authorization (QC)*	*Act respecting natural gas storage and natural gas and oil pipelines (Layer 3)* *Act ending exploration for petroleum and underground reservoirs and production of petroleum and brine (Layer 3)*	CSA Z731	Emergency preparedness plan must comply with this standard
			CSA Z662	Integrity management plan, safety and loss management plan, and emergency management plan must comply with this standard
			CSA Z246.1	Security management program must comply with this standard
			CSA Z246.2	Emergency management program must comply with this standard
			CSA Z731	Emergency management program must comply with this standard
			CSA Z247	Damage prevention program must comply with this standard
			CSA Z341	Gathering or transport pipeline must comply with this standard
4	*Responsible Environmental Management of Oil and Natural Gas Activities in New Brunswick – Updated Rules for Industry (NB)*	*Oil and Natural Gas Act (Layer 3)*	CAN/CSA-ISO 14062-2:06 GHG Protocol for Project Accounting	GHG emissions inventory must be consistent with one of these standards
			CSA Z1600	Emergency management program must be compliant with this standard
			CSA Z246.1:21	Security management program must be compliant with this standard
			CSA Z662-15, API Specification 6A, NACE Standard MR01-75, ASME BPV Code	Welding at casing bowls must be in accordance with this standard
			API RP 5C1	Threading casing and tubing joint connection make-up and torque procedures must meet specifications in this standard
			API RP 5A3, ISO 13678	Joint connection compounds must meet these performance requirement specifications
			API Specification 10A API RP 10 B-2	Cement must conform to this standard
			ISO 11960	Casing needs to be manufactured at minimum to meet this standard
			API RP 10D-2 / API 10TR4	Centralizers and their placement must meet this standard
4	*Responsible Environmental Management of Oil and Natural Gas Activities in New Brunswick – Updated Rules for Industry (NB)*	*Oil and Natural Gas Act (Layer 3)*	ASTM D323-82	Standard test method for determining vapor pressure in petroleum products
			ASTM D56-82, ASTM D93-85	Standard test method for flash point determination
			CAN4-S601-M84, CAN4-S630-M84, ULC/ORD-C142.3-1991, CAN4-S603-M85, CAN4-S603.1-M85, CAN4-S615-M83, API Standard 650, API-STD-12B, API-STD-12D, API-SPEC-12-F	Requirement for compliance for construction of tanks
			API Standard 620, ASME Rules for Construction of Pressure Vessels	Requirement for construction of low-pressure tanks after commencement of regulation
			CSA B139	Storage tank for fuel for stationary engines used to power emergency equipment to be installed in conformance with CSA B139
			ULC-C107C-M1984	Allowable piping system for underground installations
			API Spec 5L, ASTM A53-86, CAN/CSA-Z245.1-M90, CAN/CSA-Z183-M90	Steel piping compliance requirements
			ANSI B31.3-1976, ANSI/ASME B31.3e-1980	Conformance requirement for high pressure piping and fittings
			ULC-C340-M1979, ULC-C1321-1983	Conformance requirements for manufacturing of threaded joints for petroleum product
			ANSI B16.5-1973	Conformance requirement for flanged joints for piping
			ASTM A193/A 193M-86	Conformance requirement for ally steel used in bolting materials for flanged connections
			CAN4-S633-M90	Flexible hose connectors conformance requirements
			ULC-C842-M1984	Conformance requirement for valves in piping system
			ULC-S620-M1980	Conformance requirement for hose nozzle and emergency valves
			CSA-B346-M1950	Conformance requirement for fixed dispensing equipment for petroleum product
			CAN4-S612-M83	Conformance requirement for hose
			CSA-B376-M1980, CSA B306-M1977, ULC-C30-1974	Conformance requirement for portable containers
4	*Guideline for Plume Dispersion Modelling (NB)*	*Air Pollution Control Regulations (Layer 2)*	None	N/A

Appendix C – PNG Environmental Standards Used in Industry

C.1 Global Reporting Initiative (GRI) Standards

The Global Reporting Initiative (GRI) sets out reporting requirements against economic, environmental and social impacts [231]. The GRI Standards are comprised of three series of standards – the GRI Universal Standards that apply to all organizations, the GRI Sector Standards applicable to specific sectors, and the GRI Topic Standards that set out reporting requirements for specific economic, social or environmental topics [231].

The Universal Standards (GRI 1, GRI 2 and GRI 3) apply to all entities, and generally cover requirements and principles for applying GRI standards and for disclosures about the organization and its material topics [231].

GRI 3 provides guidance on how to determine topics that represent the most significant impacts of an organization, so-called material topics [231]. The process begins with understanding the organization's context, identifying actual and potential impacts, and then assessing the significance of the impacts [231]. The most significant impacts are the ones prioritized for reporting purpose [231]. The material topics are also tested against the list of topics identified by the GRI sector-specific standards as likely to be material for that sector [231].

The sector-specific standard for the PNG sector is GRI 11: *Oil and Gas Sector 2021.* It provides information for PNG organizations about material topics, based on the PNG sector's likely impacts on the economy, environment and people [231]. **Table C1** shows the environment-related topics that are identified in GR 11 as likely material topics for the PNG sector [231]. GRI 11 also references GRI Topic Standards that are relevant to each material topic [231].

Table C1: Likely material topics for the PNG sector identified in GRI 11 [231]

Topic	Description
11.1	GHG emissions
11.2	Climate adaptation, resilience and transition
11.3	Air emissions
11.4	Biodiversity
11.5	Waste
11.6	Water and effluents
11.7	Closure and rehabilitation
11.8	Asset integrity and critical incident management

The GRI Topic Standards for reporting are divided into three segments – standards for economic impact reporting (200 series), standards for environmental impact reporting (300 series), and standards for social reporting (400 series) [231]. The only 100 series standard is GRI 101: *Biodiversity 2024,* which concerns biodiversity-related impacts and management of such impacts [231].

Table C2 shows the GRI 300 series of standards and the specific indicators under each standard [231]. The green shading indicates disclosure standards that are referenced by GRI 11 as a result of the determination of likely material topics [231]. Although GRI 306: *Effluents and Waste 2016* was superseded by GRI 303: *Water and Effluents 2018* and GRI 306: *Waste 2020,* its spills-related content in Disclosure 306-3 Significant spills remains in effect [231].

GRI 11 provides additional recommendations for some of the disclosures corresponding to Topic Standards. For example, as part of the Disclosure 305-1, GRI 11 recommends reporting the percentage of direct (Scope 1) GHG emissions arising from methane, and reporting a breakdown of Scope 1 emissions by type of source (stationary combustion, process, fugitive) [231]. In relation to Disclosures 306-3, 306-4 and 306-5, GRI 11 recommends including a breakdown of drilling waste (muds and cuttings), scale and sludges, and tailings when reporting the composition of waste generated, diverted from disposal, or directed to disposal, respectively [231]. The GRI 305: *Emissions 2016* standard notes that the requirements of the standard are based on the GHG Protocol Corporate Accounting and Reporting Standard [228] and the GHG Protocol Corporate Value Chain Standards [231]. GRI notes that the classification of Scope 1, Scope 2 and Scope 3 emissions have alignment to concepts in ISO 14064 [231]. However, no other reference is made to the ISO 14064 standard or any other ISO standard [231].

C.2 Sustainability Accounting Standards Board (SASB) Standard

The Sustainability Accounting Standards Board (SASB) Standards are maintained by the International Sustainability Standards Board (ISSB) of the International Financial Reporting Standards (IFRS). The SASB Standards identify sustainability-related issues relevant to investors across 77 industries, four of which are *Oil & Gas – Exploration and Production, Oil & Gas – Midstream, Oil & Gas – Refining & Marketing, and Oil & Gas – Services* [232]. The SASB Standards are focused on disclosure of information about sustainability-related risks that could affect financial aspects of a business.

Each SASB Standard identifies sustainability-related topics, metrics, units of measure and activity metrics. The disclosure topics relevant to the biophysical environment are GHG emissions, air quality, water management and biodiversity impacts. **Table C3** summarizes the relevant metrics for SASB Oil & Gas Standards related to the atmospheric environment for exploration and production, midstream, and refining and marketing sectors.

Reporting on Scope 1 emissions and the percentage of methane is common to the exploration and production, midstream, and refining and marketing segments. The SASB Standard requires exploration and production companies to further segment Scope 1 emissions by source of emissions. In relation to air quality, the only difference among sectors is the reporting requirement for hydrogen sulphide (H_2S) for refining and marketing companies.

The requirements for reporting in relation to water management differs significantly across the SASB Standards for oil and gas sectors, as shown in **Table C4.** Water management metrics are more rigorous in the SASB Standard for *Oil & Gas – Exploration and Production* compared to the other standards for other PNG activities.

Table C2: 300 Series GRI topic standards and corresponding topic disclosures (shading indicates GRI 11 material topics) [231]

GRI 301: Materials 2016	GRI 302: Energy 2016	GRI 303: Water and Effluents 2018	GRI 304: Biodiversity 2016	GRI 305 Emissions 2016	GRI 306: Effluents and Waste 2016	GRI 306: Waste 2020	GRI 308: Supplier Environmental Assessment 2016
301-1 Materials used by weight or volume	302-1 Energy consumption within the organization	303-1 Interactions with water as a shared resource	304-1 Operational sites owned, leased and managed in, or adjacent to, protected areas and areas of high biodiversity value outside protected areas	305-1 Direct (Scope 1) GHG Emissions	306-3 Significant spills	306-1 Waste generation and significant waste-related impacts	308-1 New suppliers that were screened using environmental criteria
301-2 Recycle input materials used	302-2 Energy consumption outside the organization	303-2 Management of water discharge-related impacts	304-2 Significant impacts of activities, products and services on biodiversity	305-2 Energy indirect (Scope 2) GHG emissions		306-2 Management of significant waste-related impacts	308-2 Negative environmental impacts in the supply chain and actions taken
301-3 Reclaimed products and their packaging materials	302-3 Energy intensity	303-3 Water withdrawal	304-3 Habitats protected or restored	305-3 Other indirect (Scope 3) GHG emissions		306-3 Waste generated	
	302-4 Reduction of energy consumption	303-4 Water discharge	304-4 IUCN Red List species and national conservation list species with habitats in areas affected by operations	305-4 GHG emissions intensity		306-4 Waste diverted from disposal	
	302-5 Reductions in energy requirements of products and services	303-5 Water consumption		305-5 Reduction of GHG emissions		306-5 Waste directed to disposal	
				305-6 Emissions of ozone-depleting substances			
				305-7 Nitrogen oxides (NO_x), sulfur oxides (SO_x) and other significant air emissions			

Table C3: Environmental topics related to atmospheric environment in SASB Standards [232]

Metric	Unit of Measure	Exploration & Production	Midstream	Refining & Marketing
Greenhouse Gas Emissions				
Gross global Scope 1 emissions, percentage methane, percentage covered under emissions-limiting regulations	Metric tonnes CO_2e, %	●[1]	●	●
Amount of gross global Scope 1 emissions from: (1) flared hydrocarbons, (2) other combustion, (3) process emissions, (4) other vented emissions and (5) fugitive emissions	Metric tonnes CO_2e	●		
Discussion of long- and short-term strategy or plan to manage Scope 1 emissions, emissions reduction targets, and an analysis of performance against those targets	N/A	●	●	●
Air quality				
Air quality emissions of the following pollutants:				
▪ NO_x (excluding N_2O)	Metric tonnes	●	●	●
▪ SO_x	Metric tonnes	●	●	●
▪ Volatile organic compounds (VOCs)	Metric tonnes	●	●	●
▪ H2S	Metric tonnes			●
Number of refineries in or near areas of dense population	Number			●

[1] The "●" means metric is covered within the SASB Standard.

Table C4: Environmental topics related to water management in SASB Standards [232]

Metric	Unit of Measure	Exploration & Production	Midstream	Refining & Marketing
Water Management				
(1) Total water withdrawn, (2) total water consumed; percentage of each in regions with high or extremely high baseline water stress	Thousand m^3, percentage (%)	●[2]		●
Volume of water produced and flowback generated; percentage (1) discharged, (2) injected, (3) recycled; hydrocarbon content in discharged water	Thousand m^3, percentage (%), metric tonnes (t)	●		
Percentage of hydraulically fractured wells for which there is public disclosure of all fracturing fluid chemicals used	Percentage (%)	●		
Percentage of hydraulic fracturing sites where ground or surface water quality deteriorated compared to a baseline	Percentage (%)	●		
Number of incidents of non-compliance associated with water quality permits, standards and regulations	Number			●

[2] The "●" means metric is covered within the SASB Standard.

The disclosure metrics for ecological impacts and biodiversity also vary across the three SASB Standards, as shown in **Table C5.** No biodiversity or ecological impact indicators exist in the SASB Standard for *Oil & Gas – Refining & Marketing.* The biodiversity and ecological indicators for exploration and production, and for midstream, show only some minor differences. The term "biodiversity" is used in the standard for Exploration & Production, while the term "ecological impacts" is used in the standard for Midstream. The spills indicator for Exploration & Production is specific to the volume impacting sensitive shorelines and based on the Environmental Sensitivity Index (ESI), while for midstream activities, the indicator is more general to sites with high biodiversity significance.

Table C5: Topics related to biodiversity / ecological impacts in SASB Standards [232]

Metric	Unit of Measure	Exploration & Production	Midstream	Refining & Marketing
Biodiversity / Ecological Impacts				
Description of environmental management policies and practices for active sites / operations	N/A	●[3]	●	
(1) Number and (2) aggregate volume of hydrocarbon spills, (3) volume in the Arctic, (4) volume impacting shorelines with ESI rankings 8 10 / volume in sites with high biodiversity significance, and (5) volume recovered (Note 1)	Number, barrels (bbls)	●	●	
Sites within areas of protected conservation status or endangered species habitat (Note 2)	Percentage (%)	●	●	
(1) Terrestrial land area disturbed, (2) percentage of impacted areas restored	Hectares (ha), percentage (%)		●	

[3] The "●" means metric is covered within the SASB Standard.

C.3 Ipieca Sustainability Reporting Guidance

Ipieca (formerly known as the International Petroleum Industry Environmental Conservation Association) was established in 1974 as a communication channel and interface point between the United Nations Environmental Programme (UNEP) and the PNG sector. When established, Ipieca focused on environment and climate issues, but its mandate has expanded to cover broader components of sustainability [233].

Ipieca published *Sustainability reporting guidance for the oil and gas industry,* which was developed in collaboration with the American Petroleum Institute (API) and the International Association of Oil & Gas Producers (IOGP). This sustainability reporting framework includes seven indicators related to climate change and energy, and eight indicators related to the environment, as shown in **Table C6** [234]. Each indicator has a core set of reporting requirements, plus additional reporting requirements. Beyond the climate change and energy and the environment indicators, Ipieca also has indicators related to governance and business ethics; safety, health and security; and social dimensions. Ipieca provides links on its website to the sustainability reports of corporate members of Ipieca [233].

For estimating, accounting and reporting on GHG emissions (CCE-4) by PNG companies, Ipieca recommends the IPIECA/API/IOGP *Petroleum industry guidelines for reporting greenhouse gas emissions* [234]. For reporting purposes, Ipieca classifies GHG emissions into direct emissions (Scope 1), indirect emissions from energy consumption (Scope 2), and other indirect emissions (Scope 3) [234]. Estimating petroleum industry value chain

Table C6: Topics related to biodiversity / ecological impacts in SASB Standards [232]

Climate Change and Energy		Environment	
CCE-1	Climate governance and strategy	ENV-1	Freshwater
CCE-2	Climate risk and opportunities	ENV-2	Discharges to water
CCE-3	Lower-carbon technology	ENV-3	Biodiversity policy and strategy
CCE-4	Greenhouse gas emissions	ENV-4	Protected and priority areas for biodiversity conservation
CCE-5	Methane emissions	ENV-5	Emissions to air
CCE-6	Energy use	ENV-6	Spills to the environment
CCE-7	Flared gas	ENV-7	Materials management
		ENV-8	Decommissioning

(Scope 3) greenhouse gas emissions provides additional guidance for reporting against the 15 categories of emissions comprising Scope 3 emissions [234]. Ipieca defines core reporting elements for GHG emissions, as well as additional reporting elements [234].

For other air emissions, ENV-5 requires reporting on total emissions of VOCs, sulphur oxides and nitrogen oxides and a discussion on how impacts on air quality are managed and monitored [234]. Reporting on particulate matter, carbon monoxide, ozone-depleting substances or other air emissions is among the additional reporting elements.

Core reporting elements related to water include the volume of freshwater withdrawn, the volume of freshwater consumed, a list and percentage of projects in water-stressed areas, and the percentage of freshwater withdrawn or consumed from water-stressed or water-scarce areas. Ipieca also requires reporting on the reduction in freshwater withdrawn or consumed due to water reduction measures implemented. Additional reporting indicators include intensity reporting, withdrawals related to once-through cooling water, and volumes of non-freshwater taken as an alternative to freshwater [234].

For discharges to water, core reporting elements include the quantity of hydrocarbons (in tonnes), and concentrations in produced water and process water discharged to surface. Additional reporting elements related to discharges include details such as destination type, other contaminants (e.g., sulphides, ammonia, phenols, total suspended solids), and efforts taken to manage discharges [234].

The core reporting elements for biodiversity under ENV-3 include the biodiversity management approach being used, examples of areas where biodiversity management activities have been implemented, and processes for identifying and managing activities in sensitive areas. ENV-4 requires listing major projects near sensitive sites and describing commitments related to them [234].

The core reporting elements for ENV-6, ENV-7 and ENV-8 are largely narrative in nature, involving descriptions of approaches to managing impacts, and efforts undertaken to minimize impacts associated with the category of activities [234]. ENV-6 requires reporting on the number and volume of hydrocarbon spills greater than one barrel reaching the environment [234].

CSA Group Research

In order to encourage the use of consensus-based standards solutions to promote safety and encourage innovation, CSA Group supports and conducts research in areas that address new or emerging industries, as well as topics and issues that impact a broad base of current and potential stakeholders. The output of our research programs will support the development of future standards solutions, provide interim guidance to industries on the development and adoption of new technologies, and help to demonstrate our on-going commitment to building a better, safer, more sustainable world.

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