

Pipelines and Facilities Integrity Management Program (IMP) Audit Summary

Annual Report 2021





Contents

3	Executive Summary
5	Role of the BC Oil and Gas Commission
7	Introduction
8	Audit Results and Analysis
9	Permit Holder-based Analysis
9	Audit Score
10	Performance Classification
11	Component-based Analysis
15	Management System (MS)-Level: Plan-Do-Check-Act Analysis
16	IMP Audit Score Trends
17	Corrective Actions Oversight and Resolution Audit Findings
20	Safety Culture Assessment
22	Summary

Executive Summary

The BC Oil and Gas Commission (Commission) performed 28 integrity management program (IMP) audits in 2021 including 15 facility IMP audits and 13 pipeline IMP audits. The Commission audits pipeline and facility permit holders within a five-year cycle.

The audits evaluate if permit holders' IMPs meet the applicable regulatory requirements outlined in the Pipeline Regulation, Drilling and Production Regulation and Liquefied Natural Gas Facility Regulation. The [Compliance Assurance Protocol for Integrity Management Programs for Pipelines](#) and the [Compliance Assurance Protocol for Integrity Management Programs for Facilities](#) contain guidance on meeting the regulatory requirements. In 2021, expectations for pipelines IMP audits included damage prevention program requirements.

The impacts of the COVID-19 pandemic continued in 2021, therefore, all audits were performed remotely. Remote auditing required completion of an audit workbook and submission of records and documents by the auditees, followed by a virtual meeting. The final reports outlining audit findings and analysis were issued to the auditees after the audit.

High priority audit findings for pipeline IMPs were related to:

- Risk assessment and management: review and update pipeline inventory, apply risk assessment to all pipeline assets, and assess all potential hazards on an ongoing basis.
- Inspection, maintenance, and monitoring (IMM): formalize processes to manage in-house and third-party inspection, maintenance, and monitoring (IMM) activities; establish processes for inactive pipelines; leak detection and dead leg management; and review IMM processes to improve scheduling and tracking of activities and records.
- Management and performance reviews: establish meaningful and relevant key performance indicators and complete formal IMP performance reviews by senior leadership at defined intervals.

High priority audit findings for facility IMPs were related to:

- Risk assessment and management: develop and incorporate risk assessment at the facility level and equipment level.
- General IMP: ensure all equipment within the scope of the IMP is included, such as tanks, rotating equipment, flares, instrumentation, and controls.
- Inspection, maintenance, and monitoring (IMM): develop and implement processes to plan, track and manage preventative maintenance and other IMM activities for all equipment within the scope of the facility IMP.
- Management and performance reviews: establish key performance indicators (KPIs) and complete formal IMP performance reviews by senior leadership at defined intervals.
- Internal audit: establish an internal audit program at a defined interval to evaluate program effectiveness.

The Commission's corrective action plan (CAP) oversight process ensures permit holders address the audit findings through the development and implementation of CAPs.

The average annual audit score for 2021 was 91 per cent for pipeline IMPs and 86 per cent for facility IMPs. Average audit scores have continued to increase over time.



Role of the BC Oil and Gas Commission

As a provincial Crown agency, we protect public safety and safeguard the environment through the sound regulation of oil, gas and aspects of geothermal activities in B.C. while balancing a broad range of environmental, economic and social considerations.

We regulate resource activity through the [Oil and Gas Activities Act \(OGAA\)](#), the [Petroleum and Natural Gas \(PNG\) Act](#), and other associated laws related to heritage conservation, roads, land and water use, forestry, and other natural resources.

Through combined authority and working with partner agencies, we regulate activities on Crown land, private land, and the Agricultural Land Reserve. When oil, gas, or geothermal permits are granted, we are responsible for ensuring industry compliance with provincial legislation from initial exploration to final reclamation.

As more resources have been discovered, techniques for accessing them have advanced, environmental awareness has increased, and stakeholders have let us know they are interested in providing more input.

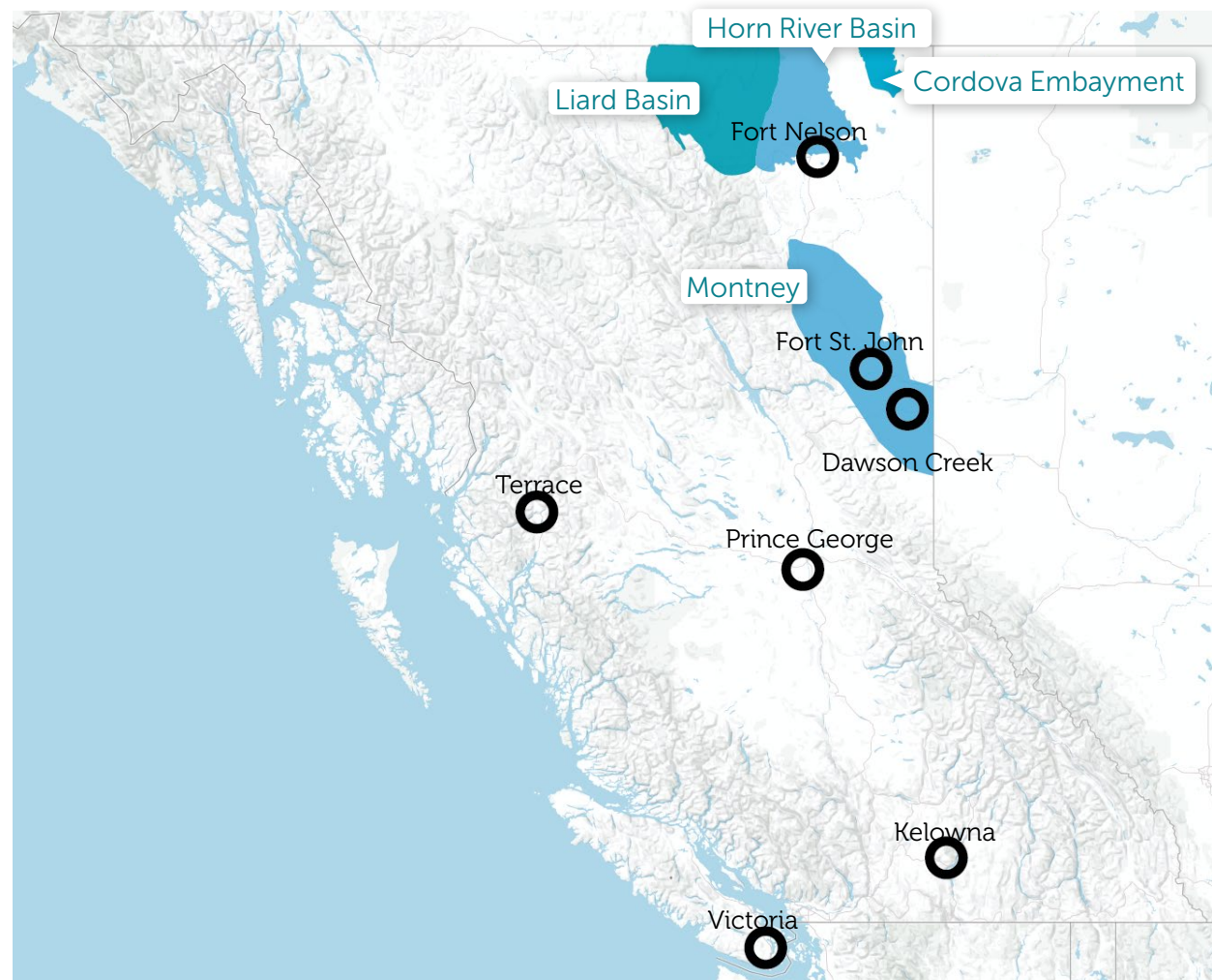
During our review and decision-making processes, we work closely with [land owners](#), [rights holders](#), and [Indigenous communities](#).

The Commission currently has over 280 employees operating out of seven locations: Fort Nelson, Fort St. John, Dawson Creek, Terrace, Prince George, Kelowna and Victoria. The largest number of employees are in the Fort St. John office.



With more than
20 years' dedicated
service, we're
committed to ensuring
safe and responsible
energy resource
management
for British Columbia.

Commission Office Locations Throughout B.C.



Territorial Acknowledgement

We acknowledge and respect the many Indigenous Territories and Treaty areas, each with unique cultures, languages, legal traditions and relationships to the land and water, which the BC Oil and Gas Commission's work spans. We also respectfully acknowledge the Métis and Inuit people living across B.C.

Introduction

Integrity Management Programs (IMPs) for pipelines have been a regulatory requirement in British Columbia since 1999, when they were introduced in CSA Z662, the national standard for pipeline systems. IMPs for facilities have been a regulatory requirement in British Columbia since 2018.

IMPs provide a systematic approach for assuring the integrity of pipeline and facility infrastructure. The focus of IMP processes is to anticipate hazards, analyze, assess, and manage risks that can adversely affect safety and the environment. IMPs must address the entire lifecycle of pipelines and facilities including planning, design, procurement, construction, operation, maintenance, and decommissioning.

The Commission has been auditing IMPs for pipelines since 2011 and facilities since 2018. Each year, audits are planned based on the Commission's inherent risk assessment of permit holders' pipeline and facility infrastructure, time passed since the last audit and other relevant criteria. On average, the Commission audits permit holders every five years. The Commission's selection criteria, scope and expectations are detailed in the [Compliance Assurance Protocol for Integrity Management Programs for Pipelines](#) and the [Compliance Assurance Protocol for Integrity Management Programs for Facilities](#). In 2021, expectations for pipelines IMP audits included damage prevention program requirements.

This report includes a summary and analysis of the pipeline and facility IMPs audit results for 2021. During 2021, the Commission completed 13 pipeline and 15 facility IMP audits. The scale of two facility IMP audits were reduced due to the small size of the permit holders. Due to their reduced scope, the results of these micro audits are not included in this report.

The COVID-19 pandemic continued to have an impact in 2021, therefore, the Commission continued to employ remote auditing techniques. This required completion of an audit workbook and written submissions by the auditees. A virtual audit meeting was scheduled following the submission review to address any outstanding issues and to present preliminary findings. The final audit reports outlining the findings were issued to complete the audit process. The auditees were required to develop and implement corrective action plans (CAPs) to address the gaps identified by the findings. Under the CAP oversight management program, the Commission reviews and approves CAPs and monitors implementation of corrective actions.

Audit Results and Analysis

IMP audits undertaken by the Commission include 19 IMP components:

PLAN: 1. General, 2. Policy and leadership commitment; 3. Goals and objectives; 4. Planning; 5. Risk assessment.

DO: 6. Organizational roles and responsibilities; 7. Communication; 8. Competency and training; 9. Managing change; 10. Information management and document control; 11. Record control; 12. Operational control; 13. Inspection, maintenance, and monitoring (IMM); 14. Evaluation of IMM; 15. Modification and repair.

CHECK: 16. Incident investigation and learning; 17. Internal audit; 18. Performance measurement and key performance indicators (KPI) analysis.

ACT: 19. Management review.

The Commission uses Integrity Management Program Audit and Knowledge Tool (IMPAKT) for audit scoring. The IMPAKT dashboard presents the overall audit score (defined as the percentage of requirements met under each IMP

component) for each permit holder and the consolidated audit scores per IMP component by distinguishing between applicable, non-applicable and not-audited indicators of components.



Permit Holder-based Analysis

Audit Score

For pipeline IMPs, the audit score ranged from 68 to 100 per cent for 13 audited permit holders. For facility IMPs, the audit score ranged from 53 and 100 per cent for 13 audited permit holders. The average audit score for 2021 IMP audits was 91 per cent for pipelines and 86 per cent for facilities. The higher audit score for pipeline IMPs compared to facility IMPs indicated program maturity and better understanding of the expectations and requirements by the pipeline operators. Figures 1 and 2 show audit scores by permit holder for pipelines and facilities.

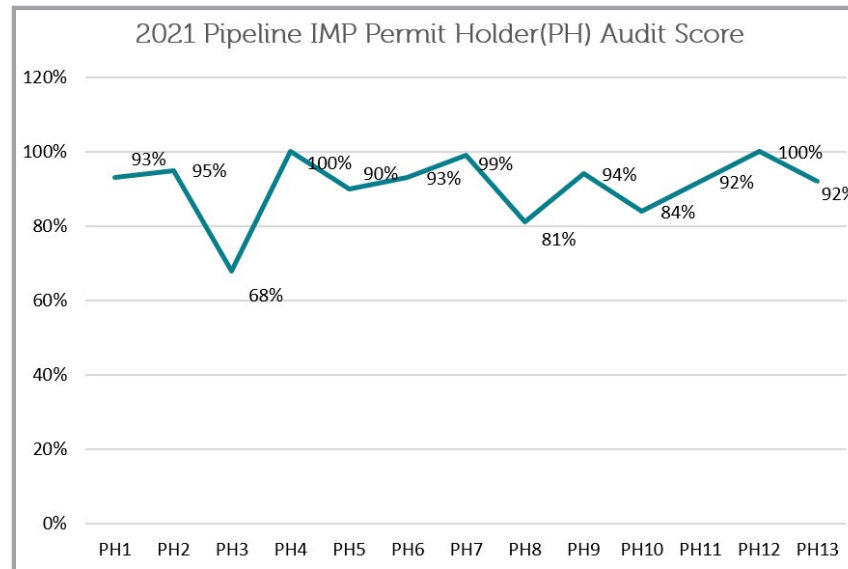


Figure 1: Pipeline IMP Permit Holder Audit Score

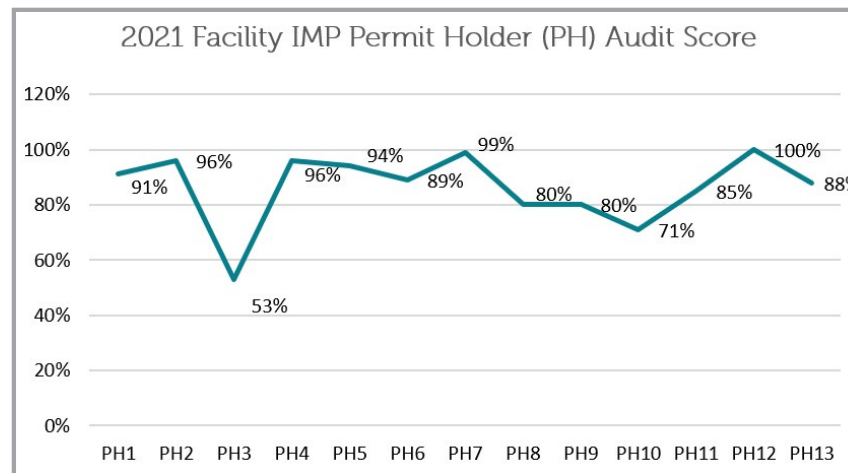


Figure 2: Facility IMP Permit Holder Audit Score

Performance Classification

To categorize IMP audit performance, the Commission uses the following scales:

Strong Performance	95-99 per cent
Moderate Performance	86-94 per cent
Weak Performance	<86 per cent

Figures 3 and 4 present the audit results using the above-mentioned performance criteria for pipelines and facilities.

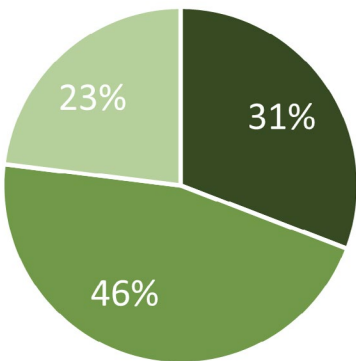
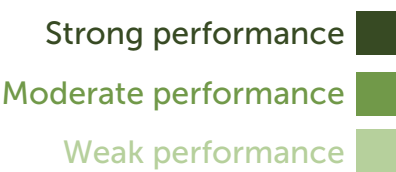


Figure 3: Pipeline IMP Audit Performance

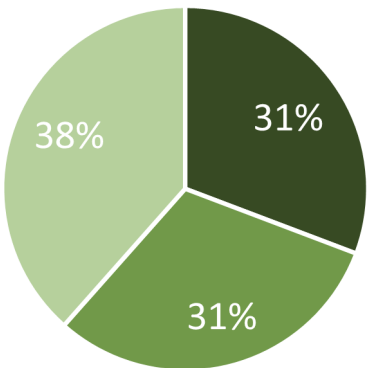


Figure 4: Facility IMP Audit Performance

Despite facility IMPs being a more recent requirement, the percentage of permit holders exhibiting strong performance was the same as for pipelines (31 per cent). Overall, comparison of moderate and weak categories indicates permit holders’ facility IMPs require more improvement compared to pipelines IMPs.

Component-based Analysis

When the performance of permit holders, with respect to the individual pipeline IMP components, is analyzed (Figure 5), it was noted permit holders generally had IMP programs that are effective and work well. With respect to the average audit score of components, risk assessment was the weakest component at 77 per cent, followed by IMM at 81 per cent, goals and KPIs at 85 per cent, records control at 85 per cent, and training and competency at 87 per cent.

Key areas requiring further improvement for pipeline IMPs were:

- Review of potential hazards for risk assessment and management on an ongoing basis, maintain pipeline inventory and perform risk assessment for all pipeline assets.
- Formalize processes to manage in-house and third-party inspection, maintenance, and monitoring (IMM) activities.
- Timely deactivate and abandon inactive pipelines, as required by the Pipeline Regulation and manage dead legs.
- Manage regulatory and organizational changes and those related to acquisition and divestitures through management of change (MOC) or a structured corporate process.
- Ensure leak detection programs for liquid hydrocarbon pipelines meet requirements under CSA Z662 Annex E.
- Develop and implement meaningful leading and lagging KPIs and a process for tracking and reporting the results for regular performance measurement to evaluate program effectiveness.
- Formalize and execute a regular management review process.
- Implement an internal audit process and manage corrective actions arising from the audits.

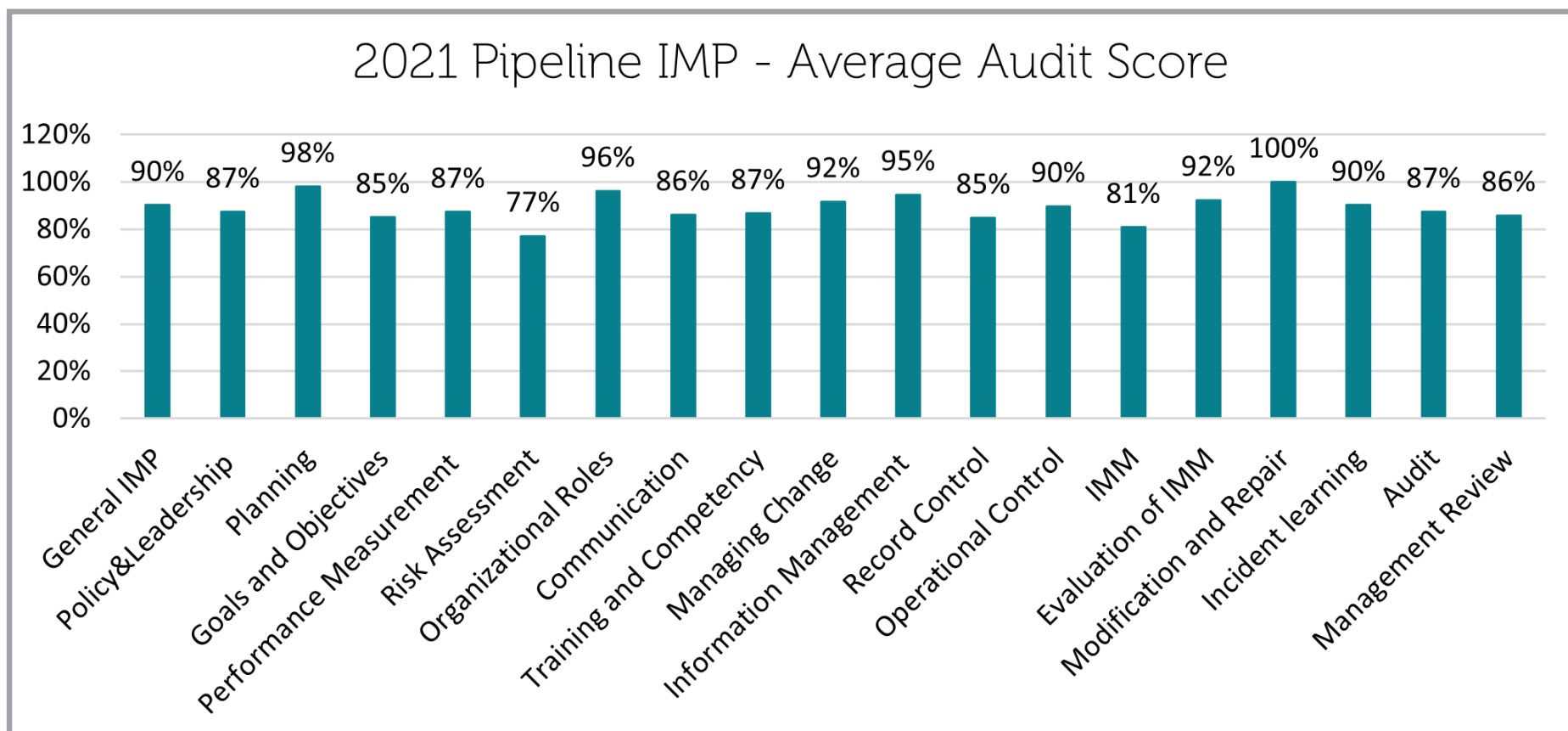


Figure 5: Pipeline IMP Average Audit Score by Component

For facility IMP audits, the management review component, followed by general IMP, internal audit, risk assessment and IMM required the most improvement (ranging from 68 per cent to 83 per cent audit scores), as shown in Figure 6. Facility IMPs not addressing the full scope of facility equipment was the most significant gap in the audits. The Commission is addressing this gap by raising awareness through the annual audit report and requiring permit holders to complete and submit IMP self-assessments.

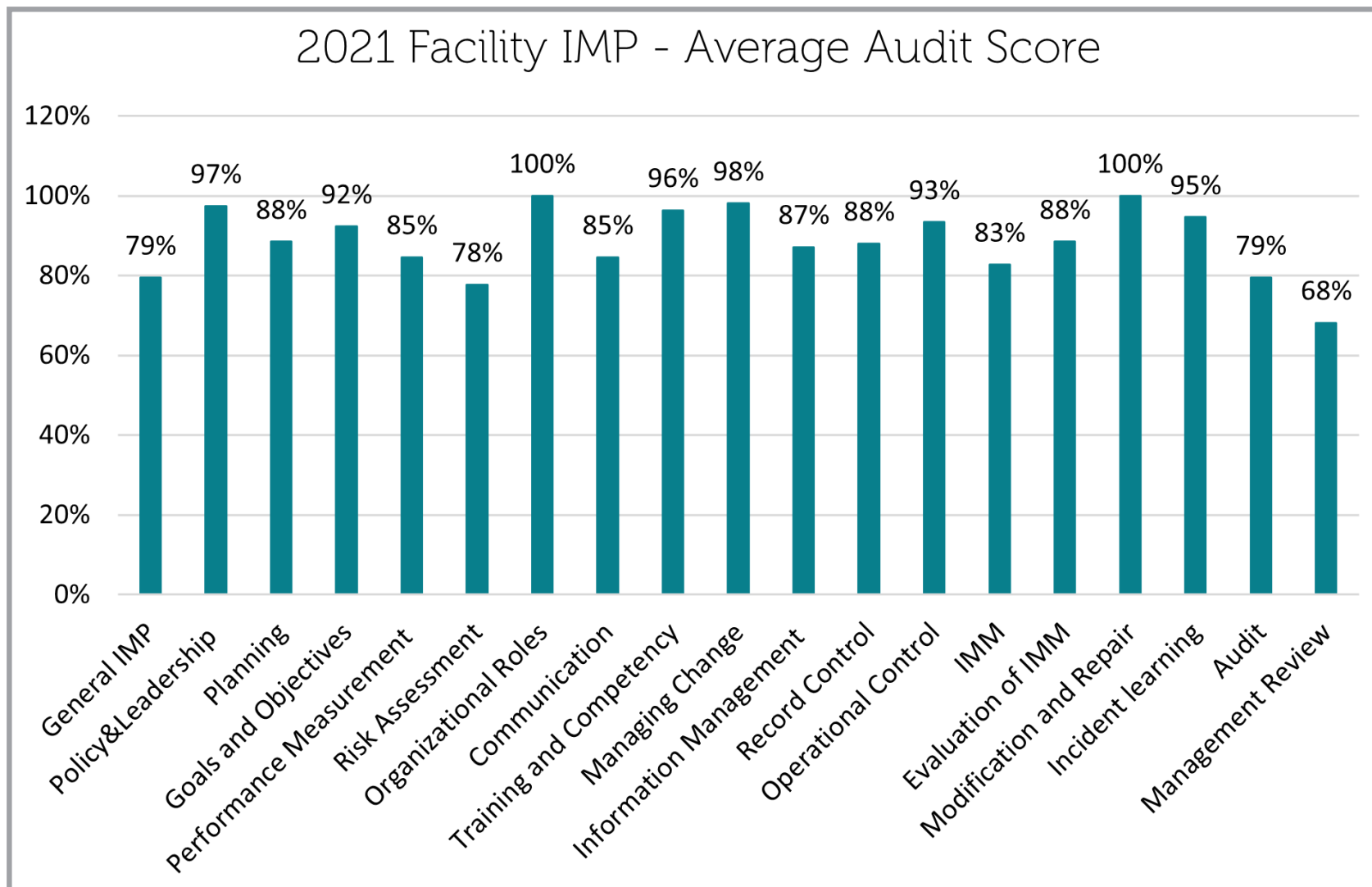


Figure 6: Facility IMP Average Audit Score by Component



Key areas requiring further improvement for facility IMPs were:

- Address all facility equipment including, but not limited to, flare systems, tanks, rotating equipment, and instrumentation and controls in the IMP documentation.
- Understand, develop, and implement a holistic facility risk assessment process that addresses risk assessment at the facility level, considers all equipment damage mechanisms, connects process safety, and identifies and manages all risks on an ongoing basis.
- Review inspection, maintenance, and monitoring (IMM) activities and ensure they are planned, tracked, and managed for all equipment, including tanks, compressors, pumps, piping along with pressure vessels and Pressure Safety Valves (PSVs).
- Review and update standard operating procedures for facility startup and shutdown and for IMM activities such as car seals.
- Formalize processes for controlling records and documents.
- Develop and implement meaningful leading and lagging KPIs and a process for tracking and reporting the results for regular performance measurement to evaluate program effectiveness.
- Develop and implement a formal management review process.
- Establish an internal audit program at a defined interval to evaluate program effectiveness.

Management System (MS)-Level: Plan-Do-Check-Act Analysis

Given that Plan-Do-Check-Act (PDCA) principles are at the core of any management system to achieve continuous assessment and improvement, the overall audit results are analysed for PDCA, as shown in Figure 7.

Pipeline IMPs results for PDCA phases were equally effective for the auditees (Figure 7).

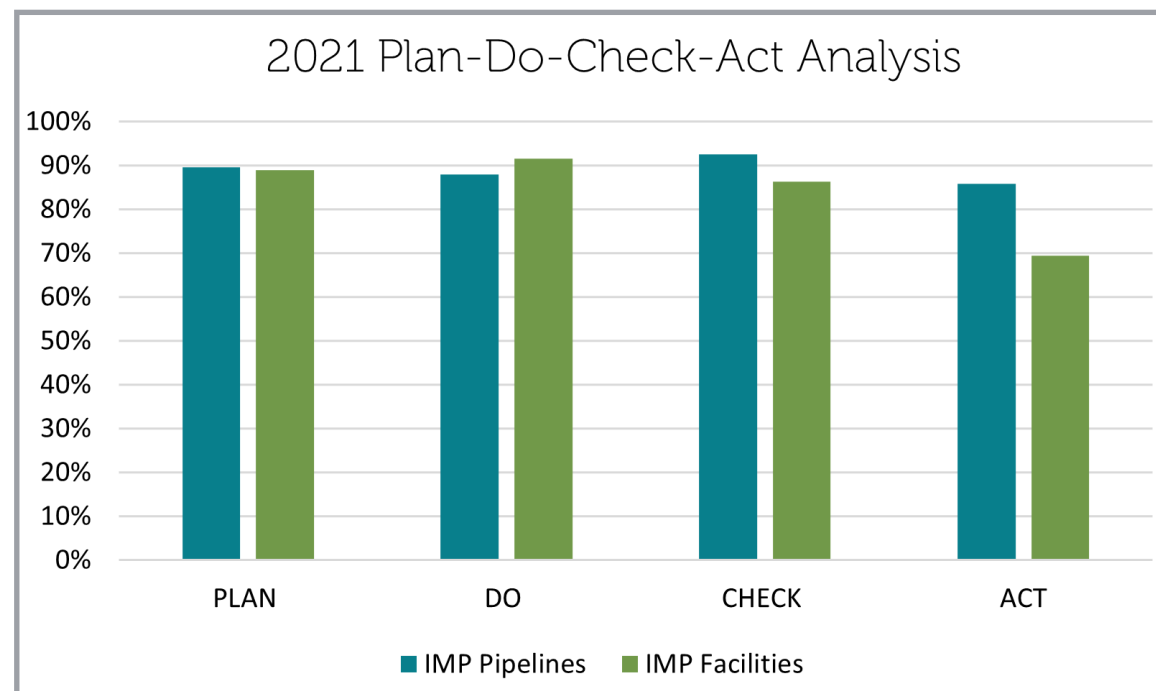


Figure 7: Plan-Do-Check-Act (PDCA) Analysis for 2021 IMP Audits

For facility IMPs (Figure 7), the Act phase was the weakest, which means the processes for management review require further development and implementation. Through the corrective action plan (CAP) management process, the Commission requires permit holders to address these gaps.

IMP Audit Score Trends

For the purposes of reviewing the IMP performance, annual pipeline IMP audit scores are compared over five years (2017-21) and facilities for the last four years (2018-21).

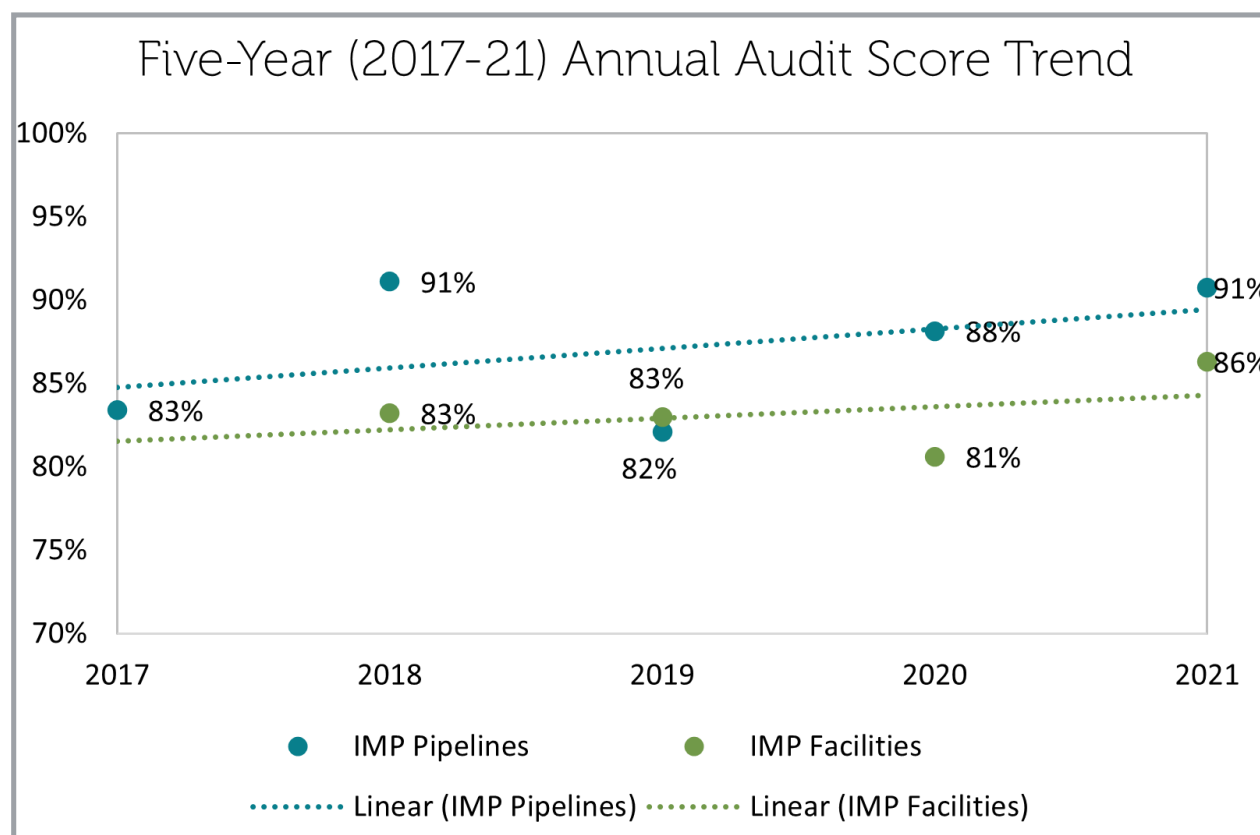


Figure 8: Five-Year IMP Audit Score Comparison

While there are variations in average audit scores from year to year, which can be influenced by the number and type of permit holders selected for audit, average pipeline and facility IMP scores continue to increase over time.

Corrective Actions Oversight and Resolution of Audit Findings

The issuance of an audit finding activates the requirement for a permit holder to submit a corrective action plan (CAP) to the Commission. The CAP identifies corrective actions, responsibilities, and timelines for implementing those actions. The Commission requires CAP submission within 30 days of the permit holder receiving its final audit report.

Audit findings and associated CAPs prioritization is managed through a structured approach based on the significance, relevance, and relation of the IMP components to the overall integrity of the pipelines and facilities, as shown in Table 1. The classification of the audit findings/CAPs as high, medium, and low priority establishes the required level of oversight through IMP Findings and CAP Priority Matrix (Table 1).

Oversight requirements for high, medium, and low priority CAPs are outlined below::

- **High Priority CAPs:** Bi-monthly CAP update is required, along with demonstration of completion and submission of evidence of completion by an agreed timeline.
- **Medium Priority CAPs:** Permit holders are required to demonstrate completion through submission of evidence by a mutually agreed timeline. CAPs with longer timelines may require regular updates.
- **Low priority CAPs:** CAPs related to administration for all IMP components are low priority and permit holders are only required to notify the Commission when the CAP is completed after CAP approval.

- High Priority
- Medium Priority
- Low Priority

IMP components/ Types of findings	Scope	Process	Execution	Records / Data	Documentation	Administrative
	1	2	3	4	5	6
General	High	Medium	Medium	Low	Low	Low
Policy & Leadership Commitment	Medium	Medium	Medium	Low	Low	Low
Goals and Objectives	Medium	Medium	Medium	Low	Low	Low
Planning	Low	Low	Low	Low	Low	Low
Risk Assessment	High	High	High	High	Medium	Low
Organization Roles & Responsibilities	Medium	Medium	Medium	Low	Low	Low
Communication	Medium	Medium	Medium	Low	Low	Low
Competency & Training	High	High	High	Medium	Medium	Low
Managing Change	High	High	High	Medium	Medium	Low
Records and Document Control	Low	Low	Low	Low	Low	Low
Operational Control	Medium	Medium	Medium	Medium	Medium	Low
IMM	High	High	High	High	Medium	Low
Evaluation of IMM Activities	High	High	High	High	Medium	Low
Modification & Repair	Medium	Medium	Medium	Medium	Medium	Low
Incident Investigation & Learning	High	High	High	High	Medium	Low
Internal Audit	Medium	Medium	Medium	Low	Low	Low
Performance Measurement (KPIs)	High	High	High	Medium	Medium	Low
Management Review	Medium	Medium	Medium	Low	Low	Low

Table 1: CAP prioritization matrix

The prioritization of the 53 audit findings/CAPs associated with the 13 pipeline IMP audits completed in 2021 is presented in Figure 9.

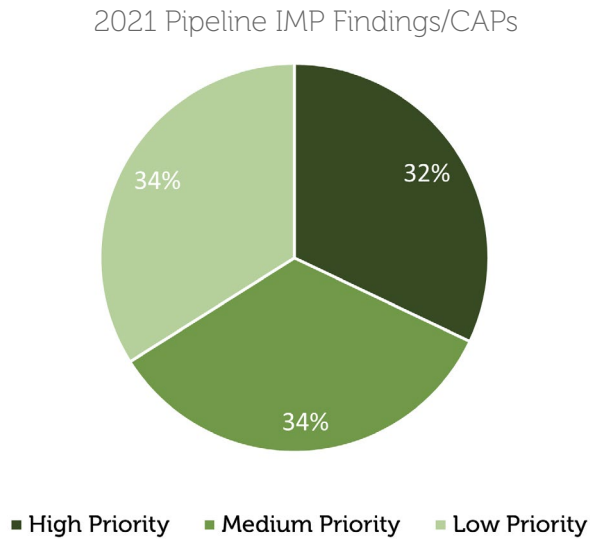


Figure 9: Pipeline IMP Corrective Action Plans Prioritization

The prioritization of 62 audit findings/CAPs associated with the 13 facility IMP audits completed in 2021 is presented in Figure 10.

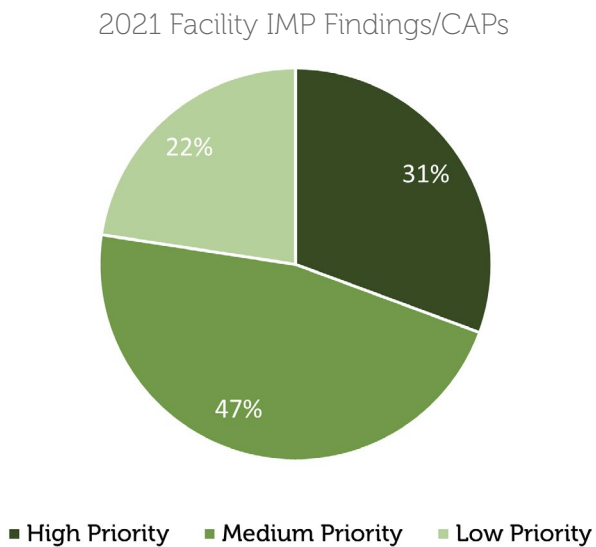


Figure 10: Facility IMP Corrective Action Plans Prioritization

The proposed corrective actions and timelines for completion are carefully reviewed and evaluated during the CAP approval process by the Commission. Progress review of CAPs and proposed actions continues until all findings have been fully addressed by the permit holders.

Safety Culture Assessment

The Commission's IMP audit process incorporates a broader assessment of permit holder's safety culture. For this purpose, 12 safety culture attributes are selected and broadly applied to IMP audits.

1. Safety (a core value)	7. Managing change
2. Leadership and management commitment	8. Training and competency
3. Goals and KPIs measurement	9. Learning from events
4. Legal and Systems Compliance	10. Non-punitive reporting
5. Communication	11. Empowerment and accountability
6. Systematic consideration of risk	12. Continual improvement

Table 2: Safety Culture attributes

The safety culture assessment is interpreted through a 10-point scale collectively for a permit holder using the IMP audit results. Values of 8-10 are assigned to most positive responses (strong), 5-7 to moderately positive responses (moderate), and 1-4 to represent the least positive indicators (weak) of safety culture.

The collective visualization of the overall findings for safety culture attributes from IMP audits is presented through the radar / spider plot (Figure 11).

The collective visualization of the overall findings for safety culture attributes from IMP audits is presented through the radar/spider plot (Figure 11).



Figure 11: Safety Culture Performance

From an IMP audits perspective, safety culture performance was generally positive. Overall, permit holders' leadership and management showed commitment to safety by enforcing IMP policies that prioritize safety over production and adopt safety as a core value. Having proactive initiatives in meeting compliance and standard regulations, empowering staff to stop unsafe work, encouraging non-punitive reporting, and establishing effective change management techniques were used as signals to determine safety culture. To avoid complacency and to nurture a safety culture, permit holders are encouraged to promote vigilance through enhancement of risk assessment and contractor oversight; align goals and objectives with KPIs; improve learning from internal and external events; and focus on continual improvement.

Summary

Integrity Management Programs (IMPs) are documented programs, with a long history, specifying the processes and practices used by permit holders to ensure public safety, environmental protection, and operational reliability through the entire lifecycle of their pipelines and facilities.

IMPs for pipelines have been a regulatory requirement in British Columbia since they were introduced in CSA Z662, the national standard for pipeline systems, in 1999.

IMPs for facilities have been a regulatory requirement in British Columbia since 2018. The Commission has been auditing IMPs for pipelines since 2011 and facilities since 2018.

The Commission completed 13 pipeline IMP audits in 2021. High priority audit findings were related to:

- Risk assessment: review and update pipeline inventory, assess all potential hazards and apply risk assessment to all pipeline assets on an ongoing basis.
- Training and competency: develop oversight processes for activities performed by contractors.
- Inspection, maintenance, and monitoring (IMM): formalize processes to manage in-house and third-party IMM activities, deactivate and abandon inactive pipelines within the timelines required by the Pipeline Regulation and manage leak detection programs in accordance with CSA Z662.

- Performance and management review: develop meaningful leading and lagging KPIs and complete formal IMP performance reviews by senior leadership at defined intervals.
- Internal audit: implement an internal audit process to evaluate program effectiveness and manage corrective actions.

The Commission completed 15 facility IMP audits in 2021. High priority audit findings were related to:

- General IMP: ensure all equipment within the scope of the IMP is included, such as tanks, rotating equipment, flares, instrumentation, and controls.
- Risk assessment and management: develop and implement a holistic ongoing facility risk assessment process at a facility level and equipment level.
- IMM: plan, track, and manage IMM activities for all equipment including tanks, compressors, pumps, piping, pressure vessels and PSVs; and update standard operating procedures especially for startup and shut down processes.
- Management and performance review: develop and implement meaningful leading and lagging KPIs and complete formal IMP performance reviews by senior leadership at defined intervals.
- Internal audit: establish an internal audit program to evaluate program effectiveness and manage corrective actions.



The Commission ensures permit holders address the audit findings by outlining appropriate actions and implementing them in the specified and agreed time frame through the corrective action plan oversight process.

The average annual audit score for 2021 was 91 per cent for pipeline IMPs and 86 per cent for facility IMPs. Overall, average audit scores have continued to increase over time.

The 2021 audit results in this report highlight permit holders are fully committed to their IMPs, are following management system principles of Plan-Do-Check-Act and endorsing a positive safety culture. The Commission will continue its compliance oversight of Integrity Management Programs for pipelines and facilities to promote process enhancement and safe operations.



Discover how we regulate energy in B.C.