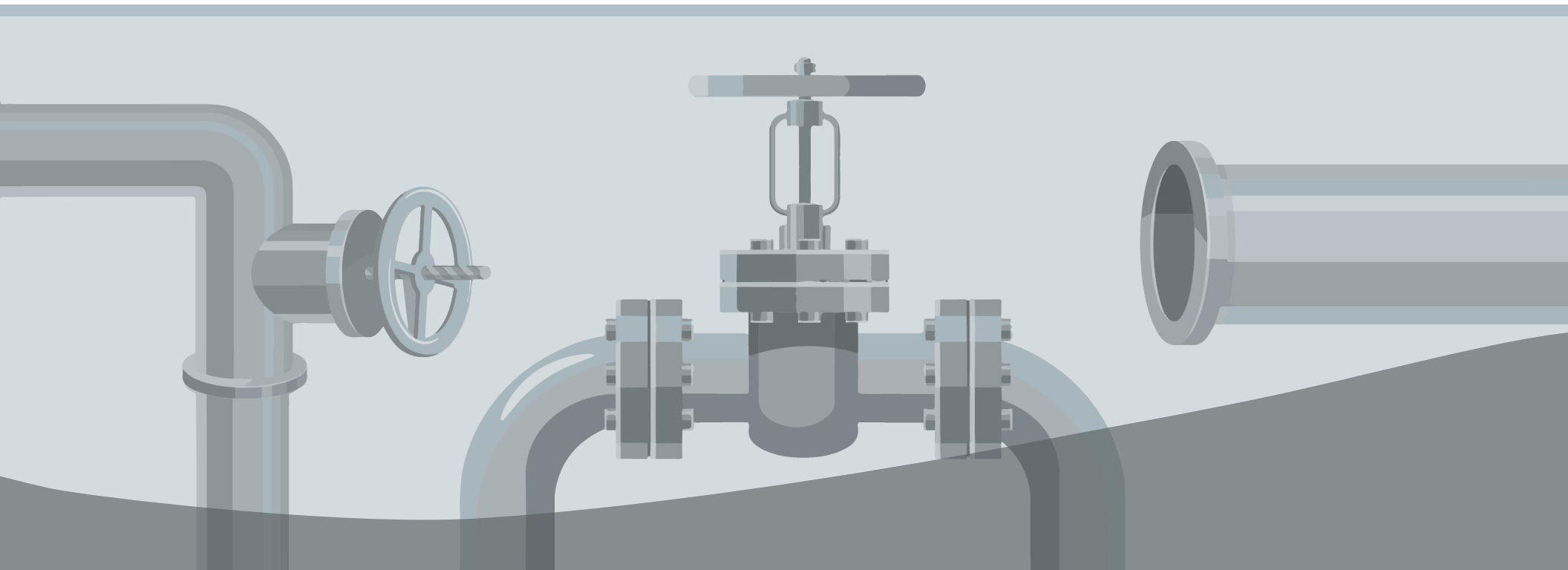


The Pipeline Integrity Management Program (IMP) Compliance Assurance Summary



Annual Report 2017



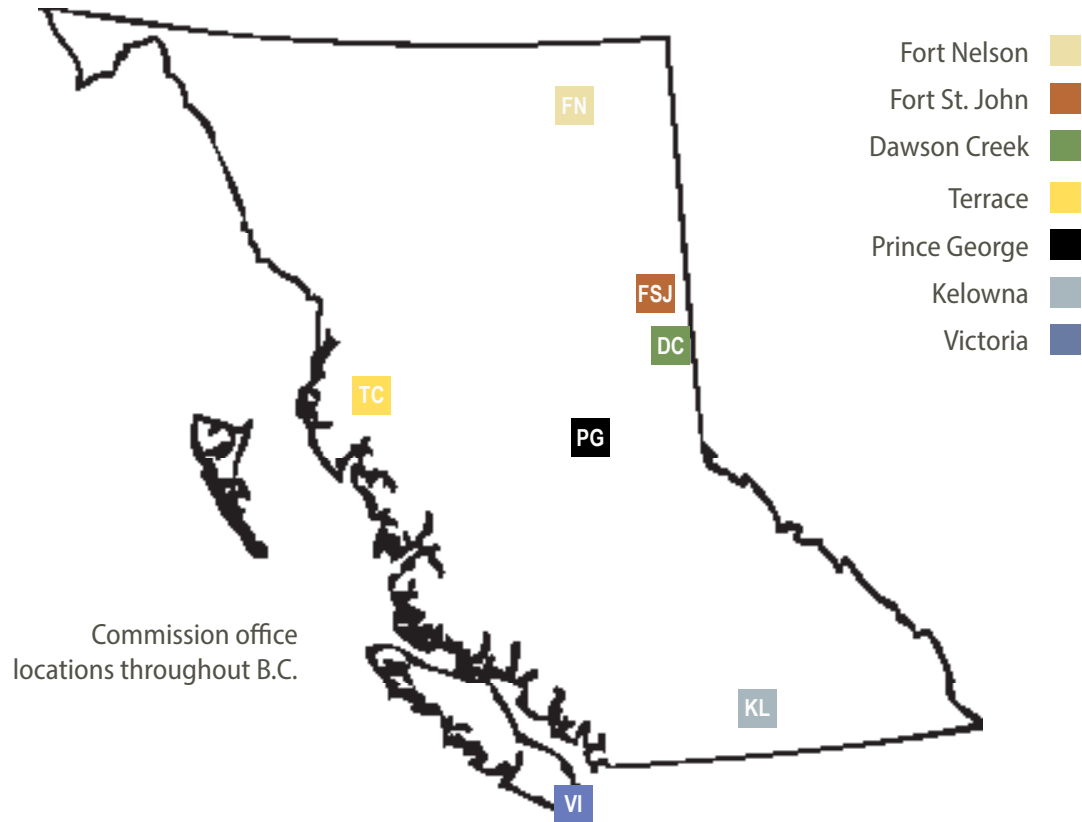
Role of the BC OIL AND GAS COMMISSION

The [BC Oil and Gas Commission](#) (Commission) protects public safety and safeguards the environment through the sound regulation of oil, gas and geothermal activities in B.C.

From exploration through to final reclamation, the Commission works closely with communities and land owners, and confirms industry compliance with provincial legislation. It also ensures there are close working relationships; consults with, and considers the interests of Indigenous peoples.

With more than 20 years' dedicated service, the Commission is committed to safe and responsible energy resource management for British Columbia.

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



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

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Safe and responsible
energy resource development
for British Columbia.

OUR MISSION

We provide British Columbia with
regulatory excellence in responsible
energy resource development by
protecting public safety, safeguarding
the environment and respecting
those who are affected.

OUR VALUES

Respect
Integrity
Transparency
Innovation
Responsiveness

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INTRODUCTION

British Columbia's oil and gas industry depends on pipelines for transporting products such as natural gas, oil and water. Pipelines are recognized as a safe and economical way to transport fluids, and secure pipeline infrastructure and operation is essential to protecting public safety and the environment.

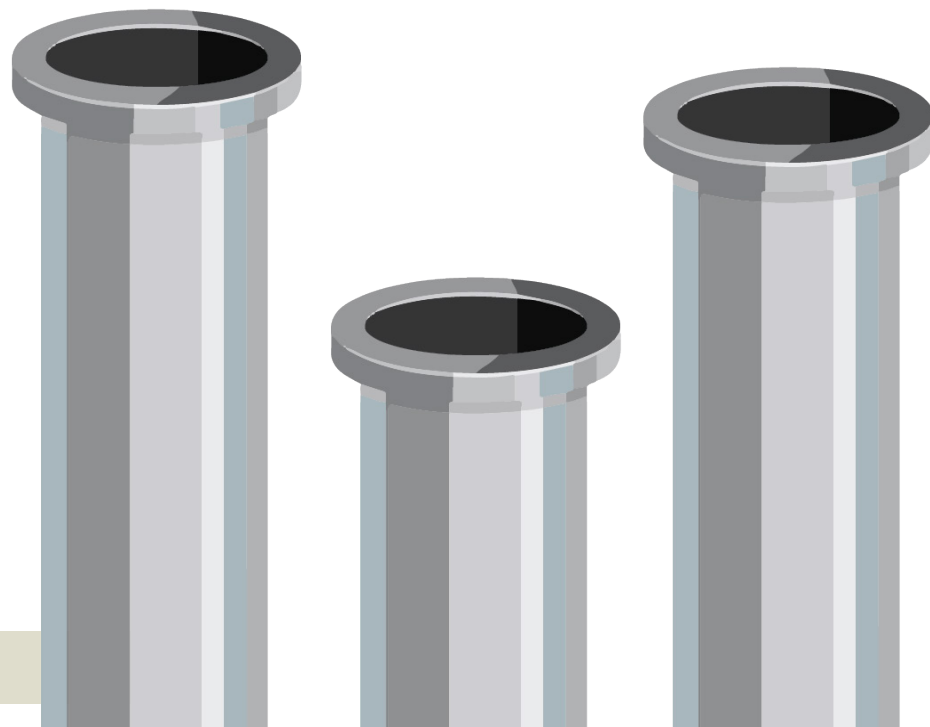
The Integrity Management Program for Pipelines (IMPP) is a preventative framework that specifies the processes and practices used by operators to anticipate hazards, and analyze, assess, and manage risks associated with pipelines.

Integrity Management Programs (IMPs) have been a regulatory requirement in B.C. since 1999. The BC Oil and Gas Commission (Commission), under Section 7 of the Pipeline Regulation (PR), requires every permit holder (licensed operator) planning, designing, procuring, constructing, operating, maintaining, or abandoning pipeline infrastructure within the province to have a fully developed and implemented Integrity Management Program for Pipelines (IMPP). The Commission has been auditing the operators' IMPP since 2011. Each year operators are selected based on certain criteria to participate in this process.

This inaugural annual report includes an overview of the compliance assurance process; a summary and analysis of the audit results (2016-17); and insight into operators' IMPP performance and compliance. This report also provides the results and comparative performance analysis of operators from two audit cycles—Audit Cycle 1 (2011-15) and Audit Cycle 2 (2016-17).

During 2016, the Commission audited the IMPP programs of 19 pipeline operators; however, this report only includes results for 17 operators. During 2017, the Commission audited 10 operators. Where non-compliance was determined during the audits, operators were required to develop and implement corrective actions to address deficiencies. The Commission assesses and monitors all corrective actions to ensure all non-compliance findings are addressed and corrective actions are implemented and fully resolved.

The Commission will continue overseeing IMPP compliance through auditing for all B.C. pipeline operators by engaging with companies to improve the design, construction, operation and maintenance of pipelines, including older, legacy pipelines.

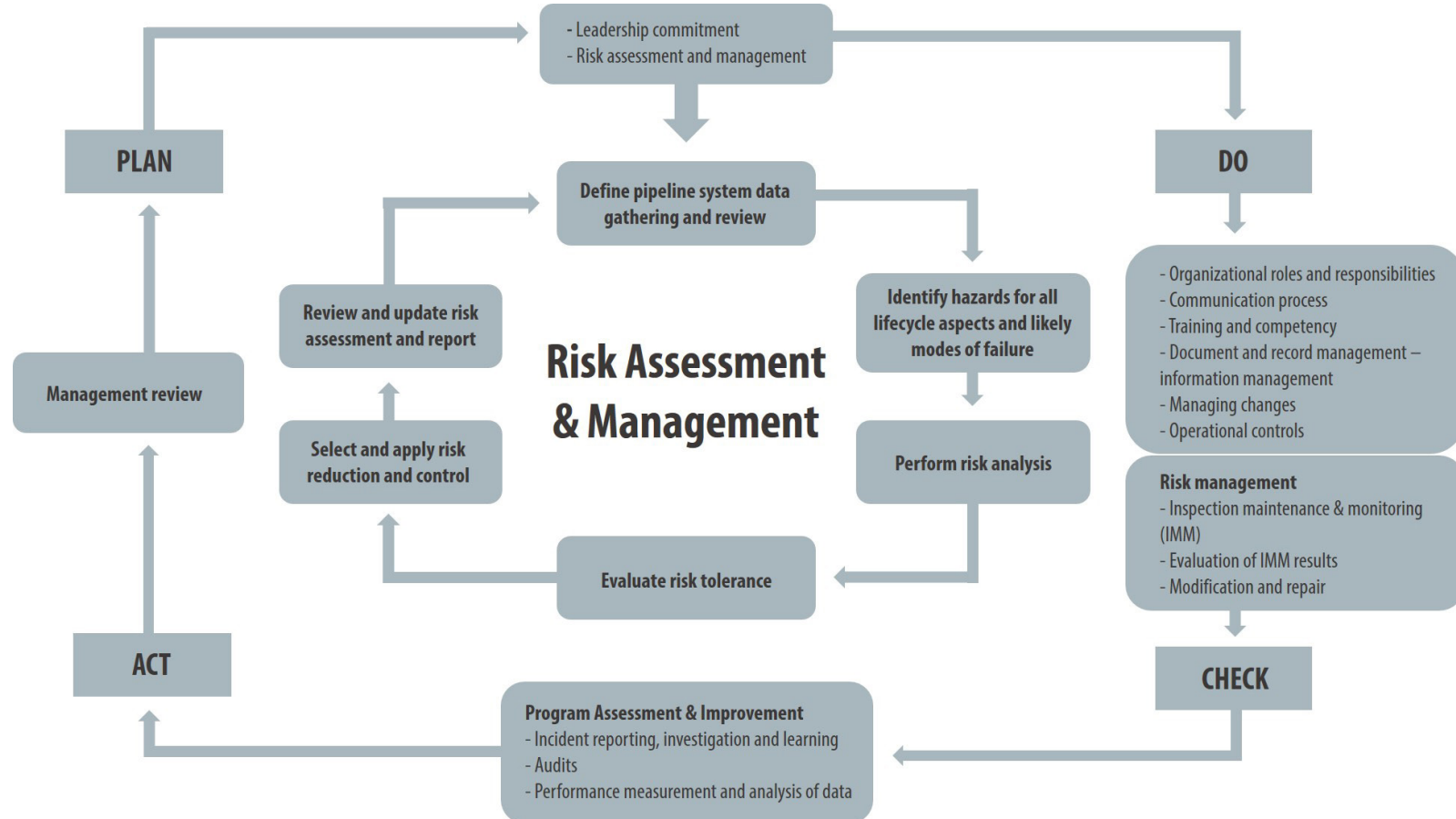


IMPP COMPLIANCE ASSURANCE PROCESS

The Commission's compliance assurance process for IMPP is based on the most current version of the CSA Z662 standard (a national standard). According to CSA Z662 Clause 3, an IMPP forms part of a comprehensive safety and loss management system and shall apply to the entire life cycle of a pipeline system. The Commission requires operators to comply with the IMPP requirements defined within its Compliance Assurance Protocol. The objective of the Commission's compliance assurance process is to verify adequate development, implementation, and effectiveness of an operator's IMPP.

Since 2016, the Commission is requiring and expecting operators to have a management system based IMPP. Plan-Do-Check-Act (PDCA) categorization of 19 IMPP components is presented in Figure 1. The Commission's IMPP compliance assurance process also incorporates a risk-based evaluation and a life cycle approach that covers all phases of a pipeline system from planning and designing to decommissioning.

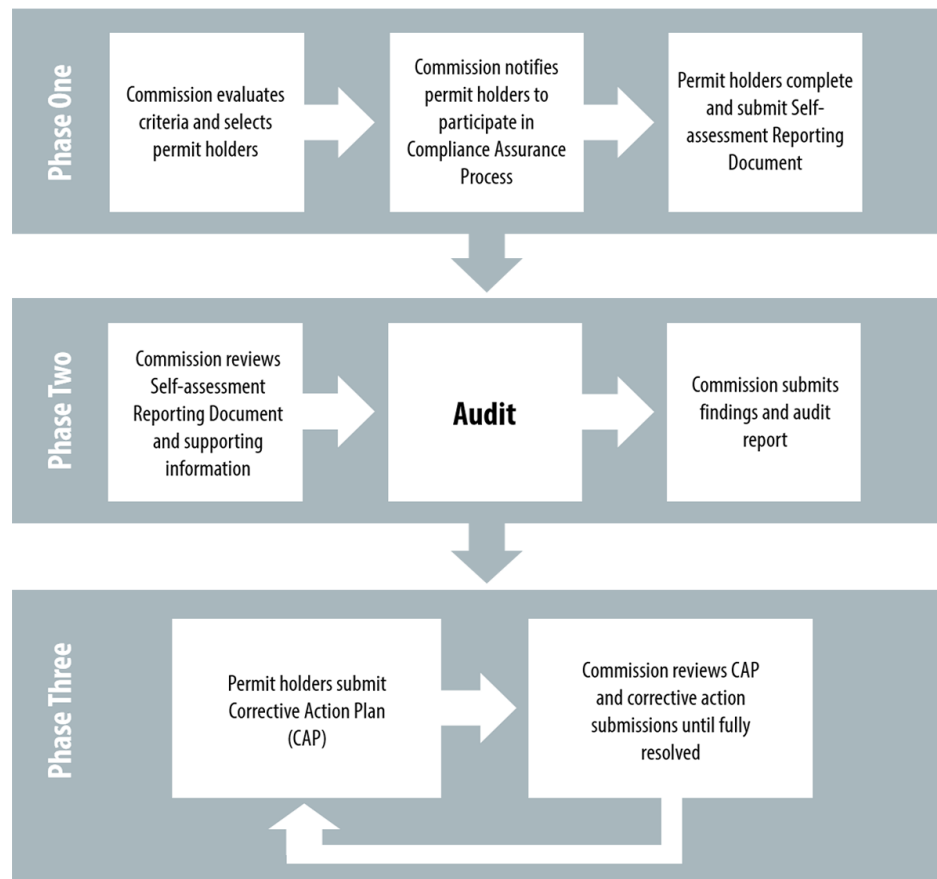
FIGURE 1: IMPP Components and Risk Assessment/Management Representation in a PDCA Cycle



IMPP PHASES

The Compliance Assurance Process for the IMPP is differentiated by three phases (Figure 2). These phases can run longer than a year and therefore often overlap with the previous/future year's oversight activities. The Commission oversees and ensures that the entire process is complete for each year.

FIGURE 2: IMPP Compliance Assurance Process



AUDITING

Since 2016, the Commission has been using an Integrity Management Program Audit and Knowledge Tool (IMPAKT) for auditing, which was developed in collaboration with the University of British Columbia – Okanagan campus. IMPAKT uses a risk assessment technique (Failure Mode Effects Analysis) to analyse audit results, and assigns them a Risk Priority Number (RPN). Compliance rate for an operator is also an output through IMPAKT. The self-assessment reporting document is synchronized within this tool and the audit observations are recorded directly into IMPAKT.

AUDIT RESULTS AND ANALYSIS

The audit results from 17 operators from 2016 and 10 from 2017 generate a risk profile expressed as Risk Priority Numbers (RPN) for IMPP components for each operator, which is used for audit result analysis and intelligence extraction.

The analysis is extended further by comparing RPNs with compliance rate, which is the percentage of requirements meeting compliance under each IMPP component out of the total number of requirements. The relationship between compliance rate and RPN values is non-linear. Higher RPNs indicate poor performance based on low compliance, high severity/impact of non-compliance per component, and lack of existing and proposed actions.

OPERATORS-BASED ANALYSIS 2016-2017

The results from all audited operators for 2016 and 2017 are compared based on the RPN values and compliance rate, as shown in Figure 3.

The overall average compliance rate for 2016 was 88 per cent, which was higher than 83 per cent for 2017. Similarly, overall average RPN for 2016 was lower as compared to 2017.

Three performance criteria are identified to classify IMPP performers: RPN values between one and 88 (compliance rate 95-99 per cent) are ranked as “strong performance”; RPN values, between 88 and 320 (compliance rate 86-94 per cent), are considered “moderate performance”; and RPN values between 320 and 1,000 (compliance rate < 86 per cent) are considered “weak performance”.

Close to 60 per cent of the operators exhibited moderate performance overall for both 2016 and 2017. For 2016, 24 per cent of the operators exhibited strong performance, while 18 per cent were weak performers between 85 and 74 per cent compliance rate. In 2017, 20 per cent of the operators showed weak performance and 20 per cent showed strong performance (Figure 4).

FIGURE 3: 2016 & 2017 IMPP: IMPP RPN vs. Compliance Rate

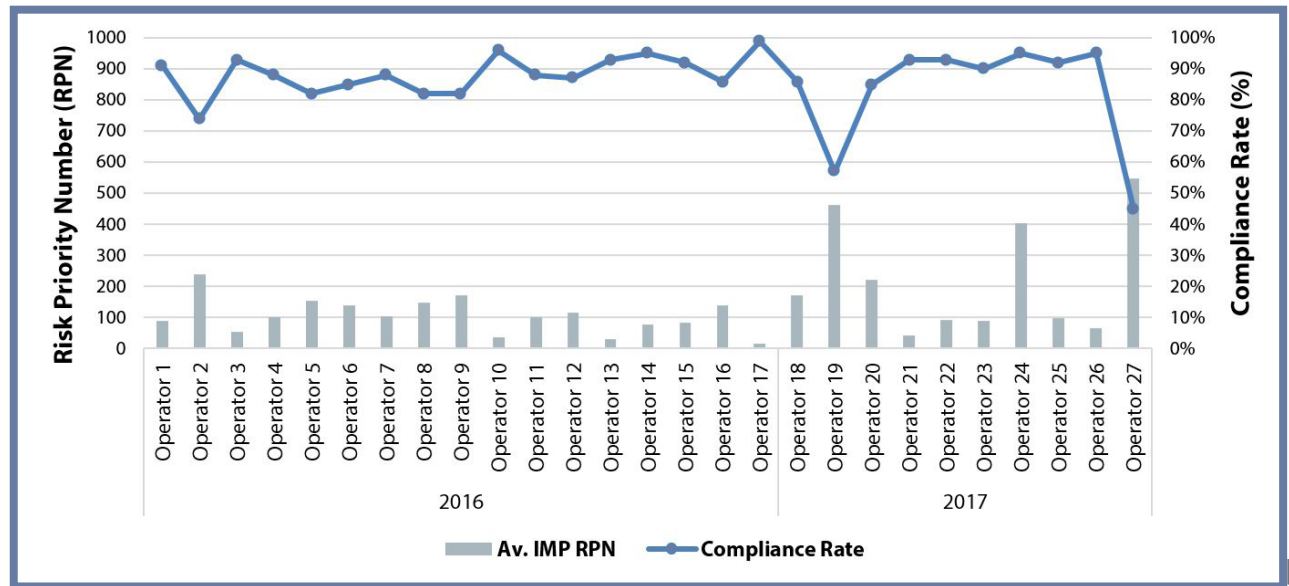
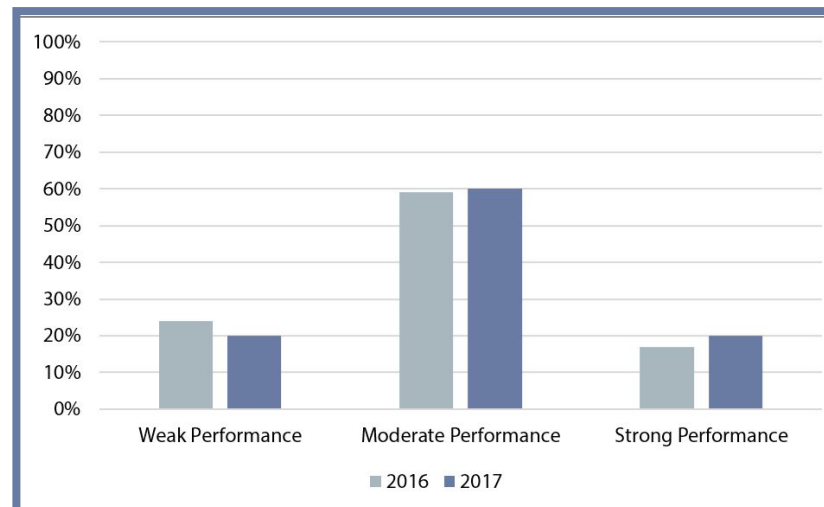


Figure 4: 2016-2017 IMPP Performance



OPERATORS-BASED ANALYSIS 2016-2017 CONT.

Performance is further evaluated by classifying operators based on three asset sizes: small, medium, and large. The operators with pipeline assets up to 100 kilometres (km) of length are grouped under the small category. The operators with asset lengths from 100 to 500 km are grouped as medium-sized operators, and those with total pipeline lengths greater than 500 km are classified as large.

In 2016 and 2017 combined, 44 per cent of the audited operators were medium sized, 30 per cent were large and 26 per cent were small. The asset size classification results are shown in Table 1. In 2016, 11 per cent of small-sized operators showed “strong performance”, which is a higher percentage compared to medium-sized operators (six per cent) and none of the large-sized exhibited strong performance.

However, in 2017, 10 per cent of the large operators showed strong and moderate performance levels. Also in 2017, 10 per cent of small and medium operators showed weak performance, while 60 per cent of small (30 per cent), medium (20 per cent), and large (10 per cent) operators showed moderate performance in IMPP.

In 2016, 18 per cent of medium and six per cent of large operators were weak performers; six per cent of small, 29 per cent of large operators and 24 per cent of medium-sized operators showed moderate performance. The weak performance was due to recent asset transfer and personnel changes resulting in non-availability of records.

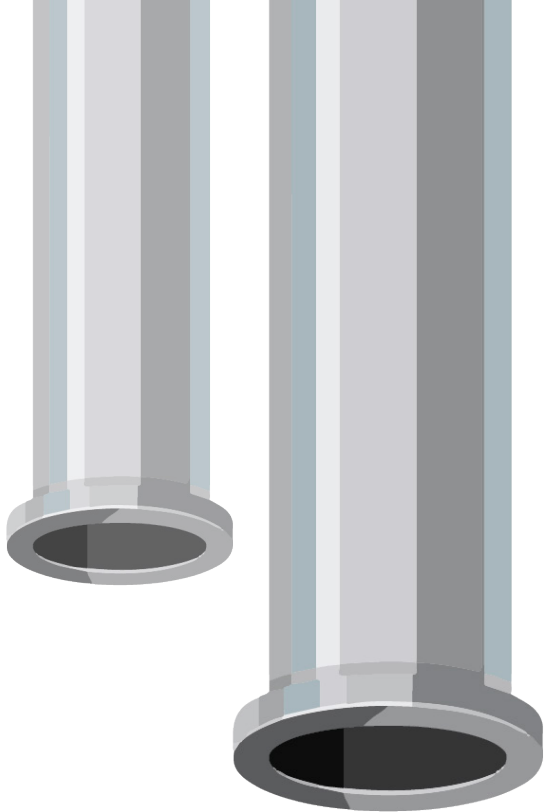


TABLE 1: Operator size based performance analysis

		2016			2017		
		Operator Size Classification			Operator Size Classification		
		Small	Medium	Large	Small	Medium	Large
IMP Performance	Strong	11%	6%	0%	0%	10%	10%
	Moderate	6%	24%	29%	30%	20%	10%
	Weak	0%	18%	6%	10%	10%	0%

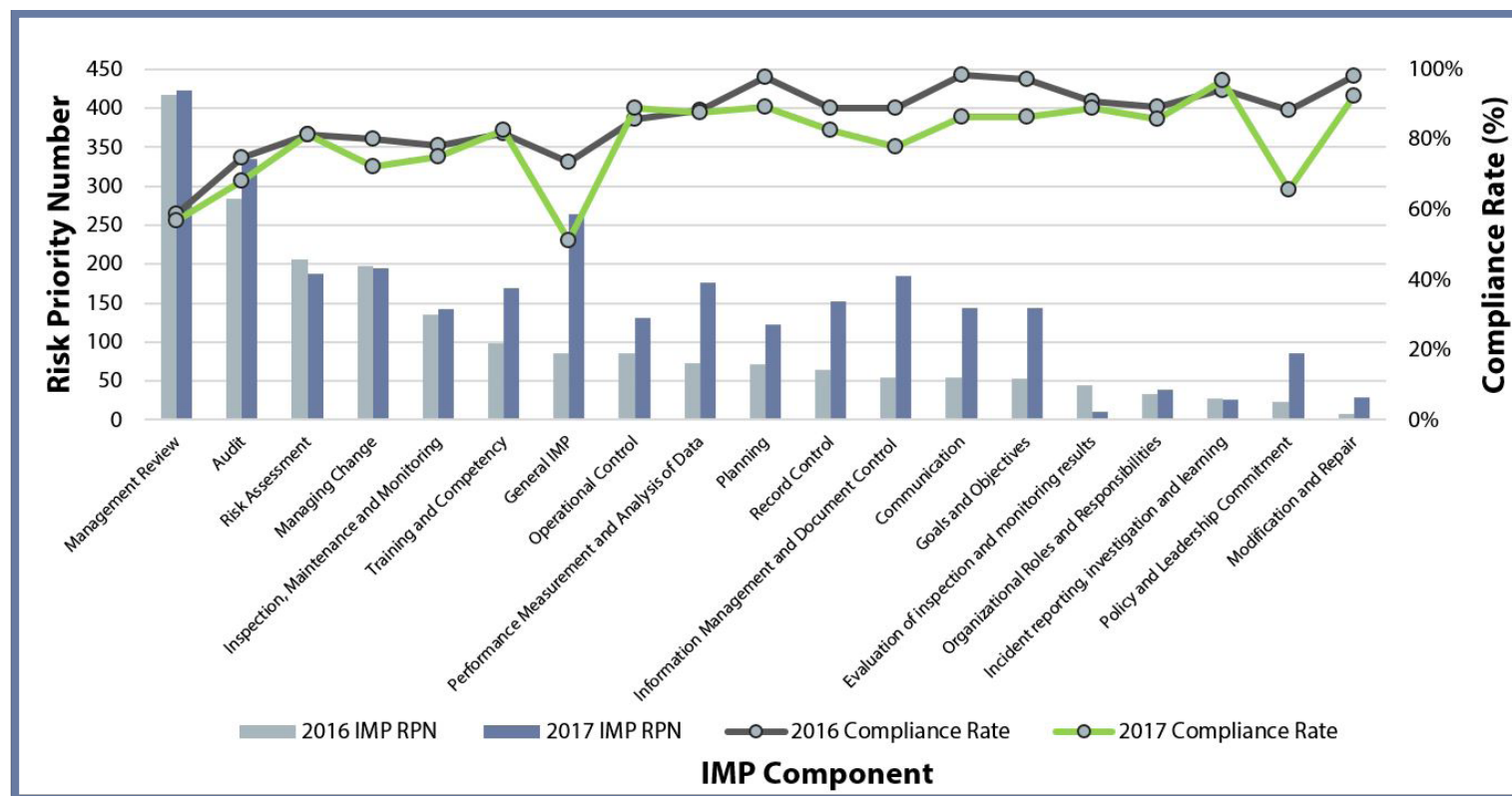
COMPONENT-BASED ANALYSIS 2016-2017

The RPNs for individual components for each operator are further aggregated and analyzed to compare audit results and compliance rates for 2016 and 2017. See Figure 5.

Overall, with respect to RPN and compliance rate, it was noted that operators have good processes and programs in place for reporting, investigating, and learning from all Incidents and Organizational Roles and Responsibilities, which are clearly defined and communicated. Tracking and trending near

misses and monitoring actions on any recommendations need to be further enhanced. For 2016, the weakest components overall with respect to RPN were Management Review, Audit, Risk Assessment, Managing Change, and Inspection-Maintenance-Monitoring. The weakest components for 2017 with respect to RPN were Management Review, Audit, General IMP, Managing Change, Risk Assessment, Performance Evaluation, Training and Competency, and Information Management and Document Control.

FIGURE 5: Component Average RPN & Compliance Rate



COMPONENT-BASED ANALYSIS 2016-2017 CONT.

Regarding IMPP components, the lowest compliance rate and highest RPN were found for Management Review for both years due to lack of a formalized review process involving senior management.

A combination of Performance Measures and Internal System Audits are necessary to evaluate the overall effectiveness of a pipeline's integrity management program. Comparison of IMPP RPN and compliance rate for 2016 and 2017 showed that even for the same compliance rate of 88 per cent for Performance Evaluation, the RPN values were almost double.

Operators have developed and implemented processes for reviewing performance indicators that correspond to pipeline policy and objectives. However, the process for selecting relevant and comprehensive performance indicators, and for performance monitoring and review, is still evolving. Operators' auditing processes showed considerable improvement; however, the frequency of audits and lack of documented auditing processes were noted in the findings.

The findings for IMPP component of Document Control and Information Management often related to lack of processes for document control and information between field and head offices. Similarly, the operators' Records Control process related to legacy pipelines was not formalized, resulting in an 11 per cent non-compliance rate for 2016 and 17 per cent for 2017, respectively and RPN values that were more than doubled--65 in 2016 and 153 in 2017.

For Training, there was a one per cent difference in the compliance rate of 82 per cent, while the RPN values were 98 in 2016 and 169 in 2017. It was observed within the Training-Competency IMPP component that established practices and procedures for training of operational employees were not consistently developed and expanded to non-operational and contract employees.

Risk Assessment had comparable results to training and competency at 207 RPN for 2016 and 188 RPN for 2017 for a compliance rate of 81 per cent.

It was observed that the operators' understanding and implementation of risk assessment and management as the main intent of the IMPP program has significantly improved; however, the following areas related to hazard identification, risk assessment, risk reduction, risk control and management require further improvement:

- Data collection, data connectivity and validation of data, risk-assessment technique and implementation of the risk-assessment process were determined to be deficient.
- Lack of integration between risk assessment and risk management (implementation of risk reduction measures) was observed.
- Risk assessment was not documented and maintained as an ongoing process for evaluating the risks associated with identified hazards.
- Typically, integrity management is considered after pipelines are commissioned and therefore, a life cycle aspect is not integrated into IMPP, so determination of hazards and risk assessment at the design and planning stage required further improvement.

It was noted that inspection and monitoring programs are developed and implemented based on industry practice and not necessarily integrated with risk-assessment results. The requirements and expectations under the Inspection and Monitoring component have been extended since 2016 and areas of leak detection, procedures for dead-leg maintenance, and licensing data mismatch related to deactivation, were identified as areas of non-compliance.

Within the Managing Change component (RPN around 200 and compliance rate of 75 per cent and 80 per cent for 2016 and 2017 respectively), it was observed that operators often did not have documented processes to address changes related to ownership of assets. Findings also related to not having processes to manage changes to third party operated assets. Additionally, low-risk findings related to not providing sufficient references to existing applicable corporate procedures were noted.

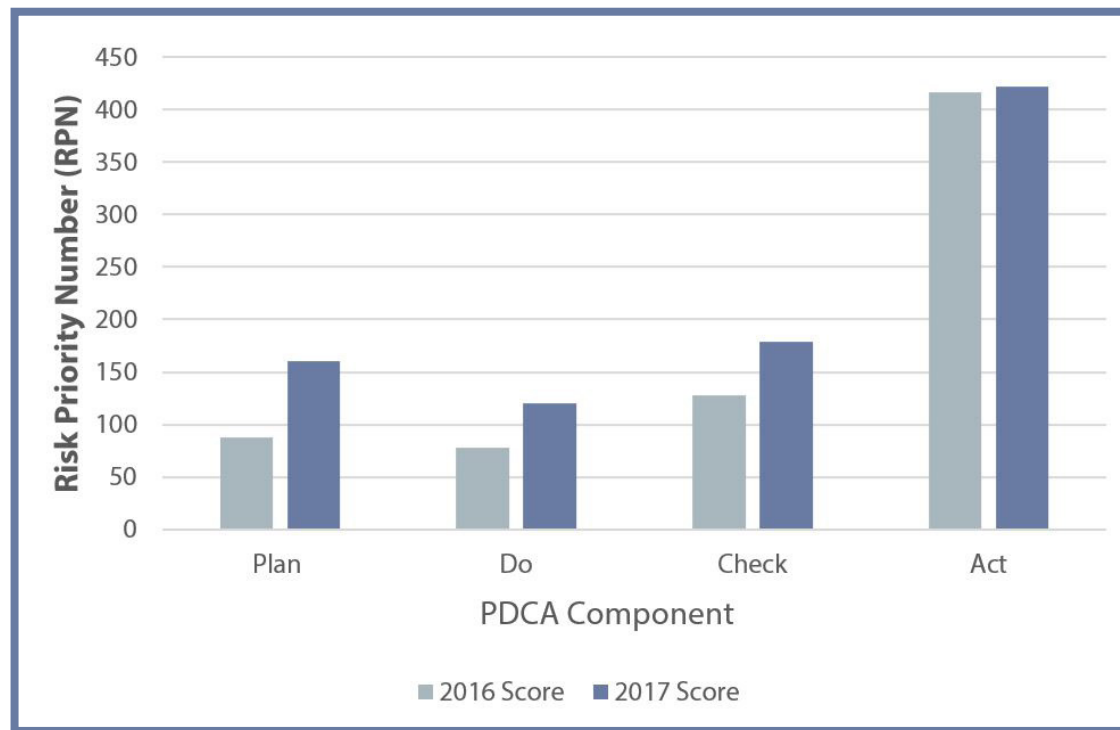
MANAGEMENT SYSTEM (MS)-LEVEL: PLAN-DO-CHECK-ACT ANALYSIS

For management system based analysis, the IMPP components under each PDCA category shown in Figure 6 are analyzed. Annual average RPNs by PDCA displayed in Figure 6 for 2017 are generally consistent with those from 2016.

Over the two audit years, operators received the highest and equal RPNs in the ACT phase, nearly twice as much as the other three phases. In

2017, the RPNs under the Check, Do and Plan phases exceeded those issued under 2016. It is noted efforts are required to continually improve the IMPP by refining the Management Review (ACT) phase for both years (2016 and 2017). Higher performance was observed within IMPP components under implementation phase (DO).

Figure 6: 2016-2017 Plan-Do-Check-Act (PDCA) Risk Profile Comparison



COMPLIANCE ASSURANCE PROGRAM CYCLE EVALUATION

In 2016, the Commission initiated Audit Cycle 2. Twenty-five operators audited in 2016-17 had been previously audited during Audit Cycle 1 (2011-15). The audit results and performance from the two cycles were reviewed to evaluate performance of the Commission's compliance assurance process and to determine if it is adding any value to the overall IMPP performance of the operator's program. The compliance rates for the 25 operators with recurring audits in 2016-17 and 2011-15 are compared in Figure 7. On average, compliance rates were higher in Cycle 2, which indicates a higher or improved performance from Cycle 1 to Cycle 2.

Figure 8 compares average annual compliance rates for all audited operators audited since 2012, excluding results from 2011, which were not comparable due to auditing process differences.

Since 2016, the IMPP requirements have expanded to include the life cycle aspect, and many areas previously not examined under performance evaluation, inspection and monitoring, and risk management have been added. Even with the increase in industry regulation requirements and expanded scope, the compliance rate increased over 20 per cent during Cycle 2.

The results in Figures 7 and 8 provide evidence to support the assertion the Commission's compliance assurance process is adding value to the overall IMPP performance for operators who were selected to participate in the program. The results highlight annual improvement as well as the continued improvement of IMPP components.

Figure 7: Compliance Rate Comparison from IMPP Audit Cycle 1 & Cycle 2

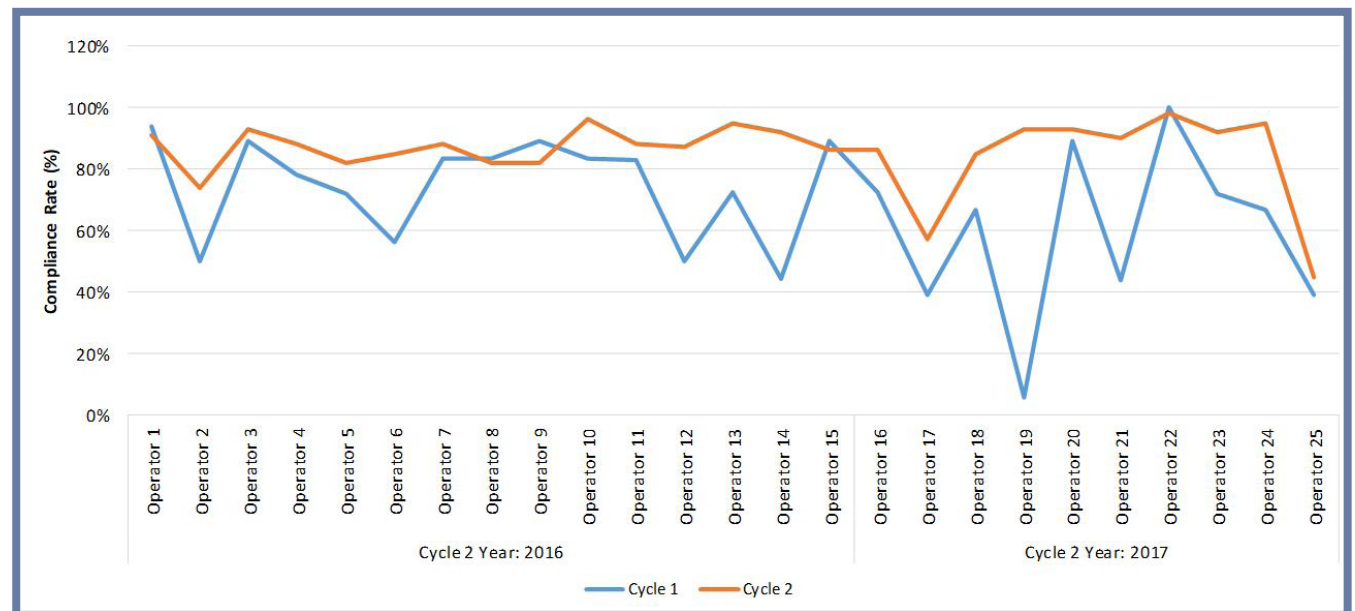
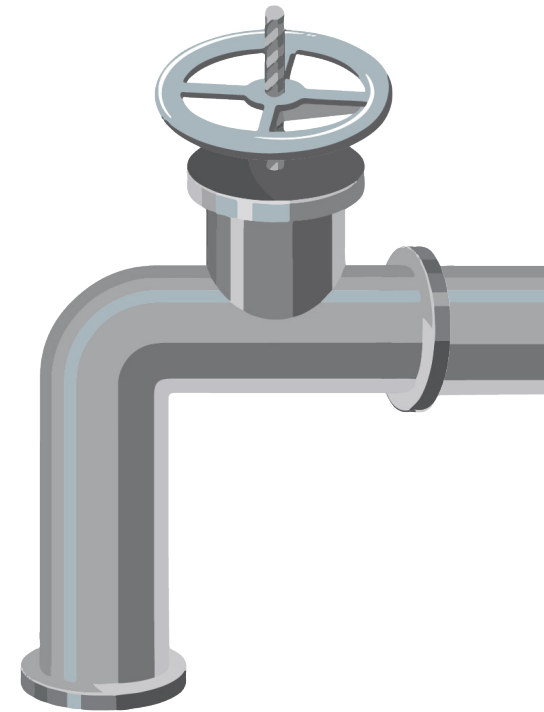
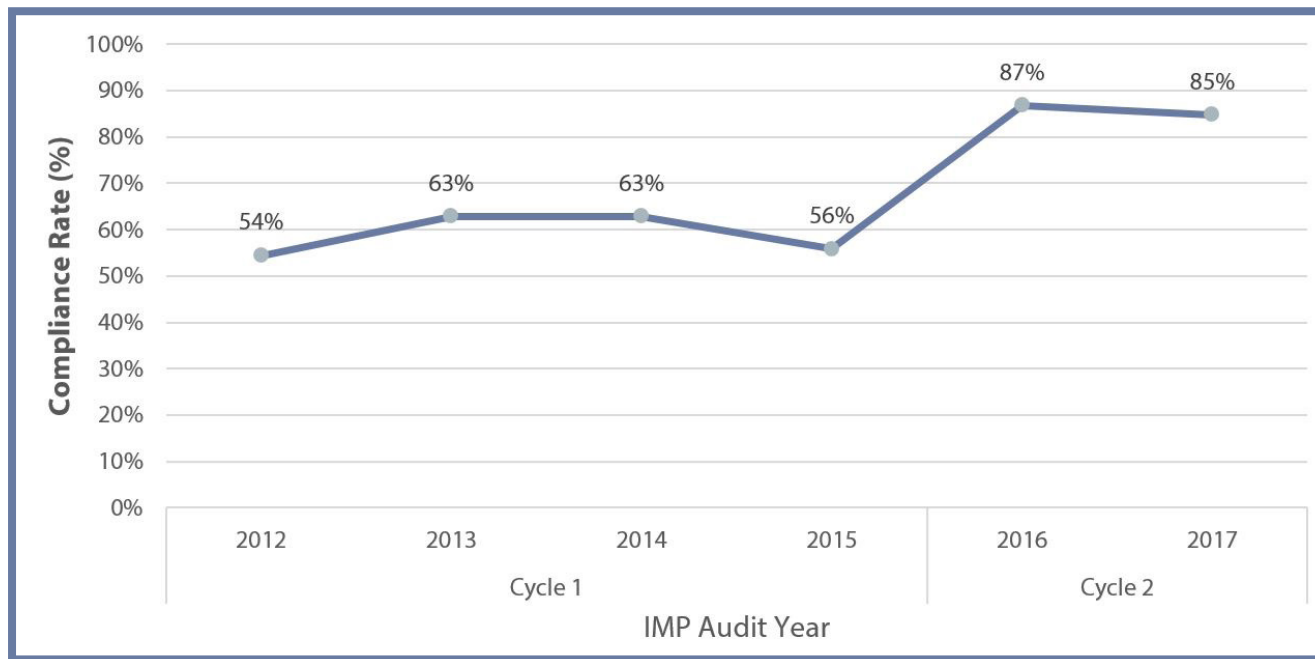


FIGURE 8: Annual Compliance Rate Comparison



CORRECTIVE ACTIONS (FOLLOW UPS) & RESOLUTION OF NON-COMPLIANCES

Non-compliances are issued for audit findings ranging from procedural discrepancies to missing processes and systemic deficiencies. The issuance of a non-compliance triggers the requirement for an operator to submit to the Commission a corrective action plan (CAP) which identifies corrective actions (CAs), responsibilities and timelines for implementing those actions. The CAPs must be received by the Commission within 30 days of the operator receiving its final audit report.

The Commission reviews and evaluates CAPs to assess whether the proposed CAs and timelines for completion are acceptable. Review of the approved CAPs and proposed actions continues until all non-compliance findings have been fully addressed by the operators within the agreed timeframe.

SUMMARY

Integrity Management Programs (IMP) for pipelines have been a regulatory requirement since 1999 in B.C. These are documented programs specifying the processes and practices used by pipeline operators to ensure public safety, environmental protection, and operational reliability.

The Commission has been performing compliance oversight for operators' IMP programs since 2011. This compliance assurance process is three-phased, including: a self-assessment, a one-day audit, and a process to follow-up on corrective actions related to the audit findings (Figure 2). The audit involves obtaining and evaluating evidence from operators' IMP and demonstration of inspection and maintenance processes to meet or exceed relevant regulatory and standard requirements.

This inaugural annual report provides an overview of the Commission's compliance assurance process; a summary and analysis of audit results (2016-17); and insight into operators' IMPP performance and compliance. This report also provides the results and comparative performance analysis of operators from two audit cycles—Audit Cycle 1 (2011-15) and Audit Cycle 2 (2016-17).

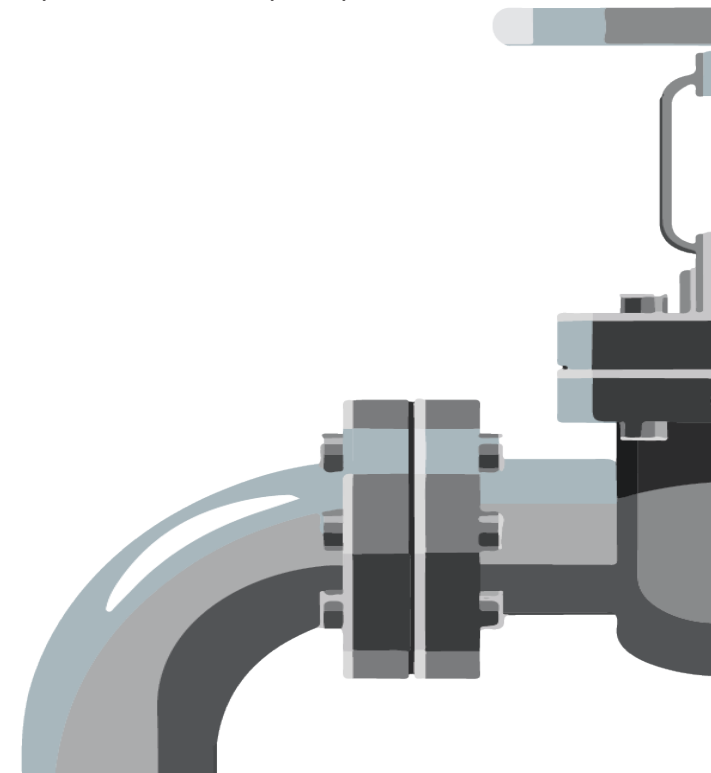
Following the audit of the IMP programs of 17 pipeline operators in 2016 and 10 operators in 2017, the Commission found overall, the operators' IMPs have well developed and implemented processes in place.

The Commission's auditing process has evolved over the years. Since 2016, the IMPP requirements have expanded to include the life cycle aspect and management system-based approach, and many areas previously not examined under performance evaluation, inspection and monitoring, and risk management. It is encouraging to note that even with this expanded scope, the compliance rate for operators' Integrity Management Programs is increasing. (See Figures 7 and 8).

There were non-compliances/gaps identified during the audits, such as: ensuring Information and Document Control is effective between field and head office; ensuring Risk Assessment and Management is an ongoing process for the entire life cycle; integrating Inspection and Monitoring activities as a part of the Risk Assessment process; implementing an internal audit program and performing audits regularly; and the involvement of senior leadership in Management Review. See the Audit Results and Analysis section for further details.

Through the corrective actions review process, the Commission ensures appropriate and timely actions are undertaken by the operators to address gaps identified during the audits.

Overall, the results in this report highlight continued improvement of operators' Integrity Management Programs and provide evidence to support the assertion that the Commission's compliance assurance process is adding value for operators selected to participate in the program.



CONTINUED IMPROVEMENT

The Commission will continue its compliance oversight of operators' Integrity Management Programs for pipelines to promote ongoing improvement and subsequently enhance pipeline safety throughout British Columbia.

The Commission is also committed to continued improvement of its compliance assurance process by evaluating its effectiveness and incorporating appropriate enhancements to the auditing and evaluation processes; such as, monitoring corrective actions, determining risk profiles and RPNs, and incorporating PDCA and safety culture approaches.

Lastly, the Commission will use a systematic review of operators' past incident reports and investigations in conjunction with the IMPP audits to focus its oversight on potential weak process areas.

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