



Petroleum and Natural Gas Regulatory Board

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**Review of the extant Safety framework, recommendations for unified &
comprehensive Safety and Integrity framework for downstream Oil and Gas sector**

September 2024

Report of the High-Level Expert Committee

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Preface

This Committee has been constituted to recommend a way forward for PNGRB to effectively discharge its regulatory responsibilities towards ensuring safety in the downstream oil and gas industry. With increasing size, complexity, and reach of this sector in both public and private domain, it is only appropriate to review the development status of regulations and compliance thereof by the industry.

Safety has always been a core value within the oil industry and is given the highest priority. Although there has been a decline in the number of incidents over the years, however, safety is an area which requires constant vigil, and thus, there can be no room for complacency. Accidents, especially where contractor workmen are involved, and also in the road transport sector, continue to be a special area of concern. Periodic occurrences of process-related accidents, both in our country and elsewhere, with their disastrous consequence, have been a grim reminder of the hazards and risks associated with this industry. Besides the accepted standards and best practices, we also need to continuously seek improvements and learn from global experience.

The Committee held a number of meetings and in-depth discussions with public and private sector oil companies as well as private entities operating in different downstream segments, including visits to installations. Discussions were held with Government and Industry bodies like PESO, OISD, and other auditing agencies. I wish to place on record my sincere thanks to the Committee members, special invitees who all are distinguished experts in their fields. Their valuable contributions were crucial in arriving at our final recommendations which are being submitted for the consideration of PNGRB.







I owe special thanks to Dr. A.K. Jain, IAS, Chairman PNGRB, under whose guidance and initiative this exercise was undertaken. His unwavering support, constant encouragement, and expert advice at various stages of our discussions have gone a long way in giving shape to our final report.

I would also like to put on record my appreciation for the efforts of PNGRB Officials in facilitating the smooth conduct of the meetings and for providing relevant data from time to time. Thanks also to Deloitte's representative for providing help in preparation of the final report.

Shri M B Lal

Chairman

Committee Members

Name	Position	Signature
Shri M B Lal	Chairman	
Shri Mukesh Rohatgi	Member	
Shri K K Jha	Member	
Shri R D Goyal	Member	
Shri Hirak Dutta	Member	
Shri Muktikam Phukan	Convener	

Executive Summary of Recommendations

To enable PNGRB to fulfil its responsibilities as a regulator in the most effective manner, the committee has made certain recommendations, which are based on the following General Directions/Guiding Principles.

Guiding Principles

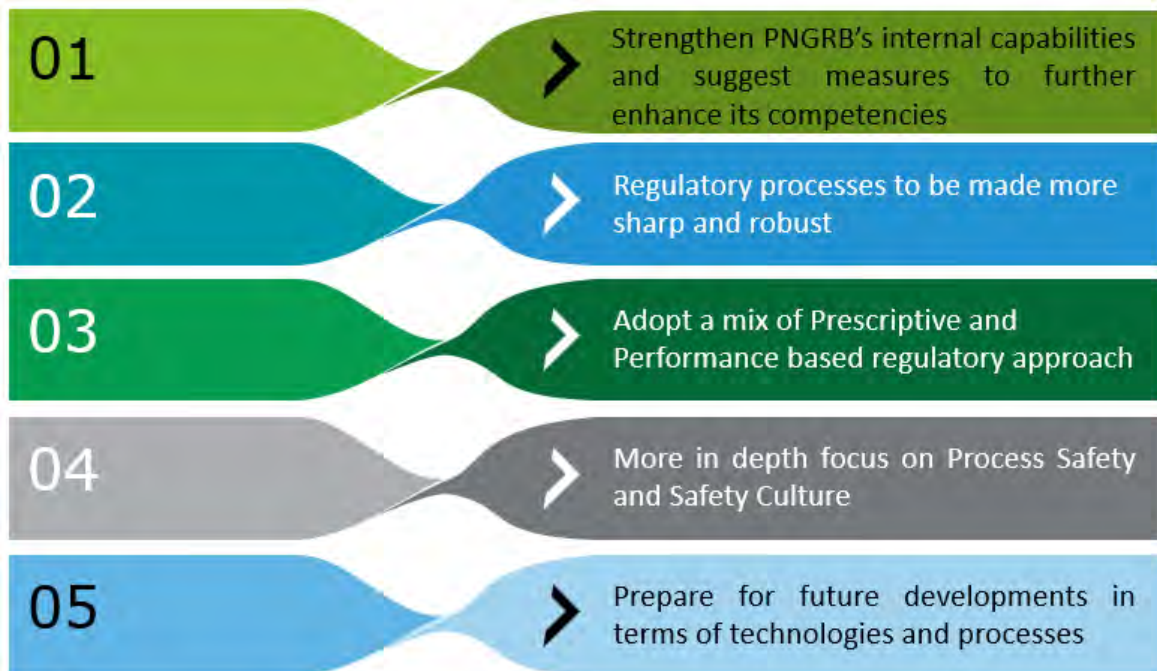


Figure: Guiding Principles

I. Strengthen PNGRB's internal capabilities:

Building competence in the safety area is of paramount importance and thus a guiding principle. PNGRB needs to focus on imparting safety-related competence to its workforce to effectively manage regulations and assist entities. Competency building will require adopting processes and guidelines for continuous learning, certifications, and development programs. These initiatives are necessary for equipping PNGRB's personnel with the latest knowledge and skills needed to manage and lay strong regulations in addressing safety related challenges in the sector. By emphasizing these practices, PNGRB can ensure that its workforce remains proficient, upholds high safety standards, and can seamlessly integrate new regulations and emerging risks.

II. Sharp and robust regulatory processes:

It is essential for PNGRB to enhance the robustness of its regulatory processes with regard to safety. This involves reviewing existing regulations periodically to ensure that safety standards are not only rigorous but consistently enforced across the sector. Continuous improvement, active stakeholder engagement, and incorporation of advanced safety measures are key to achieving this goal.

III. Hybrid regulatory approach:

Transitioning from Prescriptive to Hybrid approach (a combination of Prescriptive and Performance-based approaches) has been an important guiding principle. The committee recommends adoption of hybrid approach for its regulations. Hybrid regulations will provide a balance between flexibility and structured guidelines, allowing scope for innovation by the entities. By integrating both approaches, PNGRB will encourage entities to become more participative in the entire safety process.

The aforesaid approach offers several significant benefits mentioned below:

- Upholds necessity for compliance with core requirement
- Encourages innovation in finding tailored safety solutions
- Encourages active participation of entities in framing regulations

IV. Process Safety Management and Safety Culture:

A more in-depth focus on Process Safety is essential to prevent catastrophic incidents in the downstream industry. This involves a comprehensive approach to managing hazardous processes, as many major incidents can be attributed to failures in Process Safety Management.

Developing a strong safety culture is also a key guiding principle in the committee's recommendations. PNGRB should encourage the entities to adopt "**Safety First**" culture. Safety should be adopted as a core value by the entities supported by strong leadership commitment, active employee engagement, and transparent communication. Entities should be actively encouraged to recognize and prioritize the significance of a robust safety culture.

PNGRB should take a pole position in emphasizing the importance of safety.

V. Future readiness in terms of technologies and processes:

This principle focuses on proactive identification of emerging risks—those that may not yet be fully understood or recognized within the oil and gas industry. It emphasizes the importance of looking beyond current operations to anticipate future challenges, including technological advancements and evolving market conditions. This guiding principle encourages the development of forward-looking strategies.

The benefits of this guiding principle consist of:

- Increased resilience to disruptions, ensuring continuous safe operations.
- Quicker adoption of cutting-edge safety technologies and practices, thus staying ahead of industry trends.

Recommendations

All the recommendations of this report are related to the role of PNGRB as a safety regulator. These can be grouped under three broad headings:

- Strengthening Regulatory Capability
- Enhancing Regulatory Process
- Future Readiness

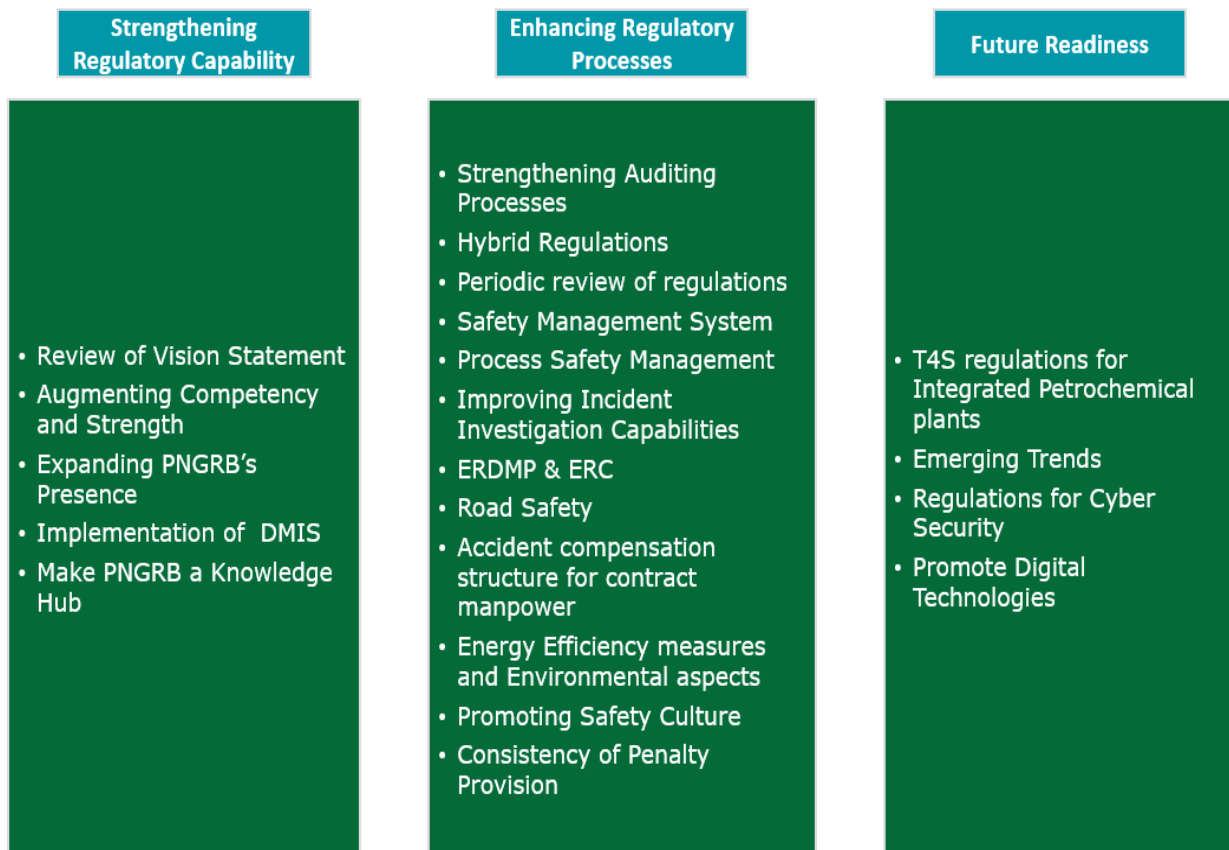


Figure: Categorization of Recommendations

Section 1: Strengthening Regulatory Capability

This section focuses on enhancing PNGRB's ability to effectively oversee and enforce safety standards within the downstream oil and gas industry. The following recommendations are aimed at strengthening the regulatory capacity of PNGRB:

- **Revisiting Vision/Mission Statement:**

PNGRB to revisit its vision statement, placing safety as a paramount element. Safety should be at the forefront of PNGRB's mission as the National Regulator for the Downstream Oil and Gas sector.

- **Augmenting Technical and Safety Division manpower:**

The Safety function within PNGRB needs to be augmented and reorganized to ensure comprehensive coverage of all areas of Fire and Safety. PNGRB should have its own cadre of experienced professionals in respective areas of all functions.

- **PNGRB's Nationwide Presence:**

The Committee understands that PNGRB may be considering setting up regional offices to facilitate closer interactions with the local entities/authorities and the public to meet the unique needs of various regions. If such offices were to become operational, it is recommended that dedicated Safety Officers may also be positioned in these offices.

- **Implementing Document Management and Information System (DMIS):**

To effectively utilize the increasing volume of safety data and documentation for knowledge and learning, it is recommended that PNGRB implement a cutting-edge Documentation Management and Information System (DMIS). This system will serve as a centralized repository for regulatory compliance documents, facilitating seamless communication, collaboration, and knowledge transfer among stakeholders.

- **Make PNGRB a Knowledge Hub:**

The committee strongly recommends that PNGRB should transform into a leading Knowledge Hub in Safety. This involves building competencies in all areas of safety regulations and different engineering disciplines by forming strategic partnerships and organizing regular knowledge-sharing events. This approach will not only position PNGRB as a leading authority in safety regulation but also achieve the tag of a knowledge-driven regulator.

PNGRB should initiate domestic and international partnerships through MOUs and collaborations with safety organizations and standards-making bodies. It should strengthen academic engagements by building strong connections with research institutes and academic institutions to drive innovation in the field.

Section 2: Enhancing Regulatory Processes

This section emphasizes the need for more resilient and efficient regulatory processes. It includes recommendations aimed at improving existing procedures and implementing best practices.

- **Strengthening Safety Auditing process:**

Several recommendations were made to improve upon the extant audit processes. These include proper selection, certifications, compensation, and monitoring of audit reports. Periodic refresher training for the auditors is important to ensure that they are abreast with the latest developments. A rating system for audit reports and TPIAs is recommended for continuous improvement.

The Committee presents two alternatives for the selection of TPIAs as their role is vital in making audits a corrective and learning tool, which are described in section 2.1.

- **Hybrid Model for regulations:**

A Hybrid approach, combining elements of both Prescriptive and Performance-based regulations, offers a balanced solution that leverages the strengths of each approach. This approach allows regulators to set clear expectations while providing flexibility for industry stakeholders to develop and implement installation customized SOPs (Standard Operating Procedures).

- **Review of Regulatory Documents:**

The committee also recommends that PNGRB establish a defined review schedule for all existing regulations. A dedicated document should be created to formalize review frequency, ensuring that standards remain relevant with technological advancements and evolving industry practices.

- **Safety Management System across all T4S regulations:**

The committee recommends that the Safety Management System (SMS) be incorporated consistently across all T4S regulations, extending beyond Refineries/GPU/CGD & LNG Terminals to ensure uniform safety standards throughout the downstream industry.

PNGRB should establish minimum safety standards for equipment, maintenance, and operations.

- **Process Safety Management:**

Committee recommends that regulations & checklist should include all elements of Process Safety Management (in addition to 14 original elements, newly added 9 elements in the PSM after the 2012 fire and explosion accident in Chevron Richmond, California should also be included) in Audits.

The committee recommends PNGRB regulations should require entities to develop and monitor a comprehensive set of performance indicators. These indicators should be categorized into leading indicators, which precede a failure and lagging indicators, which are reactive in nature.

- **Establishing a Robust Incident Investigation Process:**

The incident investigation process in safety management is a fact-finding process that aims to prevent future incidents and injuries. PNGRB should develop a procedure for carrying out the incident investigation such that the root cause of the incident is identified, and remedial actions are taken to prevent recurrence.

A compendium of all Near-miss incidents must be prepared by the Entities; learnings should be shared with employees and submitted to PNGRB for dissemination of lessons learned.

PNGRB should form an incident investigation committee, including its officers, to investigate all major incidents for improved transparency and accident prevention. PNGRB must define a report format for the entities that include data analysis, root cause identification, and actionable recommendations.

- **Emergency Response and Disaster Management Plan (ERDMP) & Emergency Response Centre (ERC) concept:**

The Committee recommends that ERDMP regulation must be segregated into two distinct areas one is actual emergency handling of the incident and second is preparedness to handle emergencies which involves activities like mock drill, risk analysis, imparting training to key personnel, tabletop exercises.

The Committee also suggests that the learnings from regular audits, Incident Investigations and ERDMP audits need to be captured periodically, which may call for periodic updates and amendments in ERDMP regulations.

The committee recommends that ERC at the affected site as is envisaged currently needs a revisit in view of the time lag between "additional resources made available" and "incident occurrence". In its present form, the cost is prohibitive, prompting a look at other alternatives like beefing up facilities at individual locations.

The Committee recommends structured interaction on ERDMP preparedness at all levels with stakeholders such as downstream industry members, state government(s) authorities, NDMA, SDMA, DDMA, etc., on a regular basis.

- **Road Safety:**

The committee recommends PNGRB lay down a Regulation on transportation of POL, LPG, LNG /CNG for enhancing Road Safety in the Oil & Gas sector.

- **Accident compensation structure for contract manpower:**

In case of disability or fatality PNGRB should establish guidelines for compensation structure for contract manpower, considering service duration, skillset, and other criteria. Clear timelines are to be defined for payment to ensure timely and adequate support for workers' families.

- **Adopting Energy Efficiency measures and Environmental aspects in T4S Regulations:**

The committee acknowledges that maintaining safe operations inherently ensures the protection of health and the environment, and the proposed measures reflect this holistic approach. The Committee has deliberated on all points to reinforce this commitment.

- **Promoting a strong Safety Culture across operating entities:**

Violation of SOPs has been assessed as a major contributing cause of accidents. Promoting a strong Safety Culture within the industry, where safety is seen as a core value, not just a regulatory obligation, can have a significant impact on reducing accidents.

PNGRB should encourage entities to promote a strong safety culture focusing on leadership, risk management, continuous improvement, stakeholder communication, adherence to international standards, ensuring that safety is integrated into all levels of operations and decision-making. Building consensus and agreement across an entity on accepted behaviors should be a priority task for the management to build a strong Safety Culture.

- **Enhancing Consistency and Effectiveness of Penalty Provisions:**

The effectiveness of regulations depends critically on enforcement. Depending on the severity of the non-compliance, a graded response can be made. The use of penalties as a tool should be made consistent in all sub-segments.

Section 3: Future Readiness

The recommendations in this section are aimed at exploring new avenues and measures for enhancing safety, including the adoption of advanced safety technologies, the implementation of sustainable safety practices, and the development of strategies to address future safety challenges and opportunities within the sector.

- **Extend Refinery T4S regulations for Integrated Petrochemical plants:**

The committee recommends that PNGRB should extend its Refinery T4S regulations to include integrated petrochemical plants, aligning them with the existing standards for refineries. This will encourage a unified approach to managing shared processes. The technical standards may be reviewed to assess their appropriateness for the Petrochemical and downstream chemicals sector which may also be added in integrated plants subsequently.

- **Emerging Trends:**

PNGRB should update its regulatory framework to incorporate emerging trends such as alternative fuels like hydrogen, CBG, and multifuel systems.

- **Introduction to Regulations for Cyber Security:**

PNGRB should promptly address any identified gaps in cybersecurity regulations and work collaboratively with stakeholders to ensure comprehensive coverage and robust protection for the downstream oil and gas sector from cyber threats.

- **Promote Digital Technologies:**

The Committee recommends that by embracing digital transformation, leveraging real-time monitoring, predictive analytics, and AI-powered safety management, the industry can enhance safety compliance, improve communication, and mitigate risks.

Introduction

The Petroleum and Natural Gas Regulatory Board (PNGRB) is an independent statutory body established under the Petroleum and Natural Gas Regulatory Board Act, 2006, via Gazette Notification on 31st March 2006. Its primary role is to regulate the refining, processing, storage, transportation, distribution, marketing, and sale of petroleum, petroleum products, and natural gas, excluding crude oil and natural gas production, to ensure a consistent and adequate supply of petroleum, petroleum products and natural gas across India.

PNGRB's responsibilities include setting technical and safety standards for the country's petroleum and natural gas industry, assuring compliance with safety audits and incident investigations, and levying penalties for non-compliance. The Board also promotes a competitive market environment, protects consumer interests, and encourages investment by providing a transparent regulatory framework. Furthermore, PNGRB oversees the construction and operation of pipelines as well as CGD infrastructure to ensure efficient and reliable delivery of energy resources to meet India's growing demand. Recognizing the emerging challenges and complexities in the sector, PNGRB continuously seeks to enhance its regulatory framework. In line with above objectives, this committee was formed vide PNGRB Order No. PNGRB/Tech/18-Comm/(12)/2023/(E-4765) dated 24th November 2023.

Committee formation

The Committee comprised of the following members:

Sr. No.	Name	Designation and Organization	Position
1	Shri M B Lal	Former CMD- HPCL	Chairman
2	Shri Mukesh Rohatgi	Former CMD- EIL	Member
3	Shri K K Jha	Former Member- PNGRB & Former Director (Pipeline), IOCL	Member
4	Shri R D Goyal	Former Director, (Project), GAIL	Member
5	Shri Hirak Dutta	Former ED, OISD	Member
6	Shri Anil Kumar Garg	Former JA (Technical), PNGRB	Convener (Superannuated)
7	Shri Muktikam Phukan	Director – Technical, PNGRB	Convener (<i>w.e.f. 20th May 2024</i>)

Terms of Reference of the Committee

The committee's mandate was to review the existing safety framework and recommend a unified and comprehensive Safety and Integrity Framework for the Indian Oil and Gas sector, in accordance with the following terms of reference:

- a) To examine regulatory regime, its modalities and domain of PNGRB to ensure safety and integrity of assets in the country's downstream Oil and Gas sector as mandated under PNGRB Act, 2006.
- b) To review the technical and safety framework with respect to system and procedures for the following:
 - i. formulation/amendments of technical and safety standards,
 - ii. the effective compliance of these standards,
 - iii. investigation of incidents,
 - iv. fixation of responsibility for incidents and
 - v. effective Emergency Response and Disaster Management Plan (ERDMP), etc.
- c) To explore inclusion of regulatory provisions related to energy efficiency and environmental parameters in T4S Regulations of PNGRB. Also, to explore and recommend inclusion of Petrochemical Plants in PNGRB's domain.

Process adopted by the Committee



Figure: Process Adopted

1. Committee Brainstorming and Discussions

Extensive Brainstorming:

The committee began with extensive brainstorming sessions among its members. Valuable insights were also received from the vast industry experience of the committee members. These initial sessions aimed to understand the current working practices and clarify the expectations from the committee, setting a strong foundation for subsequent discussions.

Consultations with PNGRB:

Discussions were carried out with the PNGRB Chairperson, Board Members, Technical, Legal, and Safety teams to understand current workings and expectations.

2. Stakeholder Engagements and third-party Discussions

Inputs from Industry experts:

To ensure a comprehensive perspective, the committee sought views and comments from major oil and gas organizations and other stakeholders. Feedback was collected through emails and web hosting, allowing a broad spectrum of stakeholders to provide input. This method ensured transparency and inclusivity.

Alongside this, direct interactions with oil and gas entities were conducted to discuss their safety systems and the challenges they face. These discussions were crucial for understanding real-world issues and practical challenges in implementing safety standards.

Third Party Inspection Auditors (TPIA):

The committee interviewed TPIAs to understand their workflow during audits, best practices, gaps, and challenges. These interviews provided a detailed view of the auditing process and highlighted areas for improvement.

Institute of Road Traffic Education (IRTE):

Discussions with IRTE were focused on road safety, an important aspect of the oil and gas sector, given the extensive transportation of hazardous materials. Insights from IRTE helped in understanding the integration of road safety within the broader safety framework.

3. Comparative Analysis and field visits

Discussion with Safety Organizations:

Invited representatives from other safety organizations like PESO (Petroleum and Explosives Safety Organization) and OISD (Oil Industry Safety Directorate) to discuss standards, human resources, safety audits, and incident investigations.

Review of International Standards/Literature Survey:

Committee also analyzed standards and practices of international regulators in order to arrive at the best practices.

Field Visits:

The committee also conducted comprehensive field visits to several downstream installations to gain firsthand insights into the extant safety systems and their real-time effectiveness.

The field visits involved interactions with the management and concerned stakeholders to understand implementation challenges and efficacy of existing safety measures. Key areas assessed included emergency response preparedness, safety training programs, maintenance practices, and the overall safety culture of the organization. Insights from these visits were key in shaping the Committee's recommendations and ensuring they were based on real-world operations and challenges.

The methodology adopted by the Committee enabled a comprehensive approach towards formulating recommendations.

Meetings Conducted

A summary of the meetings conducted by this committee is provided in the table below. This table encapsulates the collaborative efforts and insights gathered from various industry experts and organizations.

Table: Meetings Conducted

S.No.	Date of Meeting/Visit	Purpose	Experts Invited From – Company Name
1	01-Dec-23	Kick-off meeting	-
2	13-Dec-23	Committee Meeting	-
3	21-Dec-23	Committee Meeting	-
4	02-Jan-24	Committee Meeting	<ul style="list-style-type: none"> Indian Oil Corporation Limited (IOCL) - Corporate
5	15-Jan-24	Committee Meeting	-
6	01-Mar-24	Committee Meeting	<ul style="list-style-type: none"> Oil Industry Safety Directorate (OISD) Institute of Road Traffic Education (IRTE -Road Safety)
7	05-Mar-24	Committee Meeting	
8	15-Mar-24	Committee Meeting	<ul style="list-style-type: none"> CGD - Gujarat Gas Limited (GGL) TPIA - AMPY pipeline Solutions Bureau Veritas
9	21-Mar-24	Committee Meeting	<ul style="list-style-type: none"> SHELL RO
10	28-Mar-24	Committee Meeting	-

S.No.	Date of Meeting/Visit	Purpose	Experts Invited From – Company Name
11	03-Apr-24	Committee Meeting	-
12	10-Apr-24	Committee Meeting	-
13	18-Apr-24	Committee Meeting	-
14	24-Apr-24	Committee Meeting	-
15	02-May-24	Visit to Mumbai	<ul style="list-style-type: none"> • Bharat Petroleum Corporation Limited (BPCL) • Hindustan Petroleum Corporation Limited (HPCL)
16	03-May-24	Visit to Mumbai	<ul style="list-style-type: none"> • Reliance Industries Limited (RIL) • Mahanagar Gas Limited (MGL)
17	10-May-24	Committee Meeting	<ul style="list-style-type: none"> • Petroleum and Explosives Safety Organization (PESO)
18	17-May-24	Committee Meeting	-
19	24-May-24	Committee Meeting	-
20	30-May-24	Committee Meeting	<ul style="list-style-type: none"> • TPIA - Root Thinker
21	05-Jun-24	Committee Meeting	<ul style="list-style-type: none"> • Bharat Petroleum Corporation Limited (BPCL) – Presentation on Emergency Response Centre (ERC)
22	12-Jun-24	Committee Meeting	-
23	21-Jun-24	Committee Meeting	-
24	03-Jul-24	Committee Meeting	-
25	12-Jul-24	Committee Meeting	-
26	05-Aug-24	Committee Meeting	-
27	09-Aug-24	Committee Meeting	-
28	16-Aug-24	Committee Meeting	-
29	23-Aug-24	Committee Meeting	-
30	29-Aug-24	Committee Meeting	-
31	03-Sep-24	Committee Meeting	-
32	06-Sep-24	Committee Meeting	-

Focus Areas for Committee Members

The recommendations provided by the committee are a collective effort. However, to facilitate the preparation of the report and avoid duplication of efforts, initially the areas to be covered were divided for developing a base paper. Thereafter, these were deliberated upon in full meetings, and final recommendations emerged from the collaborative efforts and unanimously agreed to. The table below outlines these areas and the lead members responsible for them.

Committee Member Name	Focus Area
Shri M B Lal	Vision and Mission Statement of PNGRB
	Safety Culture and Behavioral aspects in regulations
	Plant/Field visit schedule for different hierarchy
	Safety Management System and Process Safety
	Increased focus on contractor workmen training
Shri Mukesh Rohatgi	DMIS (Document Management and Information System)
	Incident Reporting
	Regulations for Road transportation of PoL, LPG, NG, etc.
	Safety Culture
Shri K K Jha	Prescriptive to Hybrid type Technical/Safety Regulation
	Consistency of Penalty Provision
	Competency of PNGRB
Shri Hirak Dutta	Strengthening the quality of Audits and Incident Investigation process
	Payment model for audits
	Review of ERDMP and ERC philosophy
Shri R D Goyal	Fixation of responsibilities at different levels
	Penalty provisions for Non-Compliances and Incidents
	Compensation for contractual workmen in case of fatality/injury

Furthermore, PNGRB facilitated all the meetings and organized field visits to various locations to observe the actual scenarios for a better understanding. They also invited representatives from relevant entities, statutory bodies, and TPIAs to ensure a comprehensive perspective.

Current Status of the regulatory regime in India (Oil and Gas Sector)

Segment	Acts	Rules /Regulations	Statutory Authority	Ministry	
<ul style="list-style-type: none"> • Refineries • Gas Processing Plants • Storage of petroleum products • Cross- country Pipelines • LPG Bottling Plants • LNG Terminals • Retail Outlets, LPG cylinder, CNG & LNG stations etc. • Lubricating Oils • CGD Network 	Petroleum Act,1934	Petroleum Rules, 2002	Petroleum & Explosive Safety Organization (PESO)	(DPIIT), Ministry of Commerce & Industry	
	Explosives Act,1884	Explosive Rules 2008			
		Static and Mobile Pressure Vessels (Unfired) Rules, 2016			
			Gas Cylinder Rules, 2016		
	Factories Act 1948	Factories Rules promulgated by the respective State Govts underthis act	Chief Inspector of Factories or Director of Factories or Director of Industrial Safety & Health	Ministry of Labor & Employment	
	Petroleum & Natural Gas Regulatory Board (PNGRB) Act, 2006	PNGRB Regulations	PNGRB	Ministry of Petroleum& Natural Gas	
Electricity Act2003	CEA Regulations 2023	Central Electricity Authority (CEA)	Ministry of Power		
Indian BoilerAct 1923	The Indian Boiler Regulations 1950	Chief Inspector of Boilers	(DPIIT) Ministry of Commerce & Industry		
OISD, a technical directorate under MoPNG, carries out safety audits and accident investigations for the oil and gas installations and develops safety standards which are generally followed by the Indian Oil and Gas Industry					

Table: Present technical & safety regulatory system in India, *Indian regulators have been described in Annexure-1

The Indian oil and gas sector comprises of two main segments, Upstream and Downstream:

Upstream Segment:

The upstream segment is mainly focused on Exploration and Production activities, including drilling wells, installing production facilities, and implementing technologies to extract hydrocarbons efficiently. OISD is the statutory authority for Exploration & Production - Offshore and DGMS is the statutory authority for Exploration & Production - Onshore.

Downstream Segment:

The downstream segment plays a crucial role in refining crude oil into usable products, storing and transporting these products efficiently, and ensuring their availability to consumers across various sectors of the economy. This segment is vital for meeting the energy demands of India and driving economic growth.

Regulatory oversight in the Indian oil and gas sector involves multiple authorities and organizations which are tasked with ensuring compliance and safety standards as per their respective acts, regulations & directions. A snapshot of all the relevant agencies & authorities as applicable to the downstream segment is depicted.

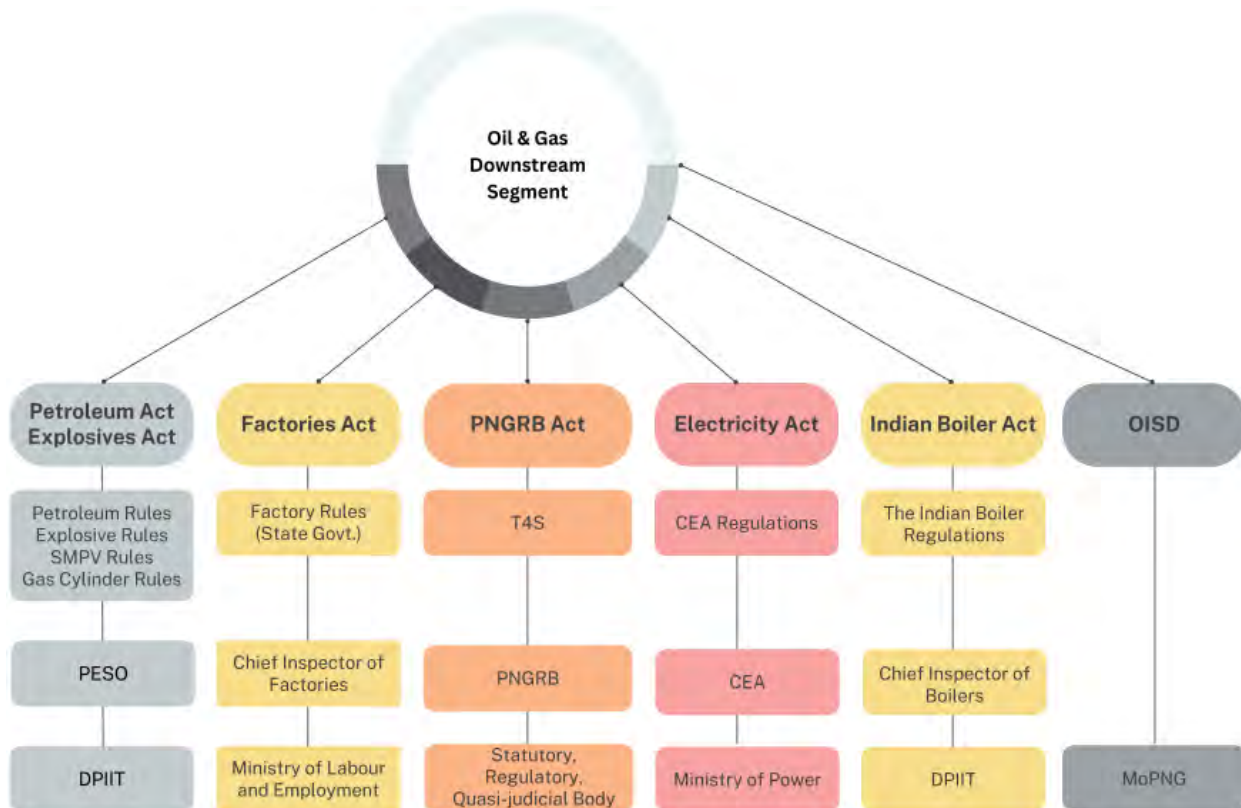


Figure: Oil and Gas Regulatory Set-up in India

PNGRB is the only identified regulator specifically for the downstream oil and gas sector in view of its following functions:

Statutory Function:

PNGRB derives its power and authority from the PNGRB Act of 2006, making it a statutory body with a legal mandate to regulate activities related to refining, transportation, distribution, and marketing of petroleum and natural gas. This statutory backing provides PNGRB with the necessary legal framework to formulate standards and enforce regulations in the industry, including imposing penalties.

Regulatory Function:

PNGRB acts as a regulatory body, establishing norms and standards for the petroleum and natural gas sector. It oversees various aspects such as authorization, fixation of tariffs, and infrastructure development, ensuring fair competition and consumer protection within the industry. As of now, PNGRB has promulgated 38 regulations, including T4S, IMS and ERDMP regulations and is getting inspection audits outsourced by PNGRB empaneled TPIAs. *(Refer to Annexure-1 and Annexure-2 for regulations promulgated by PNGRB)*

Quasi-Judicial Function:

PNGRB also performs quasi-judicial functions, adjudicating disputes, and grievances within the sector. It has the authority to investigate violations of regulations, impose penalties, and resolve conflicts between stakeholders.

The Committee examined the provisions of the Act and concluded that the Act has empowered PNGRB as an independent body to lay down the standards and regulate safety for the downstream petroleum and gas sector. **Thus, PNGRB is duty-bound to take all necessary steps in this regard.** This will ensure long-term protection of consumer and national interest.

1.1 Revisiting Vision Statement

A vision statement is a critical foundational guide for any organization, encapsulating its aspirations, broad strategic direction and core values. For PNGRB, the vision statement plays a very important role in setting the tone for regulatory practices, industry standards, and stakeholder expectations. It embodies the organization's dedication to guiding the future of the industry it oversees, ensuring that its objectives are aligned with broader societal and environmental priorities.

1.1.1 Current Vision Statement of PNGRB

"To create a vibrant energy market with rapid and orderly growth through facilitation of flow of investments into the basic infrastructure for efficient transportation and distribution of petroleum, petroleum products and natural gas at minimum cost and high level of protection of consumer interests through fair trade practices and competition amongst the entities so as to ensure the enhanced competitiveness of Indian economy and customer satisfaction."

1.1.2 Global Perspective on Regulatory Vision Statements

It is desirable to evaluate how the leading regulatory bodies around the world articulate their mission and vision statements. By doing so, we can identify key elements that are universally recognized as critical to effective regulation in the Oil and Gas sector. The global benchmarking will provide valuable insights into how safety and sustainability can be effectively incorporated into the revised vision statement of PNGRB.

Mission statement of Federal Energy Regulatory Commission (FERC), USA:

"Assist consumers in obtaining reliable, safe, secure, and economically efficient energy services at a reasonable cost through appropriate regulatory and market means, and collaborative efforts."

Safety is explicitly featured in FERC's mission statement, highlighting the regulator's commitment to protecting public health, the environment, and the integrity of the energy infrastructure. By incorporating safety alongside reliability and economic efficiency, FERC ensures that its regulatory practices prioritize the well-being of consumers and the sustainable development of energy resources.

Vision Statement of Canada Energy Regulator (CER):

"The Canada Energy Regulator (CER) is a recognized leader in the regulation of energy infrastructure. We enable safe, reliable, competitive, and environmentally sustainable energy transmission. We have the confidence of Canadians, and we uphold the inherent and constitutionally protected rights of First Nations, Inuit, and Métis. Our commitment to regulatory excellence enhances Canada's global competitiveness."

Safety is a core element of the Canada Energy Regulator's (CER) vision, as shown in its commitment to ensuring "safe, reliable, competitive and environmentally sustainable energy transmission." By highlighting "safe" in the first place, CER makes it clear that safety is not just a priority but a fundamental aspect of its vision. This focus on safety ensures that all energy infrastructure under the CER's oversight adheres to strict standards, protecting both people and the environment.

Bureau of Safety and Environmental Enforcement (BSEE): Objectives towards Safety

"The Bureau of Safety and Environmental Enforcement (BSEE) is dedicated to improving safety and ensuring environmental protection in the oil and gas industry, particularly on the U.S. Outer Continental Shelf (OCS). Central to BSEE's mission is the continuous improvement of its regulatory functions, which include worker safety, emergency preparedness, environmental compliance, and resource conservation."

Hence, top regulators worldwide in the Oil and Gas sector, such as the Canada Energy Regulator (CER) and the Federal Energy Regulatory Commission (FERC), prominently feature safety and sustainability in their vision or mission statements. These elements are essential for ensuring regulation and promoting safety as a top priority for the management.

Currently, PNGRB's vision statement does not address safety or sustainability. Incorporating these critical elements into PNGRB's vision would not only align it with global best practices but also establish a clear discipline for adhering to these priorities. This revision would reinforce PNGRB's commitment to protecting consumers, the environment, and maintaining industry safety standards, thereby fulfilling the mandate as per the Act.

Recommendations:

PNGRB should revisit its vision statement, placing safety as a key element, and frame a Vision and Mission Statement that covers safety aspects of the downstream Oil & Gas sector.

1.2 Augmenting Technical and Safety Division Manpower

1.2.1 Strengthening of PNGRB's Technical Safety Division by Induction of Cadre-based competent manpower:

Under the PNGRB Act, 2006, the Board is composed of the Chairperson, a Member (Legal), and three additional Members. PNGRB has a sanctioned manpower strength of 44 positions, excluding the Chairperson, Members, and Secretary. These sanctioned posts are currently filled by officials on deputation from oil and gas public sector enterprises and various Central Government departments.

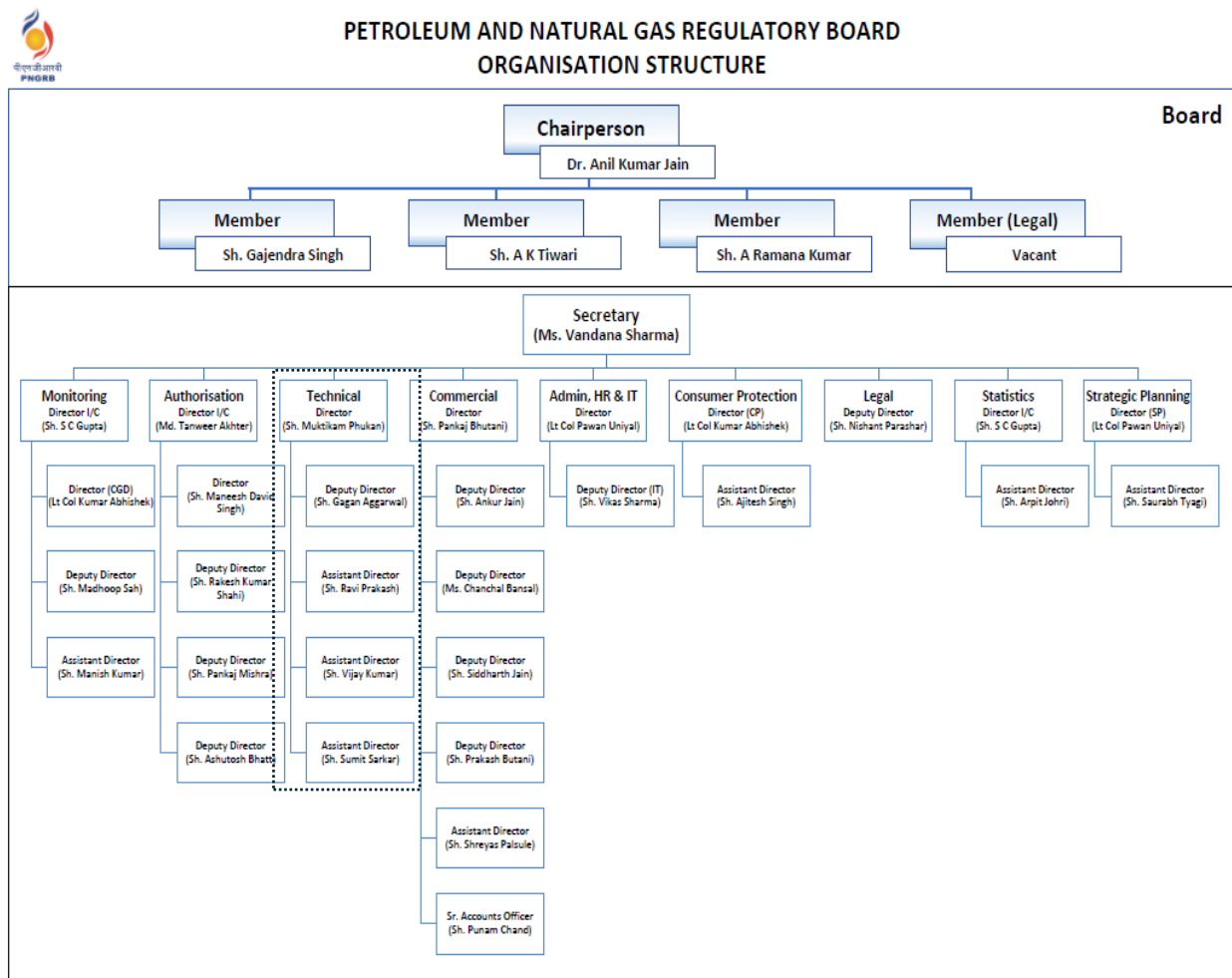


Figure: Current Organization Structure (Source: PNGRB website)

1.2.2 PNGRB's Organization Structure:

In the current organizational structure at PNGRB, safety function is a part of the technical division. The current organizational structure of the technical division is as per the fig., the total number

employees in the technical division of PNGRB are 14 which includes 05 officers (on deputation) and 09 technical consultants (contractual).

The Technical Division ensures the implementation of safety standards ensuring compliance with:

- Technical Safety Standards
- Integrity Management System
- Emergency Response and Disaster Management Plan (ERDMP);

In addition, it also carries out:

- Capacity Determination
- Empanelment & Third-Party Assessment (TPA)

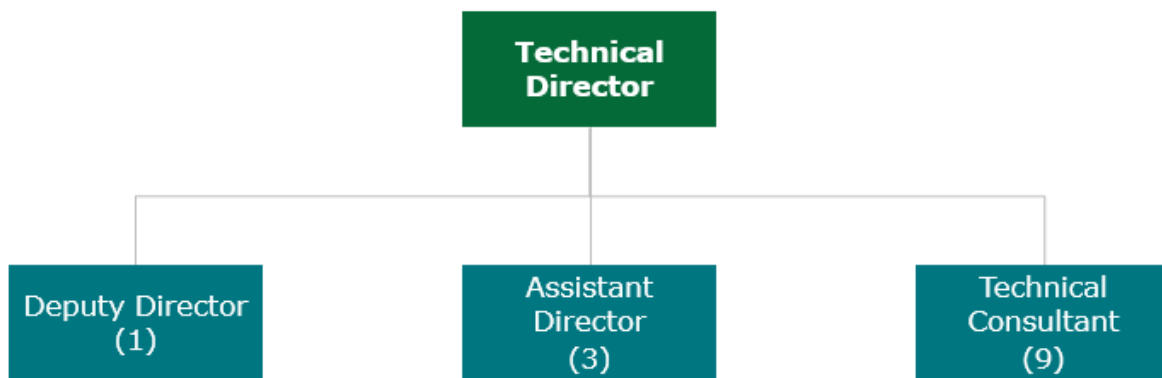


Figure: Technical Division's Current Organization Structure

In the current organization structure, accountability for safety at PNGRB is distributed among the technical division rather than being assigned to a dedicated safety group. The Committee felt that a dedicated safety division or a group with an exclusive focus on safety would be more effective.

1.2.3 Proposed Structure:

During committee discussions, it became evident from presentations that augmenting manpower for PNGRB's Technical Division—responsible for T4S, IMS, and ERDMP audits is crucial. The committee assessed that the scope of these audits presents a significant challenge, and strongly recommends increasing manpower within the Technical Division.

The committee also emphasizes the importance of addressing safety at the highest level by assigning safety as a dedicated responsibility to a senior-level officer (preferably at head level or higher). This will demonstrate PNGRB's commitment to ensure availability of petroleum and natural gas products without compromising on safety. Additionally, the committee urges the deployment of competent Safety Officers in the Technical Division at the earliest. This will help in:

- Spearheading all safety initiatives of PNGRB

- Interfacing with operating stakeholders such as PESO and OISD
- Acting as the nodal point for all operating entities
- Managing safety audits and incident investigations

The number of officers under the Technical Division is inadequate even for present requirements. Strength to be increased to cater to the requirements of existing infrastructure and upcoming needs in the immediate future. PNGRB to establish its own cadre of experienced professionals to ensure effective discharge of its activities. As the industry advances, the complexity of safety management, risk assessment and integration of cutting-edge technologies becomes increasingly significant.

PNGRB should also consider appointing mentors to guide and oversee the program for development of competencies and expertise within the organization.

1.2.4 Building a High-Caliber Team

PNGRB to focus on skill development of technical and safety manpower in ways mentioned below:

“Listen to people with lived experience, they will always know best.”

PNGRB can initiate learning sessions on a regular (monthly or fortnightly) basis where its own officers can make presentations to internal audiences on various topics of interest in safety (e.g., case studies of accidents, etc.) based on their self-learnings.

PNGRB to engage top talent who possess necessary expertise, skills, and experience. Engaging individuals with relevant experience in Oil and Gas sector will enhance the effectiveness of safety initiatives.

Interaction with International experts:

Engaging in partnerships with international regulatory bodies and safety organizations to stay abreast of global best practices. Regular field visits to gain hands-on experience to enhance team's knowledge related to safety.

Knowledge Sharing Sessions:

Invite industry experts to conduct periodic workshops and seminars focused on key safety and risk management practices. Topics should include safety management, risk assessment and regulatory compliance.

This will lead to the development of Subject Matter Experts (SMEs) in various sub-segments of downstream industry and discipline-wise specialists within PNGRB.

Recommendations:

Safety should be assigned as a dedicated responsibility to a senior level officer (preferably at head level or higher within PNGRB).

The safety function within PNGRB should be enhanced and reorganized to ensure comprehensive coverage across all disciplines, PNGRB must establish its own cadre of experienced professionals.

PNGRB should consider the appointment of experienced mentor for developing internal competencies.

1.3 PNGRB's Nationwide Presence

The Committee understands that PNGRB may consider setting up regional offices as provided in the Act to facilitate closer interactions with the local entities/authorities and the public to meet the unique needs of various regions. If such offices were to become operational, it is recommended that dedicated Safety Officers may also be positioned in these offices.

Placing safety officers in Regional Offices would enhance regulation and compliance monitoring, allowing PNGRB to provide more comprehensive and responsive oversight of regional needs such as:

- Enhanced access to entities for more effective control and regulation
- Improved databank management
- Easier coordination with state authorities
- Closer interaction with the entities
- Streamlined incident reporting at both Regional Office and Headquarters level
- Increased participation by PNGRB in safety audits

Recommendations:

The Committee recommends that should there be regional offices in future, dedicated Safety officers may also be positioned in these offices.

1.4 Implementing Document Management and Information System (DMIS)

Document Management and Information System (DMIS) is a tool that helps organizations manage their documents and information more efficiently. It automates tasks like storing, organizing, and retrieving documents, making it easier to handle large volumes of data. DMIS ensures that information is accurate, accessible, and secure. This system improves how documents are managed, supports compliance with rules, and helps teams work together more effectively by keeping all necessary information in one place. Furthermore, analyzing the data can offer valuable insights and lessons for the regulator and the entities.

Implementation of DMIS will provide opportunities for learning. By leveraging the data collected and analyzed, PNGRB can identify trends, learn from past incidents, evaluate performance, gain a deeper understanding of safety practices and disseminate the learnings to the entities.

The relevant clause of PNGRB Act is reproduced below:

Clause-51. Maintenance of data bank and information

(1) The Board shall maintain a data bank and information system relating to activities of entities dealing with petroleum, petroleum products and natural gas in such form and manner as may be provided by regulations.

(2) The Board shall have power to verify the data supplied by the entities and appoint any person or persons for the purpose and take such measures as it may consider necessary.

1.4.1 Deliberations

A robust Data and Documentation Management and Information System (DMIS) with Safety as a key module is recommended.

The DMIS will enable PNGRB to efficiently monitor, analyze safety performance and suggest measures for continuous improvement, thereby ensuring adherence to regulatory requirements. A significant advantage of the DMIS is its capacity to greatly simplify access to stored information, allowing for prompt retrieval under various criteria. This capability is essential for effective data management and regulatory oversight. DMIS will thus reinforce PNGRB's ability to oversee and regulate the sector with greater efficacy, ensuring that all necessary data is readily accessible, analyzed and meticulously managed.

To operationalize this initiative effectively, the Committee recommends establishing a dedicated Documentation Cell within PNGRB's technical division employing skilled personnel.

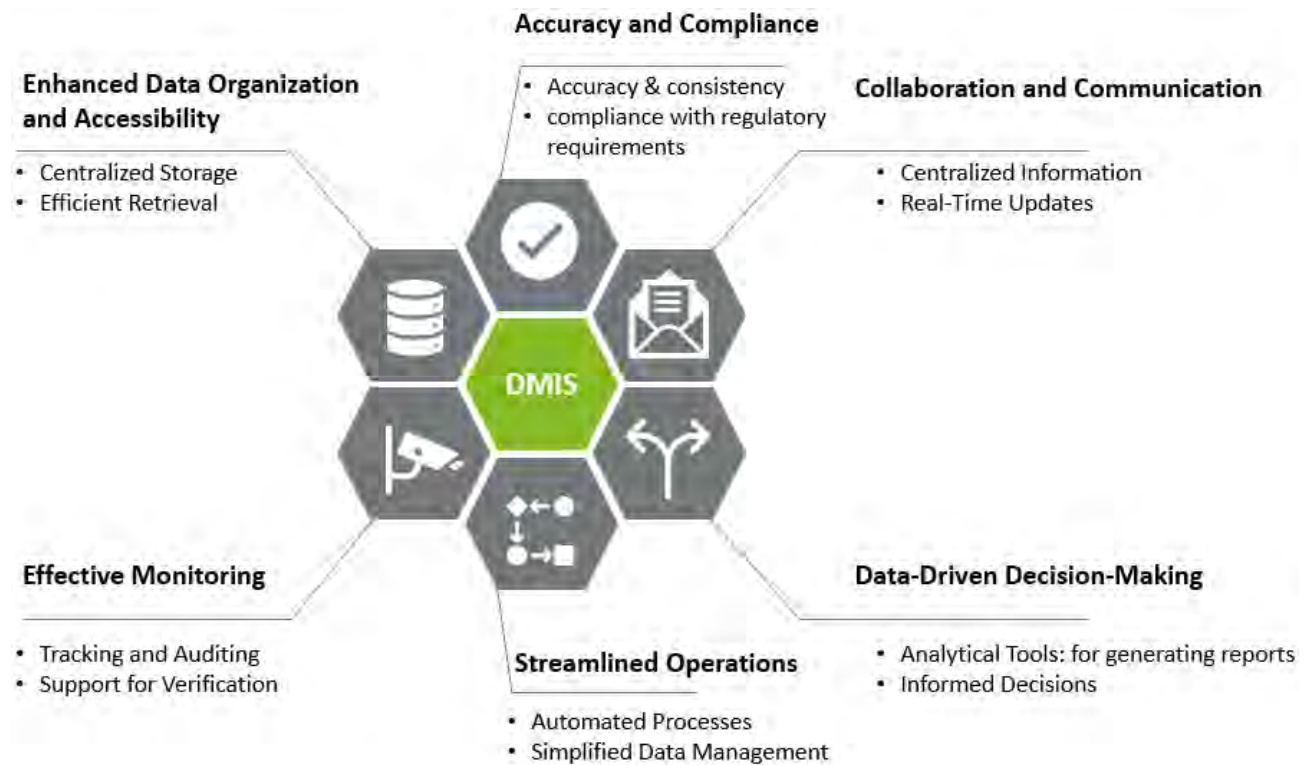


Figure: Advantages of Implementing DMIS

Recommendations:

PNGRB should establish itself as the central repository for all activities by maintaining a comprehensive Data Bank with Safety as a key module.

To ensure the effective implementation of the DMIS, PNGRB should establish a dedicated Documentation Cell equipped with skilled personnel.

DMIS will enable PNGRB to extract valuable insights from data, identify trends, and disseminate learnings to enhance industry practices.

1.5 Make PNGRB a Knowledge Hub

Transforming PNGRB into a knowledge hub is essential for advancing safety and regulatory practices within the downstream Oil and Gas sector. By becoming a knowledge hub in safety, the regulator can promote innovation, drive continuous improvement, and maintain effective and up-to-date safety regulations. This transformation will position PNGRB as a leader in safety regulations.

Importance of Collaboration and Academia Interface:

Domestic and international Collaboration and strong ties with academic institutions are vital for advancing safety standards in the oil and gas sector. Such partnerships enable regulatory bodies to stay abreast of the latest developments, foster innovation, and ensure that safety regulations remain effective and up to date. Engaging with the industry experts and institutions can provide valuable insights and drive continuous improvement necessary for addressing safety challenges proactively.

Currently, PNGRB's engagement with both domestic and international safety organizations, academic institutions and standards-making bodies is limited. The organization has yet to fully realize the potential benefits of these collaborations. This gap presents a significant opportunity for PNGRB to enhance its regulatory capabilities and strengthen its role in advancing safety.

1.5.1 Approach towards Enhancement:

To address these gaps, PNGRB should adopt a strategic approach to enhance its partnerships and academic engagements.

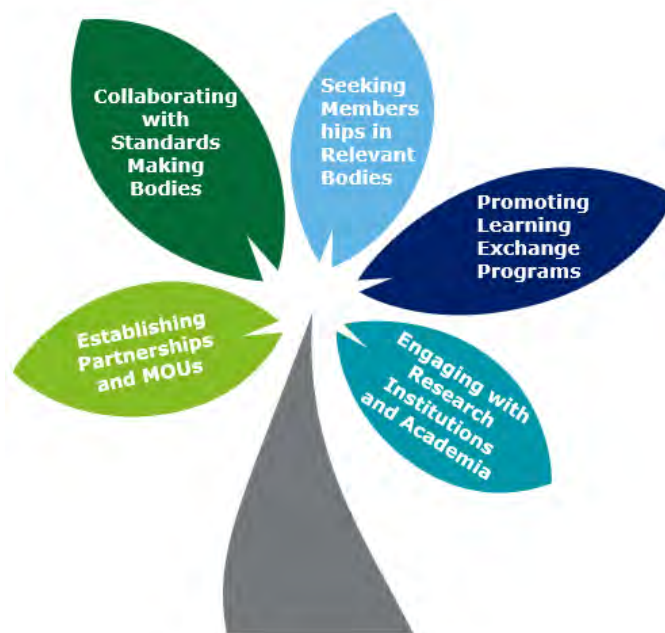


Figure 1: Approach towards partnerships and engagements

Establishing Partnerships and MOUs:

PNGRB should actively pursue Memorandums of Understanding (MOUs) & partnerships with a range of safety organizations and regulatory bodies, both within India and abroad. These agreements will facilitate exchange of best practices, regulatory insights, and joint research initiatives.

Collaborating with Standards-Making Bodies: By partnering with standards-making organizations, PNGRB can stay aligned with emerging technologies and regulatory frameworks. These collaborations will help PNGRB contribute to the development of industry standards and incorporate global best practices into its regulations.

Seeking Memberships in Relevant Bodies: PNGRB should become a member of key international and domestic organizations dedicated to safety and regulatory excellence. Membership in these bodies will provide access to global networks, resources, and expertise.

Engaging with Research Institutions and Academia: PNGRB should build strong relationships with leading research institutes and academic institutions specializing in safety and technology relevant to the oil and gas sector. Joint research projects, workshops, and academic partnerships will promote innovation and address critical safety issues.

Promoting Learning Exchange Programs: Facilitating exchange programs that enable knowledge sharing between industry professionals, regulatory experts, and academic researchers is essential. These programs can include study tours, seminars, and workshops focused on various safety topics.

Organizing Workshops and Seminars:

- PNGRB should conduct regular workshops and seminars to disseminate knowledge and best practices. This includes:
 - Periodic safety workshops at regional and national levels.
 - Development and propagation of training modules for T4S.

Website Upgradation:

A dedicated section should be added to PNGRB's website for Safety Bulletins, Case Studies, Guidance Notes and Articles related to safety. This will spread awareness, provide easy access to crucial information related to safety.

To effectively implement these strategies, PNGRB requires a detailed intervention plan:



Figure: Implementation Strategies

Recommendations:

The committee strongly recommends that PNGRB should transform into a leading Knowledge Hub for Safety. This involves building a skilled team, forming strategic partnerships, and organizing regular knowledge-sharing events. This proactive approach will not only position PNGRB as a leading authority in safety regulation but also achieve the tag of a knowledge driven regulator.

PNGRB should initiate Domestic and International partnerships through MOUs and collaborations with safety organizations, standards-making bodies, and research institutions. It should strengthen Academic engagements by building and maintaining strong connections with research institutes and academic institutions to drive innovation and address safety challenges.

Chapter-2: Enhancing Regulatory Processes

This chapter emphasizes the need for more resilient and efficient processes related to safety within the industry. The recommendations in this chapter are aimed towards refining existing procedures, implementing best practices, and introducing new technologies to strengthen overall operational safety. The aim is to promote a culture of continuous improvement and proactive risk management by addressing these areas.



2.1 Strengthening Safety Audit Process

Safety audit is a critical process that provides a clear picture of what is actually happening within an organization. It highlights potential risks and ensures compliance with safety standards.

2.1.1 Improving the quality of Audit Reports

To enhance the quality of audit reports following measures should be implemented:

- **Audit Report Rating:** Introduce a rating system for audit reports to objectively assess the thoroughness and quality of the audits. This will help in maintaining high standards and ensuring that reports meet the required quality benchmarks. This will also help ranking TPIAs on the basis of their accumulated rating.
- **Adequate Compensation for TPIAs:** Ensure that TPIAs are paid adequately to attract and retain top talent. Payments should be benchmarked against industry standards and other regulatory bodies to ensure competitiveness and recognize the expertise of auditors. Furthermore, the payment to TPIAs should be done on the basis of the task completed.
- **Incorporation of Lessons Learned:** Include a section in the audit reports dedicated to lessons learned. This will facilitate continuous improvement and help in addressing recurring issues, ultimately enhancing the overall safety and effectiveness of the auditing process.

2.1.2 Auditing System Payment Methodology

The extant system of awarding audits to TPIAs based on lowest rates must be dispensed with. Further it is suggested that instead of the entity selecting the TPIAs, PNGRB should select the TPIAs. This is expected to improve the quality of audits. This shall also overcome the problem of delayed payment to TPIAs by entities till audit certification requirement is fulfilled.

Following two options emerged after detailed deliberations and can be considered by PNGRB for an effective Auditing System in place:

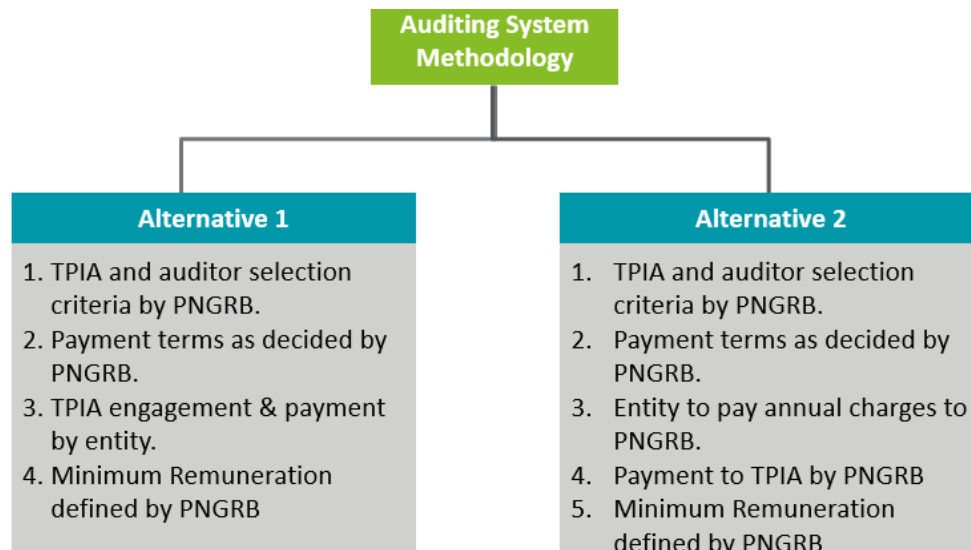


Figure: Auditing System Methodology

2.1.3 Surprise Safety Audits

The committee recommends that Surprise Safety Audits be conducted to assess the actual implementation of Safety Management Systems within organizations. Surprise Safety Audits are an effective tool for verifying the quality of audits conducted by TPIAs, reviewing pending audit recommendations, and providing new recommendations to enhance safety and prevent accidents.

During these audits, the lead auditor and a PNGRB-nominated representative should engage in face-to-face discussions with the top management team to gain firsthand insights into the organization's safety culture.

2.1.4 Knowledge Sharing Sessions among Auditors

PNGRB should encourage active engagement among auditors to promote knowledge sharing. This will help them disseminate valuable insights and lessons learned from the entities they have audited, enhancing overall understanding and effectiveness of the process.

2.1.5 Strengthening Safety Audit Process:

- PNGRB should devise a mechanism for training and certification of TPIAs (Third Party Inspection Agency).
- Regulations and checklists should include Safety Management System/Process Safety Management (SMS/PSM) in Safety Audits. Intensive training of auditors may be required for the same.

- A panel of Consultants / Experts may be engaged by PNGRB, who would, on a regular basis, examine and review the audit reports of various TPIA/auditors.
- Audit reports to be shared with the Entity's board.
- Drawing up a detailed schedule of all installations covering an entire cycle of audits (3 to 5 years period).
- Only auditors certified by a competent agency will be eligible for selection.
- Auditor should be physically fit especially for carrying out field audits.
- Representative from PNGRB should get actively involved in TPIA audit for effective oversight of the entire audit process.

Recommendations:

PNGRB should establish a mechanism for Training and Certification of auditors of TPIA and only those certified by a competent agency will be eligible for selection.

PNGRB should implement a rating system for audit reports, and TPIAs should be offered adequate compensation to attract and retain competent personnel.

A panel of Consultants/Experts may be engaged by PNGRB who would on a regular basis examine and review the audit reports of various TPIAs.

The Committee presents two alternatives for PNGRB's discretion in selection and implementation of audit system methodology.

Safety Management System/Process Safety Management should be included in Safety Audits.

2.2 Hybrid Model for Regulations

2.2.1 Overview of different models for regulations:

1. Prescriptive-Based Regulations:

Prescriptive-based regulatory requirements define specific technical and procedural actions for operations. The prescriptive regulations detail out what must be done, by whom, and how it should be accomplished. While these types of regulations establish clear guidelines, they do not specify the desired outcomes, often leading to a compliance-focused rather than a safety-driven approach.

2. Performance-Based Regulations:

Performance-based regulation sets performance goals with minimal intervention in specific measures or methods to achieve compliance. Here, the regulations must focus on the outcomes, providing the entity with the flexibility to choose the best possible methods to achieve them as per their situations. Since entities are best placed to manage the risks, this approach can encourage proactive risk management.

3. Hybrid Regulations:

The complex nature of the industry has spurred the change in emphasis from a purely prescriptive regime to a mixed hybrid form of prescriptive cum performance-based regulations.

A hybrid approach blends both prescriptive and performance-based elements of regulations. This aims to combine the clarity and structure of prescriptive regulations with the flexibility and innovation of performance-based models. By leveraging the strengths of both approaches, a hybrid approach promotes a safety culture that is not only compliant but also ready to embrace future advancements and accommodate entity-specific changes or tailored customizations.

As processes become complex, regulators alone may not be able to ensure safety in an organization. It is crucial for entities to step up and actively take responsibility for ensuring safety within their own organizations.

In the deliberations, the committee believes that **“those who create risks are best placed to control them”** Based on this theory, **“responsibility of ensuring safety lies with the entity”**.

2.2.2 Current Practice

Extensive discussions were held on existing regulations including T4S, IMS, and ERDMP, incorporating feedback from various stakeholders. It was observed that PNGRB's current regulations are predominantly prescriptive, setting specific technical standards for compliance.

However, this approach tends to focus more on meeting requirements than promoting a proactive safety culture. The current framework operates more as a technical standard rather than a

comprehensive strategy that promotes continuous improvement and innovation in safety practices.

2.2.3 Global Benchmarks:

1. Norwegian Petroleum Safety Authority (PSA):

The PSA employs a hybrid regulatory approach, where a combination of prescriptive regulations and performance-based standards is used.

For example, the PSA's regulations on "*Management and Control*" require companies to meet specific safety requirements (prescriptive), but also mandate that companies establish and implement their own safety management systems tailored to their operations (performance-based).

2. UK Health and Safety Executive (HSE):

The UK's HSE has implemented performance-based regulations in its offshore safety regime, focusing on achieving specific safety outcomes while allowing operators the flexibility to determine the methods. This approach has led to high safety standards and continuous improvements in safety practices.

Considering the global best practices that successfully blend prescriptive and performance-based regulatory approaches, the committee recommends that PNGRB should adopt a hybrid regulatory model.

When designing their risk management strategies, entities should adopt ALARP (As Low As Reasonably Practicable) principle. By practicing ALARP, entities ensure that risks are minimized to the lowest possible level, considering the cost, time, and effort involved while balancing these factors against the benefits of further risk reduction.

2.2.4 Merging T4S and IMS Regulations to Enhance Compliance and Operational Efficiency:

Committee recommends PNGRB to merge the T4S and IMS regulations for CGD, NGPL and PPPL sub-segments. This consolidation would create a unified framework by eliminating redundancies in the audits, thereby reducing documentation and efforts at both the regulator's and entity's end.

Recommendations:

The Committee recommends that PNGRB should transition to a hybrid regulatory model that combines prescriptive and performance-based elements. This approach will ensure compliance with essential safety standards while providing entities the flexibility to innovate and tailored safety practices to match their individual situations.

Consolidate T4S and IMS regulations to streamline oversight, reduce redundancies, and enhance operational efficiency.

2.3 Review of Regulatory Documents

Currently, the periodicity for reviewing existing regulatory documents, including T4S, IMS, and ERDMP, is set at 5 years. However, the committee recommends that PNGRB should establish a clear review schedule for each standard. The regulator should consider developing a dedicated document that outlines the required review frequency. Adhering to this review schedule will ensure that regulations remain relevant and effective. The regulator to note that apart from periodic reviews, standards still need to be reviewed as per exigencies or new developments.

Recommendations:

The Committee recommends PNGRB to establish a defined review schedule for all existing regulations. A dedicated document should be created to formalize the review frequency, ensuring that standards remain relevant with technological advancements, industry practices and lessons learned.

2.4 Safety Management System across all T4S Regulations

Safety Management System (SMS) provides a structured approach to managing safety risks and improving safety in high-risk industries.

Five Pillars of Safety Management System SMS:

Safety Management System (SMS) is an important concept built on the following five pillars, which need to be appropriately covered extensively & consistently.

Pillar 1: Leadership and Commitment

Pillar 2: Hazard Identification and Assessment

Pillar 3: Employee Training and Empowerment

Pillar 4: Safety Control Measures

Pillar 5: Continuous Improvement and Monitoring

The Five Pillars provide a comprehensive Safety Management System framework. To ensure effective implementation, the following recommendations will help PNGRB strengthen safety regulations and drive consistent adherence.

2.4.1 Recommendations from Five Pillars of Safety Management System

- PNGRB should emphasize in its Regulations the importance of visible leadership commitment at all levels of the Entity, ensuring that safety policies are documented, regularly reviewed, and updated as necessary. This pillar emphasizes that the Entity's top management must visibly endorse and prioritize safety.
- To effectively manage risks, PNGRB should direct entities to implement robust hazard identification and assessment procedures. This involves systematic processes for recognizing potential hazards, evaluating risks, and implementing appropriate mitigation strategies. Regular risk assessments, safety audits, and hazard analysis should be conducted to identify potential threats to safety.
- Entities must develop and implement thorough training programs that cover all aspects of safety relevant to their operations. Additionally, employees should be empowered to take ownership of safety practices, encouraged to report unsafe conditions, and participate in safety committees.
- PNGRB should specify minimum safety standards for equipment design, maintenance protocols, and operational procedures. Entities must also develop and implement emergency response plans, conduct regular drills, and ensure that all safety equipment is accessible and functional.
- Entities must establish mechanisms for ongoing monitoring of safety performance, including regular audits, inspections, and performance metrics. This pillar also involves the continuous review and enhancement of safety procedures based on incident investigations, feedback from employees, and advancements in safety technologies.

2.4.2 Safety Report for Effective Safety Management System

A Safety Report makes a positive contribution to prevention of major accidents on any site and to the limitation of their consequences to people and the environment. Firstly, it is a document in which Entities present information in a way that shows they have measures in place to prevent major accidents and limit their consequences. It can only be successful in this aim if they have systematically examined their site activities and the potential for major accidents and listed what they have done or are going to do to prevent major accidents. Secondly, the safety report is a demonstration that the safety measures onsite have been arrived at, based on a systematic process. The value in writing a safety report is that it shows that entities have investigated safety measures, whether organizational, technical or in terms of how people contribute to safety on their site. It also shows that entities have arrangements in place to put right any shortcomings as identified.

Minimum contents of any Safety report:

- (a) contains a Major Accident Prevention Policy (MAPP)
- (b) demonstrates that there is a Safety Management System (SMS) for implementing the MAPP
- (c) demonstrates that the MAPP and the rest of the SMS have been put into effect
- (d) demonstrates that all the measures necessary have been taken to prevent major accidents and to limit their consequences for people and the environment

Safety Report should also include descriptions of a series of outcomes which are themselves determined or influenced by SMS, such as the technical precautions and predictive elements.

MAPP in the safety report should include:

- (a) a statement showing the company's commitment to achieving high standards of safety and environmental performance, as well as an indication that the necessary resources will be made available.
- (b) a recognition that the nature of the company's activities gives rise to major accident hazards for employees, contractors, visitors, members of the public, and the natural and built environment. The company has obligations to safeguard employees, neighbours, and the environment.
- (c) statements explaining the company's overall aims and principles of action in relation to the control of major accidents. Without a clear policy setting out the aim delivering the necessary control is likely to be ad hoc.

It is not mandatory that entities submit the Safety Report to the regulator, but it should be made available on request. (*Refer to Annexure-4 for guidelines on writing a Safety Report*)

2.4.3 Further Deliberations

By integrating these five pillars into its regulatory framework, PNGRB can significantly enhance the safety standards within the oil and gas sector, ensuring a safer and more sustainable operational environment for all stakeholders involved.

On reviewing various T4S regulations, it was observed that the Safety Management System (SMS) concept is only mentioned in **Refineries/GPU & LNG Terminals** sub-segments, and it was found missing in other regulations.

Recommendations:

The Committee recommends that PNGRB should ensure that top management of the entities prioritize safety by regularly reviewing each pillar of the Safety Management System.

The Committee recommends that PNGRB should encourage entities to prepare a detailed safety report for effective Safety Management System.

The Committee recommends that the Safety Management System (SMS) be incorporated consistently across all T4S regulations, extending beyond Refineries/GPU & LNG Terminals to ensure uniform safety standards throughout the downstream Oil and Gas sector.

2.5 Process Safety Management

2.5.1 Importance of Process Safety Management

Major catastrophic incidents are primarily attributed to process safety failures. The major incidents at Buncefield, Piper Alpha, Flixborough disaster, Richmond-California, Bhopal disaster, Tatipaka Gas leak, Jaipur Terminal disaster, etc., resulted in failure in Process Safety Management. It is, therefore, imperative that for the high-hazard oil and gas industry, the focus must be on effective Process Safety Management.

Understanding process safety failures requires domain knowledge, deep analytical skills and an understanding of human behavior. It basically encompasses safe & inherent design of the plant and machinery with built-in adequate layers of protection, understanding of operational nitty-gritties and proper upkeep of assets both static and rotary.

In other words, Process Safety Management (PSM) involves a systematic approach to managing the integrity of hazardous processes and ensuring safe operations.

2.5.2 Elements of Process Safety Management

Originally, OSHA recommended 14 sub-elements for Process Safety Management (PSM). Following the Richmond, California oil refinery incident, 9 additional sub-elements have been incorporated into PSM. Considering the importance of Process Safety Management (PSM) in reducing incidents / accidents, Committee recommends that in the high-hazard Oil & Gas industry all the above sub-elements of PSM must be put into place to enhance Safety.

Element	Description
Process Safety Information	Provides detailed information on hazardous chemicals, technology, and equipment
Operating Procedures	Establishes clear instructions for safely operating a process
Process Hazard Analysis (PHA)	Identifies and evaluates potential hazards in the process
Employee Participation	Encourages active involvement of employees in safety processes
Training	Ensures workers are knowledgeable and competent in safety practices
Contractors	Ensures that contractors are aware of hazards and comply with safety procedures
Mechanical Integrity	Focuses on the proper maintenance of critical equipment
Incident Investigation - Root Cause	Investigates incidents to prevent recurrence

Element	Description
Management of Change (MOC)	Controls changes to processes to avoid introducing new hazards
Pre-Startup Safety Review (PSSR)	Ensures safety before starting new or modified processes
Emergency Planning and Response	Prepares for emergency situations with proper planning and response strategies
Hot Work Permit	Controls hot work activities to prevent ignition of flammable materials
Compliance Audits	Regular audits to ensure adherence to safety standards
Trade Secrets	Protects confidential information while ensuring safety
Damage Mechanism Reviews	Involves mechanical, chemical, physical, or other processes that result in equipment or material degradation
Hierarchy of controls analysis and Inherent safety measures	Reduces risks by prioritizing elimination, substitution, and controls
Process safety culture assessments	Evaluates group values and behavior which reflect commitment across the organization
Employee Participation in PSM decision making	Engages employees in PSM decision making
Management of Organizational Change (MOOC)	Controls risks associated personnel by systematically assessing their impact
Compliance Audit	Reviews processes to ensure adherence safety regulations and mandates
Access to documents and information	Ensures critical safety data and documentation are readily accessible for informed decision-making and compliance
Human Factors	Focuses on optimizing the interface between human operators and the system to reduce errors and enhance safety
Implementation	Deployment of PSM processes, tools, and practices across operations

Table: Importance of Process Safety Management Elements

Further committee deliberated on an effective Process Safety Performance Indicator System deemed essential for providing a clear overview of how well process safety is being managed at a site and across the organization.

2.5.3 Indicators for Process Safety Management:

The table below indicates typical indicators (illustrative) which need to be developed and rigorously monitored to enhance safety and reduce the likelihood of accidents.

Category	Indicators
Accidents / Incidents	<ul style="list-style-type: none"> . Loss of containment (LOC) incidents (number of times) . Flaring and relief valve activation (number of times) . Process unit trips, either partial or total (number of times) . Operating window excursions – Runaway reactions (number of times) . Operating outside safe limits / envelop for more than the specified time . Fire and Explosions (numbers)
Audits	<ul style="list-style-type: none"> . Top leaders of Installation visiting Plant – site visits (numbers/year) & Abnormalities observed (action plan for liquidation) . Plant safety audits (number/month) . Audit action mitigated and pending (annual number and %)
Permits	<ul style="list-style-type: none"> . Violation of Permits viz activities carried out without a valid permit (Nos.) . Permit non-compliance (%)
SIS Testing/ Compliance (ESD/EDP/TRIPS)	<ul style="list-style-type: none"> . Tests overdue (annual number and %) . Failure on demand (events/year) viz. resulting in process unit trips . Trip bypasses registered with durations >1 day / week; >1 month and >3 months (Change Management Process - approval for bypass for more than 15 days with HOD permission)
M&I	<ul style="list-style-type: none"> . Overdue inspections of both static and rotary equipment . Inspection waivers (annual number and % of inspections) . Overdue inspection recommendations (number and %) . PSV pre-pop test (number and % of tests) . Overdue Maintenance of Tanks (Numbers) . Not meeting preventive maintenance schedule (number of cases) . Number of leak clamps installed
Fire Protection	<ul style="list-style-type: none"> . Completion of all scheduled tests (%) . Like firewater pumps run/capacity tests, deluge systems activation, F&G alarms, Fire, HC & Gas detectors, HVLRs, ROSOVs etc.
Emergency Response	<ul style="list-style-type: none"> . Manual Call points (% working) . On-site Mock drills and scenarios (number versus target) . Off-site Mock drills (number versus target) . Recommendations pending liquidation (% of total)
Operations Related	<ul style="list-style-type: none"> . Daily/shift safety checks completion (%) . Like PSV status, drains/blanks, safety equipment, critical valves. . Housekeeping Audits by operators (%) . Start-up/shutdown pro-forma log completion (%)

Category	Indicators
	<ul style="list-style-type: none"> . Availability of well-defined SOPs (Numbers) . Toolbox Talks
Training	<ul style="list-style-type: none"> . Classroom & Hands-on Training imparted to Contract Workers (% complied) . Training for employees on Safety and Firefighting (% Compliance)
Management of Change & PSM	<ul style="list-style-type: none"> . MoCs: number of open & number of overdue MoCs . Scheduled hazard reviews (HAZOPs) completed, and action items completed . Procedure (SOP) updated (annual % of scheduled updates) . PHA program compliance – annual % of scheduled updates completed . Near-Miss Incidents Reported and learnings Shared (Numbers per employee vs actual)
Rewards / Recognitions	<ul style="list-style-type: none"> . Recognizing the star performers for their special contribution towards Safety & PSM / enhancing Safety/ Preventing major incidents/reporting of near misses (giving awards on special occasions) <ul style="list-style-type: none"> - Own Officers - Employees - Contract Workers

Recommendations:

The Committee recommends that PNGRB’s regulations and checklists should include Process Safety Management (PSM) elements for carrying out effective Process Safety Audits.

The Committee recommends PNGRB to encourage entities to develop and monitor a comprehensive set of performance indicators. These indicators should be categorized into leading and lagging indicators.

Intensive training in PSM inspection audit should be given to all auditors associated with PSM audit.

2.6 Establishing a Robust Incident Investigation Process

“Incident analysis is a process carried out in order to determine the cause or causes of an incident (that can result in single or multiple outcomes) so as to prevent further incidents of a similar kind.”

Reporting incidents, analyzing them, and conducting thorough incident-accident investigations help organizations identify and eliminate hazards, mitigate risks, and prevent recurrence while ensuring compliance with statutory provisions. Additionally, root cause analysis of incidents enables organizations to revise or amend existing safety standards and learn from mistakes. This, in turn, improves safety performance, reduces costs, and enhances the organization's reputation.

Advantages of structured Incident investigation process for PNGRB and entities

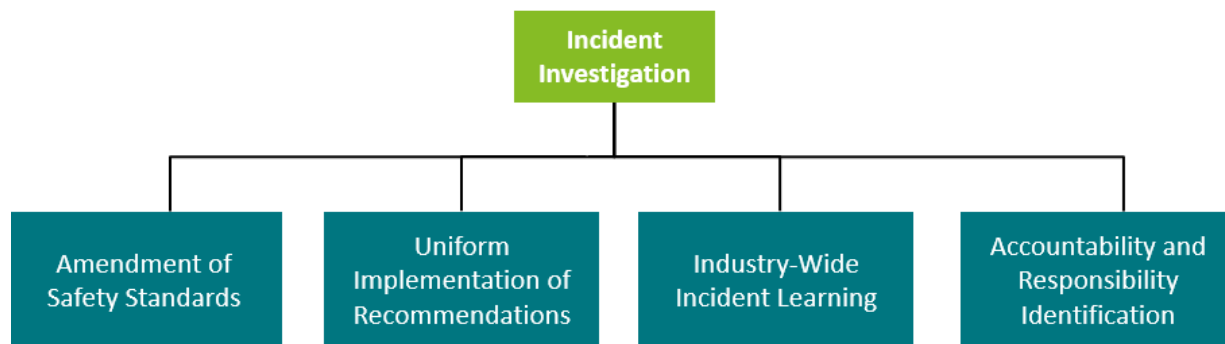


Figure: Advantages of Incident Investigation

Existing provision of PNGRB Regulations:

All 'major' incidents shall be reported to PNGRB in the format specified and placed at Schedule-VI within 48 hours of the occurrence. However, a First Information Report (FIR) must be communicated to PNGRB immediately, but not later than 4 hours after the occurrence, through telephone, email, or SMS.

The new California regulations define “major incident” as “any event involving fire, explosion or release of a substance which has the potential to result in death or serious physical harm.”

Major incidents are defined by specific criteria, including fires lasting more than 15 minutes, explosions, fatal incidents, losses exceeding INR 20.0 lakh, cumulative man-hours lost surpassing 500 hours, and plant shutdowns or outages due to the incident. A detailed investigation report of major incidents, along with a mitigation plan, must be submitted to PNGRB within 30 days. Additionally, quarterly reports summarizing major and minor incidents, as well as near misses, should be submitted to the Board within 30 days after each quarter.

2.6.1 Robust Incident Investigation Process:

After reviewing the regulations, Committee observed that currently there is no procedure in place to carry out incident investigation. Therefore, PNGRB should consider developing a detailed procedure to carry out incident investigation.

1. Incident Investigation team typically should include:
 - Process Expert to provide in-depth knowledge of the operations involved.
 - Root Cause Analysis Expert to identify and analyze the underlying causes of the incident.
 - A Lead Coordinator to oversee the entire investigation process, ensuring thoroughness and accuracy.
2. Collection of data/operational parameter and its analysis
3. Interviewing the witnesses
4. Using Root Cause Analysis tools like Why-Why Analysis/fishbone/FMEA, etc.
5. Recommendations/Learnings



Figure: Steps for Incident Investigation

There were on an average 35 major incidents per year reported in the last three financial years, out of which only 3 incidents per year were investigated by PNGRB (refer to table below)

	FY 20-21	FY 21-22	FY 22-23
Major Incidents	28	35	41
Fatality	24	22	28
Investigation by PNGRB	4	3	2

Table: Number of Major Incidents, fatalities, and Investigations

2.6.2 Deliberations:

Constitution of Incident Investigation Committee:

PNGRB should consider constituting investigation committees, including member(s) from PNGRB, to investigate all major incidents across the downstream oil and gas industry. PNGRB's involvement in major incident investigation will enhance transparency and accountability, leading to more effective accident prevention measures, particularly in cases where public interest, such as consumer safety, is affected.

The Terms of Reference for the investigation committee should essentially include identifying the root cause of the incident.

The committee strongly suggests that all High Potential Near Miss incidents be thoroughly investigated by the entity's Internal Investigation Committee, with learnings shared by PNGRB across all entities. Recommendations from all minor and major incidents must be implemented by entities and monitored for compliance by PNGRB.

A compendium of all Near-miss incidents must be prepared by the Entities, learnings should be shared with employees and submitted to PNGRB for dissemination of lessons learned.

A near miss is defined by the HSE as *“any event that doesn't lead to harm but does have the potential to cause illness or injury.”*

The Committee recommends that PNGRB periodically organize knowledge-sharing workshops on incident investigation, covering the following topics:

- a. Methodologies and techniques for incident investigations.
- b. Case studies of various incidents across the industry.
- c. Implementation of learnings from incidents.
- d. Technological advancements in the sector.
- e. Steps taken to prevent the recurrence of such incidents.

Developing a skilled pool of incident investigators is crucial for enhancing the Safety Management System within the Indian downstream Oil and Gas industry. Entities should regularly provide comprehensive training in incident investigation to build a team of internal experts capable of conducting thorough investigations.

In cases of default or non-compliance by an entity leading to an accident, penalties should be imposed as appropriate.

2.6.3 Mandate for Access to carry out Incident Investigations:

PNGRB should establish a regulation mandating that entities provide comprehensive access to facilitate effective incident investigations. This regulation should ensure that PNGRB has the authority to access installations, data, personnel, and other relevant resources. Such access is

crucial for conducting thorough investigations into incidents, allowing PNGRB to identify causes, evaluate responses, and implement corrective actions. **PNGRB should consider levying appropriate lumpsum fee for conducting incident investigations.**

Recommendations:

The Committee recommends that PNGRB should consider developing a detailed procedure to carry out incident investigation.

PNGRB should consider constituting incident investigation committees, including its officers, to investigate all major incidents for improved transparency and accountability.

The Committee recommends that a compendium of all Near-miss incidents must be prepared by the Entities, and learnings should be shared with employees and submitted to PNGRB for dissemination of lessons learned.

The Committee recommends that PNGRB should establish a mandate for access to the installations and levy appropriate lumpsum fees per incident investigation.

2.7 Emergency Response and Disaster Management Plan (ERDMP) & Emergency Response Centre (ERC) concept

An emergency can arise in case of any event involving fire, explosion or release of a substance which has the potential to result in death or serious physical harm. ERDMP should provide a structured approach for the organization to handle such an event and limit its consequences. Work force have to be made aware of their changed roles during an emergency vis a vis their routine roles during normal operations. Key personnel have to be designated with new roles and made to go through special training to effectively shoulder these responsibilities. Critical judgements have to be made to activate responses commensurate with the extent of expected damages.

ERDMP regulation must be segregated into two distinct areas one is actual emergency handling of the incident and second is preparedness to handle emergencies which involves activities like mock drill, risk analysis, imparting training to key personnel, tabletop exercises.

Separate regulations should be formulated for reporting/investigation of all kinds of incidents which is currently a part of ERDMP regulations.

2.7.1 The Committee deliberated on the current Codes and Practices of PNGRB ERDMP regulations 2010 and identified some gaps:

1. To streamline response, the onsite emergency plan should identify the nominated key personnel by name or job title and their contact information should be available in the emergency plan. It should be updated whenever there is a change.
2. Entity needs to display names of CIC, SIC and key personnel prominently in their installations at all times even if it involves frequent changes. The entity may also consider naming alternate CIC, SIC & key personnel.
3. Guidelines on broadcasting messages to the public around the installation in case of an incident should be covered in ERDMP regulations. Messaging to all mobile phones present in near vicinity is now possible and can be utilized via Common Alerting Protocol (CAP).
4. Structured interaction on ERDMP preparedness at all levels with stakeholders such as downstream industry members, state government(s) authorities, NDMA, SDMA, DDMA, etc., on a regular and periodic basis. PNGRB should play the role of a facilitator in organizing such structured discussions.

2.7.2 Emergency Response Centre (ERC):

The Committee was asked to review the Emergency Response Centre (ERC) proposal being implemented by BPCL representing Oil and Gas downstream sector. After the presentation and subsequent discussions, the Committee raised concerns about the effectiveness of ERCs, given that they would require 6-8 hours to bring additional mitigation measures to an accident site. The

Committee observed that during the period of 6-8 hours, there would be considerable loss of vital fuel oil and property.

The committee observed that the basic tenet of making ERC services available after 6-8 hours seems unacceptable. Further, only 23 ERCs, as suggested, will not be able to cater to the entire requirement of the Oil & Gas Industry. The cost of each ERC is very high, and if more than 23 ERCs are considered, the overall expenditure will be still more prohibitive.

The Committee recognized that while refineries are fairly equipped with resources to handle major emergencies, marketing/pipeline terminals do have constraints particularly to handle major fires in large diameter crude oil/product tanks, including exigencies at odd hours and thus there is a need to augment resources to handle such exigent situation(s) to prevent catastrophe.

The Committee suggests that the ERC proposal needs to be reviewed by PNGRB, keeping in view the location, hazard potential of the facility, adequacy of resources to combat major emergency situations, etc.

Recommendations:

The Committee recommends PNGRB may consider recasting the ERDMP Regulations in light of the observations above.

The Committee recommends reviewing the ERC philosophy for response time, cost effectiveness and coverage while recognizing the fact that while refineries are fairly equipped to handle major emergencies, availability of resources in Marketing and Pipeline Installations needs to be reviewed.

2.8 Road Safety

Roads are an important mode of transport in India, carrying about 65% of the total freight volume. India has the highest number of general road accident fatalities. Around 460,000 road accidents took place in 2022, causing injuries to 443,000 people and resulting in 168,000 fatalities. Road accidents occur due to multiple causes such as over speeding, use of mobile phone while driving, drunken driving, driving on the wrong side, overloaded vehicle, poor vehicle condition, jumping red light, overtaking, defect in road condition, blind spots in roads, defect in condition of motor vehicle, fault of pedestrians, etc.

Trucks constitute around thirteen percent of all road accidents and around fifteen percent of all fatalities. Oil & Gas Industry is involved in the transportation of highly hazardous and inflammable petroleum products and gas. As per estimates, around 60 thousand trucks are deployed for POL, LPG, LNG, CNG (POLNG+) transportation. Accidents in this sector often result in leakage of LPG, petroleum products which may result in fire and explosion causing damage to property, human lives, and stoppage of vehicular movements in State/National Highways.

Road incidents reported by entities to PNGRB in the past three financial years.

S. No.	Financial Year	Total incidents	Fatalities	Injuries
1.	2020-2021	286	148	96
2.	2021-2022	232	108	91
3.	2022-2023	268	157	174

Table: Road Incidents

As may be seen from the table above, Oil & Gas Industry is responsible for around 140 fatalities (avg. of last 3 years) and 120 injuries (avg. of last 3 years) each year. To arrest the large number of fatalities and injuries, appropriate measures need to be taken by Oil & Gas Industry. Some of the issues are highlighted hereunder:

Behavioral change in Driver's mindset:

There are overall around 90 lakh truck drivers in India. Around 70% road accidents happen due to the fault of the driver. This infers that proper training and awareness programs and change in the mindset of driver and driver environment is necessary for reduction in road accidents and their severity.

Selection of Drivers:

A thorough selection process of Drivers needs to be deployed for POLNG+ transportation. It has been shared that the Oil & Gas industry has laid down criteria for driver selection, which include matriculation certificate, experience, age, color blindness tests, license with endorsement fit to drive hazardous goods, etc. Proper monitoring of these and retraining the drivers can also help in reducing the number of accidents.

Use of Modern Gadgets:

It has been shared that Industry has put into place Anti braking system (ABS) in all POLNG+ transportation vehicles besides speed governor to restrict over-speeding. Some of the companies on pilot scale have also installed GPS, instruments to check driver's alertness during driving, whether driver's use mobile phone while driving etc. These steps will ensure better safety records and prevent untoward accidents.

Fitness of the Vehicle:

A good well-maintained vehicle adds to the efficiency of the driver and helps in averting unsafe situations. Besides the extant fitness certification, a specific criteria like items to be inspected, frequency of testing of such items, the certified vehicle repair workshops etc should be there for curbing the number of incidents.

Fleet Management:

As mentioned above, large numbers of trucks are deployed by Oil & Gas companies for distribution and supply of POLNG+ products. These trucks are required to ply throughout the day and night for managing uninterrupted supplies. A proper fleet management is thus essential to comprehensively oversee and optimize all aspects of fleet operations, maintenance compliance, driver management, routing and route management, fuel consumption and effective utilization. Proper tracking & monitoring of fleets shall help entities to improve upon road safety. It is learnt that some of the oil companies have started the practice of fleet / route management and got positive results.

Circadian rhythm on drivers:

Fatigue level and impaired driving performance are caused by combined impact of driving duration and circadian rhythms. Drowsy driving is a cause of many accidents. Analysis of circadian rhythms indicate that tiredness has two peaks (a) in early hours of morning and (b) late afternoon. Drivers are likely to get most tired and drowsy between 14:00 to 16:00 and between 02:00 and 4:00 hours. Thus, for long distance driving entities should ensure that drivers get proper rest as well as a substitute driver. This will go a long way in reducing the number of road accidents and fatalities thereof.

Training & Workshops:

PNGRB to organize regular training programs which would help in improving awareness in a phased manner to reduce road incidents. Besides, PNGRB should have collaborative programs with Vehicle Manufacturers, MoRTH, NHA and invite entities to participate to keep abreast with the latest developments in technologies that help reduce accidents.

Recognition and Awards:

PNGRB should develop criteria for recognizing safe and accident-free driving manhours and Institutionalize Champion Drivers & Transporters award.

Recommendations:

The Committee recommends PNGRB to lay down a regulation on transportation of POL, LPG, LNG /CNG for enhancing Road Safety in Oil & Gas sector.

2.9 Accident Compensation Structure for Contract Manpower

The deployment of contract manpower in installations has increased significantly, leading to a higher ratio of contract to permanent workers. This is likely to remain so and may even increase. In such a case it is necessary to attract talent for contract workmen set-up. Accident compensation is believed to be an important component of the salary package. Therefore, the accident compensation structure must be adequate enough to ensure that workers' families are supported in the event of an accident leading to fatality/permanent disability.

The Committee deliberated on the compensation structure for contract manpower in the meetings and suggested few guidelines that can be considered for adoption by entities after reviewing the set of information of some entities:

- **Define Compensation Criteria:** Establish clear criteria for compensation based on factors such as duration of service, skillset, and other relevant parameters to ensure adequate compensation levels.
- **Regulations for Timely Compensation Payments:** Define specific timelines for compensation disbursement to ensure timely support for families, considering the impact of inflation over time.

Recommendations:

The Committee recommends that PNGRB establish a compensation structure for contract manpower, addressing service duration, skillset, and other criteria and define clear timelines for payment to ensure prompt and adequate support for workers' families. This compensation may be over and above payable to the victim as per applicable local Factory Rules of the State Government.

2.10 Adopting Energy Efficiency measures and Environmental aspects in T4S Regulations

The committee appreciates that maintaining safe operations inherently ensures protection of both health and environment. Good safety practices are not isolated efforts; they are part of a holistic approach that safeguards all aspects of Health, Safety, and Environment (HSE). The committee has proposed measures that prioritize safety, recognizing that by doing so, the well-being of individuals and the surrounding environment is also preserved.

2.10.1 In the deliberations, the committee has put forward the following points:

- Application of Leak Detection System in Pipelines to be stringently applied with the latest techniques available.
- Adopting new technologies & Software applications that can make operations more energy efficient & environmentally friendly.
- Various handling schemes to minimize and/or recover the generated boil-off gas (BOG)
- Moving LNG carriers to use boil off as fuel itself.
- Monitoring of emissions and effluents & impact assessment on outside areas during any incident
- Usage of Dispersion Modelling software to caution the public
- Management of foam after mitigation of incident at the site
- Phasing out of Chlorine & Hypochlorite in processes
- Reduce flaring & implementation of Flare Gas compressor as mandatory.
- Soil reclamation measures to be adopted by entities after execution of pipeline laying.
- Special care and attention for handling any increased emission or effluent load during abnormal conditions and to take care of any soil containment.
- Use of latest technologies for faster, more efficient methods of cleaning tanks especially crude tanks. Techniques that may obviate the necessity for human (generally contractor) entry in sludge tanks.

The above list is illustrative, and many more items will emerge when PNGRB engages in deliberations with entities and at various other forums.

Recommendations:

The Committee acknowledges that maintaining safe operations inherently ensures the protection of health and the environment, and the proposed measures reflect this holistic approach. All the detailed pointers have been thoroughly deliberated by the committee to reinforce this commitment.

2.11 Promoting a strong Safety Culture across operating entities

“Prime responsibility of Safety lies with the Entity”, this concept can also be named as Safety Culture.

Introduction to Safety Culture:

Safety culture refers to the collective commitment of the organization to prioritize safety in all aspects of their operations. Embedding a strong Safety Culture ensures that safety is not just a compliance criterion but a deeply ingrained value that guides decision-making, operational practices, and overall organizational behavior.

Some examples from the leading regulators/companies around the world in this context are given below:

HSE UK - “Safety culture is a combination of the attitudes, values, and perceptions that influence “how something is actually done in the workplace” rather than “how it should be done”. Poor safety culture has contributed to many major incidents and personal injuries and can be just as influential on safety outcomes as an organization’s safety management system itself.”

Repsol Spain - “The Safety Culture is what determines how we act when we are not being supervised, making us feel innately responsible for prioritizing safety in our actions.”

Safety Culture Model:

The Safety Culture model provides a structured framework for understanding and promoting attitudes and behaviors that prioritize safety within an organization.

Leaders at all levels are actively engaged in promoting safety, setting clear expectations, and leading by example.

Fair Recognition Encourages recognizing both safe behavior and improvements in safety performance.

Trust in Reporting promotes an environment where employees feel safe while reporting safety incidents, unsafe conditions and near misses without any fear in their mind.

Shared Information ensures open communication and transparency about safety issues across the organization.

An organization that learns focuses on lessons learned from incidents within and outside the company. Continuous improvement by learning from past incidents is encouraged.

Sense of vulnerability ensures attitude of the members towards awareness of the potential risk.

Adaptability ensures the organization is flexible and ready to respond to new challenges and risks.



Figure: Safety Culture Model

Attributes that are indicative of a poor safety culture:

PNGRB can use following three characteristics that are symptomatic of a poor safety culture in the assessment of an entity:

- **Normalization of deviance:** Safety issues are so commonplace in organizations with a poor safety culture that deviations from safety systems are accepted as **'normal'** practice.
- **Complacency:** Believing that all potential hazards are fully controlled can lead to a false sense of security, causing the organization to lose the vigilance needed to effectively manage risks. A sense of vulnerability is needed that doesn't allow entities to become complacent. This mindset reflects a dangerous complacency in addressing ongoing threats.
- **Tolerance towards inadequate systems and resources:** Organizations with a poor safety culture try to do too much with too little. When the value of safety systems and resources is not recognized, it becomes acceptable to work with inadequate systems and resources.

2.11.1 Role of PNGRB in Promoting Safety Culture:

- PNGRB, as a regulator, should demonstrate a strong commitment to the Safety Culture concept, and it should set an example to entities within its ambit.
- PNGRB should influence operating organizations by providing guidance on safety standards, conducting inspections, and offering constructive feedback. PNGRB should emphasize the importance of safety over mere compliance, promote good practices, and engage in honest dialogues with operators to achieve safety objectives.

- PNGRB to evaluate Safety Culture through direct assessments and follow-ups on operating experience feedback programs, and event investigations. PNGRB should use process-based and performance-based approaches to identify and address safety culture issues, ensuring corrective actions are implemented and trends are monitored to improve safety performance.
- PNGRB should facilitate annual meetings or forums where industry stakeholders can share experiences and strategies for promoting safety culture. By encouraging collaboration and the exchange of best practices, PNGRB can enhance the overall safety culture across the downstream oil and gas sector.

2.11.2 Role of an entity

“Responsibility of ensuring safety lies with the entity”.

- Entities can achieve a strong safety culture by making safety a board-level priority and embedding it into core business management practices. They should implement rigorous risk management strategies, commit to continuous improvement, and maintain transparent communication with stakeholders.
- By accentuating Safety Culture in operating Entities, PNGRB can help create an environment where safety is prioritized at all levels of the entity and aligns with PNGRB's vision of fostering a Safety Culture in the downstream Oil & Gas segment.
- It is important to note that while PNGRB plays a pivotal role in establishing regulations and setting safety standards, the management and mitigation of risks cannot be solely controlled by the regulatory body. Entities operating within the industry are best positioned to manage these risks, as they have a deeper understanding of their specific operational environments, processes, and potential hazards.

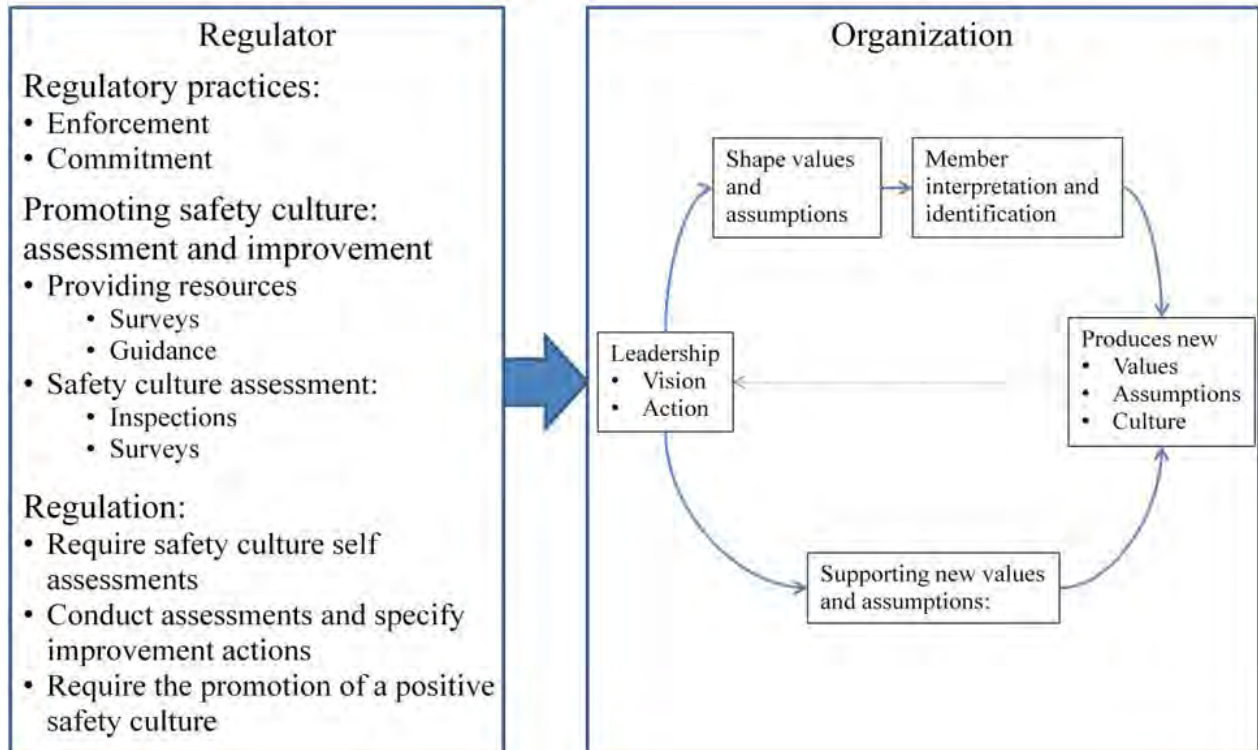


Figure: Ways a regulator can influence the safety culture

2.11.3 Institutionalize Safety Awards across Downstream sub-segments to Promote Safety Culture:

To encourage exceptional safety performance within the industry, PNGRB can institutionalize Safety Awards to promote safety performance within the oil industry. These awards will recognize exceptional achievements in various sub-sectors, including refineries, gas processing plants, pipelines, CGD, and LPG plants. The selection process can be overseen by an expert panel comprising representatives from within the industry taking into account both leading and lagging indicators.

Panel Review:

- A panel consisting of Safety Experts to review the eligible entities.
- Each nominee's performance is evaluated against the award criteria.

Final Decision:

- The panel finalizes the award recipients based on the evaluation results.
- Awards are conferred to companies at a ceremony presided over by dignitaries.

PNGRB Safety Awards shall aim to recognize and celebrate exceptional safety performance within the oil industry. By honoring both companies and individuals who demonstrate a commitment to

safety, these awards will promote a culture of safety and inspire others to prioritize safety in their operations.

Recommendations:

PNGRB should promote proactive safety culture across the downstream segment by exhibiting the role of a regulator.

The Committee recommends PNGRB to enforce an Action Plan for the entities, making safety the entity's responsibility. PNGRB should direct entities to prioritize safety at the board level.

The Committee recommends that PNGRB should establish Safety Awards to recognize and promote exceptional safety performance.

2.12 Enhancing Consistency and Effectiveness of Penalty Provisions

The effectiveness of regulations is dependent on being able to enforce the same. By incorporating penalty provision in all regulations of the downstream sub-segments, PNGRB can ensure enforceable deterrence against non-compliance of regulations. Use of penalties as a tool to enforce provisions of the regulations was found non-uniform across sub-segments of the downstream industry.

Committee held an extensive session with PNGRB's Legal Team, and they came out with following suggestion:

“Although as per Act penalty provision are enumerated only in Section 28 and apparently Section 28 deals only with entities Registered/Authorized under Act. Further, till required notification is issued by MoPNG or relevant regulations for registration are framed, in order to ensure effective implementation of existing T4S regulations for the Registered activities, we may consider incorporating “default and consequences clause” in respective T4S regulations, Needless to mention such clause has to be based on broad principles prescribed under existing penal provisions in Act & regulations framed thereunder including following up of principles of natural justice.”

In view of the above, PNGRB should incorporate appropriate changes in regulations to enable imposition of penalties in case of any non-compliance of regulations. PNGRB should strive for registration of entities as per the provision of the Act which would enable effective compliance and imposing penalty as a deterrent.

Recommendations:

PNGRB should incorporate appropriate changes in regulations to enable imposition of penalties in case of any non-compliance of regulations.

Chapter-3: Future Readiness

The recommendations in this section, aim to explore innovative approaches for enhancing safety. These include adopting advanced safety technologies, implementing sustainable safety practices, and developing strategies to proactively address future safety challenges within the downstream oil and gas sector.



3.1 Extend Refinery T4S regulations for Integrated Petrochemical Plants

Integration of petrochemical plants within refineries is a growing trend, driven by the need to optimize feedstock utilization and enhance operational efficiencies. This recommendation addresses the necessity of incorporating integrated petrochemical plants into PNGRB's regulatory framework, which currently governs refineries under the T4S (Technical Standards and Specifications Including Safety Standards) regulations.

3.1.1 Need to include Integrated Petrochemical plants in the regulatory purview of PNGRB

The operational synergy between refineries and petrochemical plants necessitates a regulatory framework that addresses their combined operational characteristics. Integrated petrochemical plants, situated within refinery premises, share infrastructure such as pipelines, storage facilities, and processing units. This close integration means that safety and operational practices applicable to refineries are equally relevant to petrochemical operations. The adoption of Refinery T4S regulations by integrated petrochemical plants would ensure a consistent standard of safety and efficiency across these interconnected facilities. The Committee also recommended the following points in the deliberations:

- A comprehensive list of toxic chemicals associated with petrochemical processes should be created and integrated into emergency response plans to address potential hazards.
- Refinery personnel must be fully aware of the hazards introduced by integrated petrochemical plants, and training programs should be conducted to manage these risks.
- The hazards associated with petrochemical plants should be linked with the broader chemical industry, ensuring aligned safety practices and shared risk management strategies.
- A common safety department should be established, conducting unified risk assessments for both refinery and petrochemical operations to ensure consistent and effective safety measures.

Recommendations:

The Committee recommends that PNGRB should extend its Refinery T4S regulations to include integrated petrochemical plants, aligning them with the existing standards for refineries. This will encourage a unified approach to managing the shared processes.

3.2 Future Readiness for Emerging Trends

The energy sector is undergoing a transformation with the emergence of alternative fuels such as Hydrogen, Compressed Biogas (CBG), and multifuel systems. To ensure that the regulations remain effective and relevant, the regulatory framework must adapt to accommodate these advancements. Integrating new fuel technologies into both existing and new infrastructure requires a forward-looking approach to the regulatory framework.

Committee's Point of View

PNGRB must adopt a proactive and flexible regulatory approach. The evolving technological landscape demands that regulations are not only catching up with updates but also anticipating future needs.

Role and Responsibilities of PNGRB:

Investing in Research and Development: PNGRB should invest in enhancing its research capabilities to stay informed about the latest developments where alternative fuels are one of the major areas. Establishing dedicated research initiatives will allow PNGRB to better understand the technical and operational requirements of emerging technologies. This proactive approach will enable anticipatory adjustment to regulatory measures and facilitate smoother integration of these technologies into existing infrastructure.

Encourage Stakeholder Engagement: Engage with industry stakeholders, including fuel suppliers and infrastructure developers, to gather input on regulatory needs and challenges. Collaborate with agencies to optimize energy efficiency and sustainability and reduce emissions.

Update and Expand Regulatory Guidelines: Develop comprehensive guidelines for emerging technologies such as Hydrogen/CBG blending in natural gas, 100% hydrogen pipelines, multifuel dispensing stations, and mobile fuel dispensers.

Recommendations:

PNGRB should update its regulatory framework to incorporate emerging alternative fuels like hydrogen, CBG, and multifuel systems. By creating a flexible, dynamic framework, engaging with stakeholders, and investing in regulatory research, PNGRB can effectively manage the integration of these technologies and ensure adaptability to future advancements.

3.3 Introduction of Regulations for Cyber Security

The downstream oil and gas industry is becoming increasingly vulnerable to cybersecurity threats due to its growing dependence on interconnected systems and digital technologies. With the adoption of Industry 4.0, including the Industrial Internet of Things (IIoT) and Cyber-Physical Systems (CPS), the risk of cyber-attacks on critical infrastructure has increased, posing significant dangers to operational continuity and safety. The industry's essential assets, such as refineries and pipelines, are more vulnerable to cyber-attacks that could lead to severe disruptions and accidents.

Need for Regulatory Framework for Cybersecurity:

Regulations provide a structured framework for implementing robust security measures, addressing vulnerabilities, and managing risks associated with cyber-attacks. The regulations ensure that organizations adhere to standardized practices, thereby enhancing overall resilience against cyber threats.

Global landscape

The Petroleum Safety Authority (PSA) in Norway focuses on the importance of cybersecurity, particularly in relation to AI and ICT systems. The regulations are performance-based emphasizing risk management. The PSA is enhancing its regulatory framework to better address AI-related safety issues, collaborating with industry and academic institutions.

Role of PNGRB: PNGRB should undertake a comprehensive review of all existing regulations related to cybersecurity within the downstream oil and gas sector to ensure whether the existing regulations adequately cover all sub-segments of the downstream industry.

If the review confirms that the existing regulations comprehensively address cybersecurity needs across all sub-segments, PNGRB should move forward with enforcing these regulations through compliance measures. This could include the implementation of periodic cybersecurity audits and mandatory reporting of incidents.

However, if the review identifies gaps in coverage, PNGRB should collaborate with relevant stakeholders to ensure that all entities within its regulatory purview are adequately covered by cybersecurity regulations.

Recommendations:

PNGRB should promptly address any identified gaps in cybersecurity regulations and work collaboratively with stakeholders to ensure comprehensive coverage and robust protection for the downstream oil and gas sector.

PNGRB must also develop checklist and carry out audits to ensure robust security system and prevent cyber-attacks.

3.4 Promote Digital Technologies

Digitalization has revolutionized multiple industries, and the oil and gas industry is just one of them. In the context of workplace safety, digital transformation involves leveraging advanced technologies to monitor, analyze, and manage safety-related data in real-time.

PNGRB should encourage entities to utilize Advanced Technologies for Real-Time Monitoring and Safety Management:

Internet of Things (IoT):

IoT devices can be deployed to remotely monitor critical equipment, pipelines, and environmental conditions. Real-time data collection enables early detection of abnormal situations, such as leaks, pressure changes, or equipment malfunctions. Automated alerts can be sent to operators about possible dangerous outcomes. This allows organizations to take immediate action and prevent potential accidents, fatalities, or equipment failures.

Wearable Technology for Workplace Safety:

Wearable devices, such as smart helmets, safety glasses, and wristbands, equipped with sensors, can continuously monitor workers' actions. These actions may include vital signs, movements, possible equipment failures, and exposure to hazardous substances. This data can be transmitted to a central system, where the problem could be analyzed at a quick rate and simultaneously prompt action can be taken. Such equipment can also identify fatigue, heat stress, or exposure to toxic gases.

Application of Drones:

Drones equipped with cameras, thermal imaging, and gas detection sensors can be used to inspect infrastructure, pipelines, potential hazards, equipment failure, or other challenges.

They can access hard-to-reach areas, perform visual inspections, and capture high-resolution images and videos.

Others:

The Committee also proposed that PNGRB update its regulations for Entities to implement advanced monitoring technologies within installations to detect potential hazards and early warning signs of emergencies. This includes the deployment of a Very Early Smoke Detection (VESDA) System, OFC sensors for Pipeline Intrusion Detection, AI technologies & other available modern tools to analyze the emergency before it happens.

It is also suggested that PNGRB should align with other stakeholders and try the implementation of "Call before you Dig" services for the reduction of accidents in excavation in the case of all pipelines.

Recommendations:

The Committee recommends that by embracing digital transformation, leveraging real-time monitoring, predictive analytics, and AI-powered safety management, the industry can enhance safety compliance, improve communication, and mitigate risks.

Conclusion

S. No.	Recommendations	
Strengthening Regulatory Capability		
1	Revisiting Vision Statement	PNGRB should revisit its vision statement, placing safety as a key element, and frame a Vision and Mission Statement that covers safety aspects of the downstream Oil & Gas sector.
2	Augmenting Technical and Safety Division manpower and building Competency	<p>Safety should be assigned as a dedicated responsibility to a senior level officer (preferably at head level or higher within PNGRB).</p> <p>The safety function within PNGRB should be enhanced and reorganized to ensure comprehensive coverage across all disciplines, PNGRB must establish its own cadre of experienced professionals.</p> <p>Consider the appointment of experienced mentor for developing internal competencies.</p>
3	PNGRB's Nationwide Presence	The Committee recommends that should there be regional offices in future, dedicated Safety officers may also be positioned in these offices.
4	Implementing Document Management and Information System (DMIS)	<p>PNGRB should establish itself as the central repository for all activities by maintaining a comprehensive Data Bank with Safety as a key module.</p> <p>To ensure the effective implementation of the DMIS, PNGRB should establish a dedicated Documentation Cell equipped with skilled personnel.</p> <p>DMIS will enable PNGRB to extract valuable insights from data, identify trends, and disseminate learnings to enhance industry practices.</p>
5	Make PNGRB a Knowledge Hub	The committee strongly recommends that PNGRB should transform into a leading Knowledge Hub in Safety. This involves building a skilled team, forming strategic partnerships, and organizing regular knowledge-sharing events. This proactive approach will not only position PNGRB as a leading authority in safety regulation but also achieve the tag of a knowledge driven regulator.

S. No.	Recommendations	
	Make PNGRB a Knowledge Hub	PNGRB should Initiate Domestic and International Partnerships through MOUs and collaborations with safety organizations, standards-making bodies, and research institutions and strengthen Academic Engagements by Building and maintaining strong connections with research institutes and academic institutions to drive innovation and address safety challenges
Enhancing Regulatory Processes		
6	Strengthening of PNGRB's current Safety Audit Process	<p>PNGRB should establish a mechanism for Training and Certification of auditors of TPIA and only those certified by a competent agency will be eligible for selection.</p> <p>PNGRB should implement a rating system for audit reports, and TPIAs should be offered adequate compensation to attract and retain competent personnel.</p> <p>A panel of Consultants/Experts may be engaged by PNGRB who would on a regular basis examine and review the audit reports of various TPIAs.</p> <p>The Committee presents two alternatives for PNGRB's discretion in selection and implementation of audit system methodology.</p> <p>Safety Management System/Process Safety Management should be included in Safety Audits.</p>
7	Hybrid Model for Regulations	<p>The Committee recommends that PNGRB should transition to a hybrid regulatory model that combines prescriptive and performance-based elements. This approach will ensure compliance with essential safety standards while providing entities the flexibility to innovate and tailored safety practices to match their individual situations.</p> <p>Consolidate T4S and IMS regulations to streamline oversight, reduce redundancies, and enhance operational efficiency.</p>
8	Review of Regulatory Documents	The Committee recommends PNGRB to establish a defined review schedule for all existing regulations. A dedicated document should be created to formalize the review frequency, ensuring that standards remain relevant with technological advancements, industry practices and lessons learned.
9	Safety Management System across all T4S Regulations	Committee recommends that PNGRB should ensure that top management of the entities prioritize safety by regularly reviewing each pillar of the Safety Management System.

S. No.	Recommendations	
	<p>Safety Management System across all T4S Regulations</p>	<p>Committee recommends that PNGRB should encourage entities to prepare a detailed safety report for effective Safety Management System.</p>
		<p>The Committee recommends that the Safety Management System (SMS) be incorporated consistently across all T4S regulations, extending beyond Refineries/GPU & LNG Terminals to ensure uniform safety standards throughout the downstream Oil and Gas sector.</p>
10	<p>Process Safety Management</p>	<p>The Committee recommends that PNGRB's regulations and checklists should include Process Safety Management (PSM) elements for carrying out effective Process Safety Audits.</p>
		<p>The Committee recommends PNGRB to encourage entities to develop and monitor a comprehensive set of performance indicators. These indicators should be categorized into leading and lagging indicators.</p>
		<p>Intensive training in PSM inspection audit should be given to all auditors associated with PSM audit.</p>
11	<p>Establishing a robust Incident Investigation Process</p>	<p>The Committee recommends that PNGRB should consider developing a detailed procedure to carry out incident investigation.</p>
		<p>PNGRB should consider constituting incident investigation committees, including its officers, to investigate all major incidents for improved transparency and accountability.</p>
		<p>The Committee recommends that a compendium of all Near-miss incidents must be prepared by the Entities, and learnings should be shared with employees and submitted to PNGRB for dissemination of lessons learned.</p>
		<p>The Committee recommends that PNGRB should establish a mandate for access to the installations and levy appropriate lumpsum fees per incident investigation.</p>
12	<p>Emergency Response and Disaster Management Plan (ERDMP) &</p>	<p>The Committee recommends PNGRB may consider recasting the ERDMP Regulations in light of the observations above.</p>

S. No.	Recommendations	
	Emergency Response Centre (ERC) concept	The Committee recommends reviewing the ERC philosophy for response time, cost effectiveness and coverage while recognizing the fact that while refineries are fairly equipped to handle major emergencies, availability of resources in Marketing and Pipeline Installations needs to be reviewed.
13	Road Safety	The Committee recommends PNGRB to lay down a regulation on transportation of POL, LPG, LNG /CNG for enhancing Road Safety in Oil & Gas sector.
14	Accident compensation structure for contract manpower	The Committee recommends that PNGRB establish a compensation structure for contract manpower, addressing service duration, skillset, and other criteria and define clear timelines for payment to ensure prompt and adequate support for workers' families. This compensation may be over and above payable to the victim as per applicable local Factory Rules of the State Government.
15	Adopting Energy Efficiency measures and Environmental aspects in T4S Regulations	The Committee acknowledges that maintaining safe operations inherently ensures the protection of health and the environment, and the proposed measures reflect this holistic approach. All the detailed pointers have been thoroughly deliberated by the committee to reinforce this commitment.
16	Promoting a strong Safety Culture across operating entities	PNGRB should promote proactive safety culture across the downstream segment by exhibiting the role of a regulator.
		The Committee recommends PNGRB to enforce an Action Plan for the entities, making safety the entity's responsibility. PNGRB should direct entities to prioritize safety at the board level.
		The Committee recommends that PNGRB should establish Safety Awards to recognize and promote exceptional safety performance.
17	Enhancing Consistency and Effectiveness of Penalty Provisions	PNGRB should incorporate appropriate changes in regulations to enable imposition of penalties in case of any non-compliance of regulations.

S. No.	Recommendations	
Future Readiness		
18	Extend Refinery T4S regulations for Integrated Petrochemical plants	The Committee recommends that PNGRB should extend its Refinery T4S regulations to include integrated petrochemical plants, aligning them with the existing standards for refineries. This will encourage a unified approach to managing the shared processes.
19	Future Readiness for Emerging Trends	PNGRB should update its regulatory framework to incorporate emerging alternative fuels like hydrogen, CBG, and multifuel systems. By creating a flexible, dynamic framework, engaging with stakeholders, and investing in regulatory research, PNGRB can effectively manage the integration of these technologies and ensure adaptability to future advancements.
20	Introduction of Regulations for Cyber Security	<p>PNGRB should promptly address any identified gaps in cybersecurity regulations and work collaboratively with stakeholders to ensure comprehensive coverage and robust protection for the downstream oil and gas sector.</p> <p>PNGRB must also develop checklist and carry out audits to ensure robust security system and prevent cyber-attacks.</p>
21	Encouragement to implement Digital Technologies	The Committee recommends that by embracing digital transformation, leveraging real-time monitoring, predictive analytics, and AI-powered safety management, the industry can enhance safety compliance, improve communication, and mitigate risks.

Annexures

Annexure - 1: Authorities in Downstream Oil and Gas Sector

In Oil & Gas (downstream sector), regulating agencies i.e., PESO, BEE, BIS, Chief Inspector of Boilers, Central Electricity Authority (CEA) and Chief Inspector of Factories are stakeholders in regulatory responsibilities through their respective Acts and regulations thereunder.

Petroleum and Natural Gas Regulatory Board (PNGRB)

PNGRB was created through PNGRB Act 2006 (No. 19 of 2006) with the purpose - “to regulate the refining, processing, storage, transportation, distribution, marketing and sale of petroleum, petroleum products and natural gas excluding production of crude oil and natural gas so as to protect the interests of consumers and entities engaged in specified activities relating to petroleum, petroleum products and natural gas and to ensure uninterrupted and adequate supply of petroleum, petroleum products and natural gas in all parts of the country and to promote competitive markets and for matters connected therewith or incidental thereto”.

PNGRB has published its own standards called T4S standards (the technical standards and specifications including safety standards) covering different areas of the oil and gas industry. Regulations notified by PNGRB also include Emergency Response and Disaster Management Plan (ERDMP) Regulations and Integrity management system regulations for CGD Networks, Natural Gas & Petroleum Product Pipelines. PNGRB monitors the compliance to these regulations directly or through third party agencies empaneled with them. Of late PNGRB has also carried out independent investigation in accidents, in addition to investigation by PESO and other agencies.

Petroleum and Explosive Safety Organization (PESO)

PESO, operating under DPIIT, Ministry of Commerce and Industry is the statutory authority to administer the responsibilities delegated under Petroleum Act 1934 and Explosives Act 1884 and rules made thereunder. PESO’s primary responsibility includes ensuring public safety in the areas related to manufacture, transport, storage, handling, etc. of Petroleum, Inflammable substances, Explosives and Compressed Gases.

PESO approval is required for almost all downstream and midstream facilities which include Petroleum Refineries, Gas Processing plants, Petroleum storage installations, LPG bottling plants, Cross-country pipelines, Petroleum service stations (Retail Outlets), Petroleum tank lorries, CNG Filling stations, Static & Mobile pressure vessels, Storage installations for compressed gases in pressure vessels, Gas cylinder filling plants, storage sheds for filled gas cylinders etc.

Activities of PESO

Scrutiny and approval of site layouts and construction plans for:

- Gas cylinder filling plants
- CNG dispensing Stations

- Storage Sheds for filled gas cylinders.
- Bulk Storage installations for compressed gases in pressure vessels
- Auto LPG dispensing stations
- Petroleum storage sheds & installations
- Petroleum tank trucks for transportation of petroleum
- Petroleum cross-country pipelines for transportation of petroleum and gas

Oil Industry Safety Directorate (OISD)

Oil Industry Safety Directorate (OISD), a technical directorate under the aegis of Ministry of Petroleum and Natural Gas, was formed in 1986 by a resolution of Government of India with an objective to formulate and standardize procedures and guidelines in the areas of design, operation, and maintenance as also the creation of safety standards. OISD assist the Safety Council, which was set up by Government of India Resolution in 1986 and coordinates the implementation of a series of self-regulatory measures aimed at enhancing safety in the Oil and Gas Industry in India.

OISD, though not a statutory body, had been the safety agency in Indian Oil and Gas Industry since 1986 in terms of developing safety standards, conducting safety audits, investigating accidents, coordinating safety activities, imparting trainings, dissipating safety information and acting as a Technical Safety Directorate for Ministry of Petroleum & Natural Gas (MoPNG). OISD have published 118 standards so far which are developed through functional committees comprising of experts drawn from the industry.

OISD has also been notified as competent authority under the Petroleum & Natural Gas (Safety in Offshore Operations) Rules, 2008 to regulate safety in offshore oil and gas exploration, drilling, production, and related activities.

Chief Inspector of Factories

States have a Chief Inspector of Factories to look after the implementation of The Factories Act 1948 and rules thereunder and is assisted by Inspector of Factories. Primarily their responsibility and authority are to see that the health and safety of workers in installations fitting to the definition of Factory as given in The Factories Act 1948 is not jeopardized. Provisions of the Factories Act are applicable to Oil and Gas Sector (but exclude a mine subject to the operations of the Mines Act 1952)

Chief Inspector of Boilers

Under the provision of Indian Boiler Act, 1923 and regulations thereunder, Chief Inspector of Boilers have overall responsibility and authority in States and Union Territories to oversee safe installation, operations and testing of boilers. Provision under Indian Boiler Act is applicable to Oil & Gas Industry wherever boilers are installed, or steam is used above a particular pressure.

Central Electricity Authority (CEA):

The Central Electricity Agency looks after enforcement of Indian Electricity Act, 2003 and regulations thereunder. These provisions are applicable to the Oil and Gas installations also wherever electrical systems above a threshold voltage are installed.

Central Pollution Control Board (CPCB):

The Central Pollution Control Board (CPCB), statutory organization, was constituted in September 1974 under the Water (Prevention and Control of Pollution) Act, 1974. Further, CPCB was entrusted with the powers and functions under the Air (Prevention and Control of Pollution) Act, 1981.

It serves as a field formation and also provides technical services to the Ministry of Environment and Forests of the provisions of the Environment (Protection) Act, 1986. Principal Functions of the CPCB, as spelt out in the Water (Prevention and Control of Pollution) Act, 1974, and the Air (Prevention and Control of Pollution) Act, 1981, (i) to promote cleanliness of streams and wells in different areas of the States by prevention, control, and abatement of water pollution, and (ii) to improve the quality of air and to prevent, control or abate air pollution in the country.

Bureau of Indian Standards (BIS):

BIS is the National Standard Body of India established under the BIS Act 2016 for the harmonious development of the activities of standardization, marking and quality certification of goods and for matters connected therewith or incidental thereto. BIS has been providing traceability and tangibility benefits to the national economy in a number of ways – providing safe reliable quality goods; minimizing health hazards to consumers; promoting exports and imports substitute; control over proliferation of varieties etc. through standardization, certification, and testing.

Bureau of Energy Efficiency (BEE)

The Government of India set up Bureau of Energy Efficiency (BEE). on 1st March 2002 under the provisions of the Energy Conservation Act, 2001. The mission of the Bureau of Energy Efficiency is to assist in developing policies and strategies with a thrust on self-regulation and market principles, within the overall framework of the Energy Conservation Act, 2001 with the primary objective of reducing energy intensity of the Indian economy.

The Vision of Bureau of Energy Efficiency (BEE): To improve Energy Intensity of Indian Economy thereby contributing towards sustainable development of country.

BEE co-ordinates with designated consumers, designated agencies, and other organizations; recognizes, identifies, and utilizes the existing resources and infrastructure, in performing the functions assigned to it under the Energy Conservation Act. The EC Act provides for regulatory and promotional functions which are assigned to the organization.

The National Disaster Management Authority (NDMA)

An apex body for Disaster Management in India. Setting up of NDMA and the creation of an enabling environment for institutional mechanisms at the State and District levels is mandated by the Disaster Management Act, 2005. NDMA is mandated to lay down the policies, plans and guidelines for Disaster Management. India envisions the development of an ethos of Prevention, Mitigation, Preparedness and Response.

The Indian government strives to promote a national resolve to mitigate the damage and destruction caused by natural and man-made disasters, through sustained and collective efforts of all Government agencies, Non-Governmental Organizations and People's participation. This is planned to be accomplished by adopting a Technology-Driven, Pro-Active, Multi-Hazard and Multi-Sectoral strategy for building a Safer, Disaster Resilient and Dynamic India.

Annexure - 2: List of PNGRB Technical Regulations

S. No.	Description of Regulation	Regulations for
1	Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for City or Local Natural Gas Distribution Networks) Regulations, 2008	City Gas Distribution
2	Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Natural Gas Pipelines) Regulations, 2009	Natural Gas Pipelines
3	Petroleum and Natural Gas Regulatory Board (Codes of Practices for Emergency Response and Disaster Management Plan) Regulations, 2010	ERDMP
4	Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Petroleum and Petroleum Products Pipelines) Regulations, 2016	Petroleum and Petroleum Products Pipelines
5	Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Retail Outlets dispensing Petroleum, Auto LPG and CNG) Regulations, 2018	Retail Outlets dispensing Petroleum, Auto LPG and CNG
6	Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Liquefied Natural Gas Facilities) Regulations, 2019	LNG
7	Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety, Safety Standards for LPG Storage, Handling and Bottling Facilities) Regulations, 2019	LPG
8	Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Petroleum Installations) Regulations, 2020	Petroleum Installations
9	Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Petroleum Refineries and Gas Processing Plants) Regulations, 2023	Refineries/Gas Processing Units
10	Petroleum and Natural Gas Regulatory Board (Procedure for Development of Technical Standards and Specifications including Safety Standards) Regulations, 2009	Framing regulations
11	Petroleum and Natural Gas Regulatory Board (Integrity Management System for Natural Gas Pipelines) Regulations, 2012	IMS of Natural Gas Pipelines

S. No.	Description of Regulation	Regulations for
12	Petroleum and Natural Gas Regulatory Board (Integrity Management System for City or Local Natural Gas Distribution Networks) Regulations, 2013	IMS of City Gas Distribution
13	Petroleum and Natural Gas Regulatory Board (Third Party Conformity Assessment) Regulations, 2015	TPCA
14	Petroleum and Natural Gas Regulatory Board (Integrity Management System for Petroleum and Petroleum Products Pipelines) Regulations, 2021	IMS of Petroleum and Petroleum Products Pipelines
15	Petroleum and Natural Gas Regulatory Board (Determining Capacity of Petroleum, Petroleum Products and Natural Gas Pipeline) Regulations, 2010	Capacity Assessment of NGPL
16	Petroleum and Natural Gas Regulatory Board (Determining Capacity of City or Local Natural Gas Distribution Network) Regulations, 2015	Capacity Assessment of PPPL

Annexure -3: How to write a Safety Report

<https://www.hse.gov.uk/pubns/priced/hsg190.pdf>



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Preparing safety reports:

Control of Major Accident Hazards Regulations 1999



This is a free-to-download, web-friendly version of HSG190 (Second edition, published 2005). This version has been adapted for online use from HSE's current printed version.

You can buy the book at www.hsebooks.co.uk and most good bookshops.

ISBN 978 0 7176 1687 9
Price £13.50

This new book gives comprehensive guidance on writing a safety report for sites containing certain quantities of dangerous substances, as required by the Control of Major Accident Hazards Regulations 1999 (COMAH).

It explains to operators of top-tier sites (as defined under COMAH) what information needs to be provided in the safety report, and how it should be presented.

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Annexure -4: COMAH Regulations

<https://www.hse.gov.uk/pubns/priced/l111.pdf>



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The Control of Major Accident Hazards Regulations 2015

Guidance on Regulations



**L111 (Third edition)
Published 2015**

This guidance aims to help dutyholders comply with the Control of Major Accident Hazards (COMAH) Regulations 2015. The purpose of the COMAH Regulations is to prevent major accidents involving dangerous substances and limit the consequences to people and the environment of any accidents which do occur.

The COMAH Regulations 2015 implement the majority of the Seveso III Directive (2012/18/EU) in Great Britain (Northern Ireland produces its own regulations). The land-use planning requirements from the Directive are implemented through planning legislation.

These Regulations replace the 1999 Regulations and are in force from 1 June 2015.

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Abbreviations

Abbreviation	Full Form
BSEE	Bureau of Safety and Environmental Enforcement
CBG	Compressed Bio Gas
CEA	Central Electricity Authority
CER	Canada Energy Regulator
CGD	City Gas Distribution
CIC	Chief Incident Controller
DDMA	District Disaster Management Authority
DGMS	Directorate General of Mines Safety
DMIS	Document Management and Information System
DPIIT	Department for Promotion of Industry and Internal Trade
ERC	Emergency Response Centre
ERDMP	Emergency Response and Disaster Management Plan
FERC	Federal Energy Regulatory Commission
HQ	Headquarters
HSE	Health and Safety Executive
LNG	Liquefied Natural Gas
LOC	Loss of Containment
MAPP	Major Accident Prevention Policy
MOC	Management of Change
MoPNG	Ministry of Petroleum and Natural Gas
MOU	Memorandum of Understanding
NDMA	National Disaster Management Authority

Abbreviation	Full Form
OISD	Oil Industry Safety Directorate
PESO	Petroleum and Explosives Safety Organization
PNGRB	Petroleum and Natural Gas Regulatory Board
PSM	Process Safety Management
PoL	Petroleum, Oil and Lubricants
POLNG+	POL, LPG, LNG, CNG
RO	Regional Offices
SIC	Site Incident Controller
SDMA	State Disaster Management Authority
SME	Subject Matter Expert
SMS	Safety Management System
SOP	Standard Operating Procedure
T4S	Technical Standards and Specifications including Safety Standards

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