



REPORT OF THE HIGH-LEVEL EXPERT COMMITTEE

To review and propose amendments to PNGRB (T4S) Regulations for City Gas Distribution (CGD), Natural Gas Pipelines (NGPL) and Petroleum & Petroleum Product Pipelines (PPPL) - with specific focus on damages being recorded in various types of pipelines due to natural calamities etc.



Preface

India's hydrocarbon energy transmission infrastructure has witnessed rapid expansion over the past decade, extending across diverse terrains to connect production sources, import terminals, refineries, and demand centres. This growth has substantially improved access to natural gas and petroleum products, reinforced energy security, and contributed to sustained economic development. Concurrently, the expanding geographical footprint of pipeline networks has increased their interaction with dynamic natural systems such as rivers, floodplains, coastal regions, and ecologically sensitive zones. Recent experience indicates that this interface has become progressively more susceptible to natural disturbances, thereby necessitating a more robust and forward-looking regulatory approach.

The Petroleum and Natural Gas Regulatory Board, constituted under the Petroleum and Natural Gas Regulatory Board Act, 2006, is mandated to regulate the refining, processing, storage, transportation, distribution, marketing, and sale of petroleum, petroleum products, and natural gas. In discharging this mandate, the Board is responsible for safeguarding consumer interests, ensuring uninterrupted and adequate supply, promoting the orderly development of infrastructure, and enforcing technical standards and safety norms across the sector. The efficacy of this mandate is intrinsically linked to the continued relevance, adaptability, and rigor of the regulatory framework governing critical energy assets—particularly

linear infrastructure such as pipelines, which operate over extended life cycles and under varied and often challenging conditions.

In recent years, multiple instances of pipeline damage have been reported across various regions of the country, with a notable concentration at river crossings and other environmentally sensitive or vulnerable locations. These incidents have frequently been associated with unseasonal and high-intensity precipitation, flooding, abrupt increases in river and stream flow velocities, riverbed scouring, bank erosion, and geotechnical instability. In several cases, such events have resulted in the exposure, displacement, or rupture of pipelines transporting petroleum products and natural gas, necessitating emergency shutdowns, repair interventions, and temporary suspension of supply.

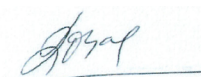
The ramifications of such incidents extend well beyond physical damage to infrastructure. Disruptions in supply have consequential impacts on domestic consumers, industrial operations, transportation fuels, and power generation, while also giving rise to safety risks and environmental concerns. As climatic patterns evolve and extreme weather events become more frequent, intense, and unpredictable, the vulnerability of pipeline systems is expected to increase. This evolving risk profile underscores the need for a comprehensive reassessment of existing technical standards and safety provisions to

ensure their adequacy in addressing both current and future operational challenges.

The PNGRB (Technical Standards and Specifications, including Safety Regulations) for City Gas Distribution networks, Natural Gas Pipelines, and Petroleum and Petroleum Product Pipelines, provide the foundational regulatory framework governing the design, construction, operation, and maintenance of pipeline infrastructure. While these regulations have played a critical role in ensuring safe and reliable operations, recent incidents highlight the necessity to re-evaluate specific provisions relating to route alignment, river crossing design, depth of cover, erosion mitigation measures, inspection and monitoring protocols, and preparedness for extreme natural events. A structured and systematic review is therefore essential to determine the need for enhanced safeguards, revised design parameters, and strengthened operation and maintenance practices.

In the light of the technical complexity of these challenges and the importance of

incorporating practical, experience-driven insights, the Board deemed it appropriate to constitute an Industry Committee to support this review. The Committee was envisaged as a platform for rigorous analysis of the root causes underlying recent pipeline damage incidents, identification of sustainable engineering solutions, and formulation of recommendations for appropriate amendments to the existing regulatory framework. It has also examined measures to enhance supply security through system redundancy, alternative routing strategies, and robust contingency planning. The establishment of this Committee was intended to enable informed and evidence-based regulatory decision-making, while strengthening the resilience, safety, and reliability of the nation's petroleum and natural gas pipeline infrastructure.



R D Goyal
(Chairman)

03rd June 2026

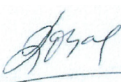


Acknowledgements

The Committee, constituted by PNGRB, places on record its deep appreciation for all stakeholders who contributed to the development of this report. It was entrusted with the mandate to review the PNGRB (Technical Standards and Specifications, including Safety) Regulations governing CGD networks, Natural Gas Pipelines, and Petroleum & Petroleum Product Pipelines, with particular emphasis on incidents attributable to natural calamities. The successful completion of this review was underpinned by extensive technical deliberations and broad-based consultations with industry participants, whose valuable insights significantly enhanced the depth and quality of the Committee's findings. The Committee conveys its sincere gratitude to the organizations and subject-matter experts who contributed incident data, engineering assessments, operational experience, and technical expertise. In particular, it acknowledges the significant contributions of GAIL, IOCL, BPCL, HPCL, EIL, MECON, IGL, and PIL. Their detailed submissions and presentations, grounded in practical operational experience, enabled the Committee to gain a more nuanced understanding of the challenges associated with pipeline exposure and failures during natural hazard events. The Committee

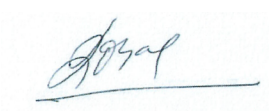
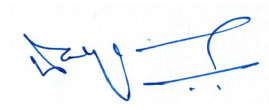
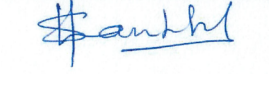
expresses its gratitude to the PNGRB for its guidance and support throughout the process. Special appreciation is extended to Shri Pradeep Tanwar, Director (Technical), Shri Arpit Johri, Assistant Director (Technical) and other PNGRB officials for their valuable contributions and coordination. The Committee also acknowledges the support provided by the officers and staff of PNGRB in facilitating meetings, documentation, and stakeholder consultations.

The Committee expresses its sincere appreciation to Shri Anil Kumar Jain, Chairperson of PNGRB, along with the distinguished Members of the Board, for constituting this Committee and facilitating a comprehensive and focused assessment of pipeline safety issues arising from natural calamities. The deliberations also drew upon international regulatory frameworks and established technical standards as well as relevant ISO and ASME codes. The findings and recommendations presented in this report represent the views of the Committee.



R D Goyal
(Chairman)

Committee Members

Name	Position	Signature
Shri R D Goyal	Chairman	
Shri D S Nanaware	Member	
Shri R K Grover	Member	
Shri G V Walimbe	Member	
Shri Ganesh S Wankhede	Member	
Shri Pradeep Tanwar	Convener	

Contents

List of Abbreviations	8
Executive Summary	10
Chapter 1: Introduction and Committee Mandate	12
1.1 Background and rationale for constitution of the committee.....	12
1.2 Terms of reference of the committee	13
1.3 Approach and methodology adopted by the committee.....	13
1.4 Committee Meetings and Stakeholder Interactions	14
Chapter 2 : Overview of Pipeline Infrastructure and Risk Environment	15
2.1 Overview of NGPL, CGD and PPPL network in India	15
2.2 Emerging Risk Landscape: Natural Calamities and Climate Variability.....	16
2.3 Impact of pipeline disruption on Safety and Supply Continuity.....	17
Chapter 3 : Review of Pipeline Incidents and Recommendations	18
3.1 Review of Incidents in Natural Gas Pipelines (NGPLs)	18
3.2 Review of incidents in City Gas Distribution	21
3.3 Review of incidents in Petroleum Product Pipelines.....	22
3.4 Summary of causes of reported failures	23
3.5 Committee's Deliberations on Design Practices and Systemic Gaps.....	25
Chapter 4 : Review of Existing Regulations	31
4.1 City Gas Distribution (CGD) Networks.....	31

Chapter 5 : Measures to Strengthen Security of Supply	33
5.1 Supply networks.....	33
5.2 Precautions	33
5.3 Multiple Injection Points and Network Looping	34
5.4 Alternate Supply Arrangements.....	34
5.5 Inter-Connectivity with Adjacent CGD	34
5.6 Comprehensive Supply Security Plan.....	34
5.7 Hook up connections at SV stations.....	34
5.8 Focus on Bio CNG plants	35
5.9 CGD Specific Regulatory Recommendations	35
Chapter 6 : Conclusions and Way Forward	36
6.1 Consolidated Findings Across NGPL, PPPL and CGD	36
6.2 Summary of Recommendations.....	37



Annexures

Annexure I: Copy of the PNGRB Order dated 07.10.2025.....	39
Annexure II: Summary of Pipeline Incidents Reviewed	41
Annexure III: Proposed amendment in PNGRB Technical Regulations	42
Annexure IV: Copy of the revised PNGRB Order dated 13.05.2026.....	47



List of Abbreviations

Abbreviation	Full Form
PNGRB	Petroleum and Natural Gas Regulatory Board
T4S	Technical Standards and Specifications including Safety Standards
CGD	City Gas Distribution
NGPL	Natural Gas Pipeline
PPPL	Petroleum and Petroleum Product Pipeline
ERDMP	Emergency Response and Disaster Management Plan
ISO	International Organization for Standardization
ASME	American Society of Mechanical Engineers
HDD	Horizontal Directional Drilling
HFL	Highest Flood Level
IITK-GSDMA	Indian Institute of Technology Kanpur – Gujarat State Disaster Management Authority
IS	Indian Standard
IRC	Indian Roads Congress
QCBS	Quality and Cost Based Selection
LNG	Liquefied Natural Gas
LCNG	Liquefied to Compressed Natural Gas
CNG	Compressed Natural Gas
PNG	Piped Natural Gas
LPG	Liquefied Petroleum Gas

OMCs	Oil Marketing Companies
SV	Sectionalizing Valve
PRS	Pressure Regulating Station
MRS	Metering and Regulating Station
CGS	City Gate Station
QRA	Quantitative Risk Assessment
MDPE	Medium-Density Polyethylene
GA	Geographical Area
DCU	Decompression Unit
TERI	The Energy and Resources Institute
NGT	National Green Tribunal
SOPs	Standard Operating Procedures



Executive Summary

This report presents the findings and recommendations of the Industry Committee constituted by the Petroleum and Natural Gas Regulatory Board (PNGRB) to review and analyse the root causes/factors contributing to recent instances of pipeline exposure and recommend short term and long terms Engineering/Technical solution to minimize recurrence of such exposures / ruptures arising from natural calamities and to review and recommend amendments in PNGRB Regulations Technical Standards and Specifications including Safety Standards (T4S) across Natural Gas Pipelines (NGPL), City Gas Distribution (CGD) networks, and Petroleum and Petroleum Product Pipelines (PPPL) to make them more effective to prevent incidents of pipeline exposures/ruptures especially due to natural calamities.

The committee was also mandated to recommend suitable measures for strengthening security of supply for natural gas and Petroleum & Petroleum products in the country, in case of any disruption in main pipeline network by way of alternate supply pipelines and other measures.

Key Observations:

The Committee's analysis of recent incidents indicates a clear shift in the risk profile of pipeline infrastructure. Failures are increasingly driven by extreme hydro-meteorological events including intense rainfall, flash floods, river

meandering, and excessive scouring. These factors lead to loss of soil cover, development of unsupported pipeline spans, and exposure to abnormal hydrodynamic forces, ultimately resulting in rupture or near-miss conditions.

Highlights of the Report:

- Failures are frequently occurring beyond trenchless crossing limits (HDD punch-in/punch-out points), indicating inadequacies in current design margins.
- Open-cut river crossings and inadequate anti-buoyancy measures remain particularly vulnerable.
- Third-party damage and coordination gaps continue to be significant contributors, especially in CGD networks.
- Disruptions in trunk pipelines have cascading impacts on CGD networks, leading to widespread interruption of CNG and PNG supply to domestic, commercial, and industrial consumers.

While existing PNGRB T4S regulations provide a strong foundation for safety and integrity, they are primarily asset-focused and require strengthening to address climate-induced risks, system resilience, and supply continuity.

Key Recommendations:

The Committee recommends a comprehensive approach combining regulatory, engineering, and operational measures:

1. Regulatory Strengthening

- Amending T4S regulations to explicitly incorporate:
 - Geo-hazard assessment as a mandatory design requirement.
 - Enhanced criteria for scour depth calculation, HFL estimation, and HDD length.
 - Mandatory use of trenchless techniques for water body crossings (with limited exceptions).
- **Introduce CGD-specific provisions on:**
 - Network redundancy and multi-feed configurations.
 - Integration of supply continuity planning with ERDMP frameworks.

2. Engineering and Design Enhancements

- Institutionalize geo-hazard assessment in line with international practices (e.g., ISO 20074) and IITK-GSDMA Guidelines for Seismic Design of Buried Pipelines.
- Increase design margins for river crossings, including:
 - Extended HDD lengths.
 - Conservative scour depth estimation.

- Standardize use of concrete coating for anti-buoyancy and avoid open-cut methods where feasible.

3. Supply Security and Resilience

- CGD network should have Looped and interconnected systems with Multiple supply sources and injection points.
- Develop alternate supply arrangements with LCNG/CNG backup systems including mobile DCUs.
- Maintain strategic line pack and localized storage, wherever feasible, to buffer short-term disruptions.

Conclusion

The Committee concludes that pipeline failures due to natural calamities are no longer isolated events, but part of an evolving risk landscape influenced by climate variability and infrastructure interdependence. Addressing these challenges requires a transition from conventional integrity management to an approach, integrating robust design, proactive monitoring, and supply security planning.

Chapter 1:

Introduction and Committee Mandate

1.1 Background and rationale for constitution of the committee:

Industry Committee was constituted pursuant to the PNGRB Order dated 07 October 2025 for reviewing and proposing amendments to PNGRB's Technical Standards and Specifications including Safety Standards (T4S) framework for City Gas Distribution (CGD) networks, Natural Gas Pipelines (NGPL), and Petroleum and Petroleum Products Pipelines (PPPL), with specific focus on incidents of pipeline exposure, damage, and rupture arising from natural calamities. The present work is driven by the convergence of two sector realities: the increasing physical exposure of linear infrastructure to hydro-meteorological and terrain hazards, and the rising systemic consequences of disruption in interconnected supply chains.

Pipeline exposure and rupture caused by floods, river scour, channel migration, heavy rainfall, and earth movement are not merely integrity events; they are public safety events, environmental risk events, and supply continuity events. Public-domain incident narratives and safety-learning publications show recurring patterns where high flows, altered channels, and slope instability can leave buried pipelines exposed or impose abnormal loads, leading to loss of containment or near-miss conditions, and where access constraints during floods delay repairs and prolong supply disruption.

PNGRB Act, 2006 – Statutory Context

The Petroleum and Natural Gas Regulatory Board (PNGRB) derives its statutory authority from the Petroleum and Natural Gas Regulatory Board Act, 2006, which empowers the Board to regulate the transportation of petroleum, petroleum products, and natural gas, and to prescribe and enforce technical standards for associated infrastructure in India, with the objective of safeguarding consumer interests and ensuring safe, uninterrupted, and reliable supply. Under Section 11 of the Act, the Board is specifically mandated to formulate and notify Technical Standards and Specifications, including Safety Standards (T4S), for pipelines, facilities, and related infrastructure.

In pursuance of this mandate, the Board has notified the Procedure for Development of Technical Standards and Specifications including Safety Standards (T4S) Regulations, which establish a structured, transparent, and consultative framework involving multiple stakeholders for the formulation, notification, amendment, and periodic review of T4S provisions. The framework is intended to ensure that regulatory standards remain contemporary, technically robust, and aligned with evolving industry practices and emerging risk profiles.

Accordingly, the Board has notified the PNGRB (Technical Standards and Specifications including Safety Standards) Regulations for

City Gas Distribution (CGD) Networks, Natural Gas Pipelines, and Petroleum and Petroleum Product Pipelines. These regulations prescribe the minimum mandatory technical and safety requirements to ensure the structural integrity, operational reliability, and safe functioning of pipeline systems, while also protecting life, property, and the environment.

The Committee's mandate is to undertake and submit its report within this established statutory and regulatory framework, with the specific objective of assessing the continued adequacy and effectiveness of the existing provisions in addressing risks arising from natural calamities and evolving operating conditions. The exercise further seeks to identify the need for regulatory refinements or amendments to strengthen safety, enhance system resilience, and ensure sustained supply security in the larger public interest.

1.2 Terms of reference of the committee:

The Industry Committee has been constituted by the Board to undertake a focused and time-bound review of issues relating to pipeline damages arising due to natural calamities, with a view to strengthening the regulatory and technical framework governing pipeline infrastructure in the country. The Terms of Reference (ToR) assigned to the Committee are as follows:

- ToR-1: Analysis of root causes/factors contributing to recent instances of pipeline exposure/rupture at or near river crossings etc. and recommend short-term and long-term Engineering/Technical solutions to

minimize recurrence of such exposures/ruptures.

- ToR-2: Review and recommend amendments in PNGRB Regulations to make them more effective to prevent incidents of pipeline exposures/ruptures especially due to natural calamities.
- ToR-3: Recommend suitable measures for strengthening security of supply for Natural Gas and Petroleum & Petroleum Products in the country, in case of any disruption in main pipeline network by way of alternate supply pipelines and other measures.

The scope of work of the Committee extends across the full spectrum of pipeline infrastructure supporting the natural gas and petroleum product value chains, covering cross-country pipelines, feeder lines, and critical interfaces such as river crossings and flood-prone corridors.

The Committee's mandate is recommendatory in nature, aimed at identifying systemic gaps in existing technical and regulatory provisions and proposing pragmatic, implementable measures. The scope also encompasses consideration of operational preparedness, emergency response, and supply continuity, ensuring that recommendations are aligned with the statutory objectives of the Petroleum and Natural Gas Regulatory Board to safeguard consumer interests and ensure uninterrupted and adequate supply of natural gas and petroleum products in an evolving risk environment.

1.3 Approach and methodology adopted by the committee

The Committee adopted a structured approach

encompassing following four primary work streams:

- i) Analysis of specific pipeline incidents to identify root causes and systemic contributors;
- ii) Review of existing T4S Regulations to identify provisions relevant to natural calamity risk and gaps therein;
- iii) Review of entities practices and stakeholder submissions; and
- iv) Reference to international pipeline engineering and regulatory standards for natural calamity risk management.

Stakeholder consultations were conducted with pipeline operators, CGD entities, and relevant technical experts. The Committee also drew operator-level root cause analysis documents, supply security plans, and historical case studies held by the PNGRB Technical Division.

The Committee's analysis is presented in terms of mechanism categories, general engineering principles, and regulatory framework gaps.

1.4 Committee Meetings and Stakeholder Interactions

S. No	Date	Meetings / Visit	Stakeholders Invited
1	27-10-25	Kick-off Meeting	PNGRB Board
2	07-11-25	Committee Meeting	GAIL
3	14-11-25	Committee Meeting	IOCL & BPCL
4	21-11-25	Committee Meeting	MECON
5	01-12-25	Committee Meeting	IGL & PIL
6	11-12-25	Committee Meeting	EIL
7	24-12-25	Visit to GAIL Noida	GAIL, ACE P/L & HDD Expert
8	06-01-26	Committee Meeting	Internal
9	30-01-26	Committee Meeting	Internal
10	13-03-26	Committee Meeting	Internal
11	30-03-26	Committee Meeting	Internal
12	29-05-26	Report Presentation	PNGRB Board
13	03-06-26	Report Finalization	PNGRB Board

Chapter 2:

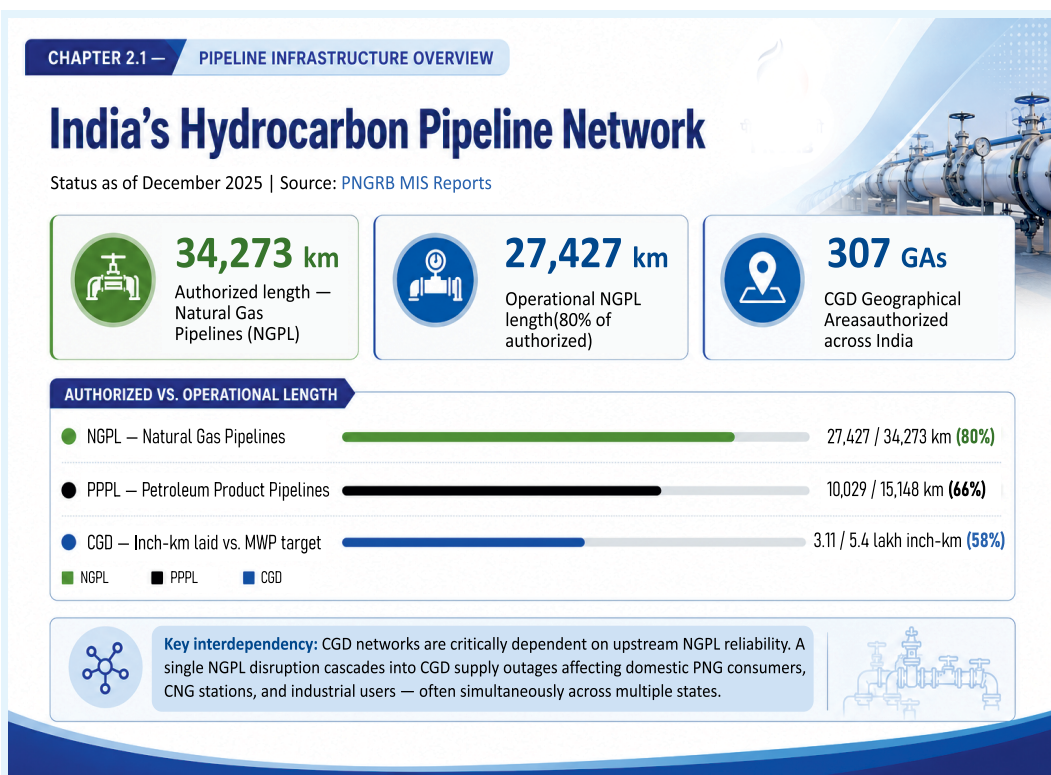
Overview of Pipeline Infrastructure and Risk Environment

2.1 Overview of NGPL, CGD and PPPL network in India

India's pipeline infrastructure has expanded rapidly in recent years to support growing energy demand, facilitate fuel switching towards cleaner alternatives, and extend the geographic reach of natural gas and petroleum products. These cross-country pipelines traverse

multiple states, crossing numerous water bodies like rivers, canals, coastal areas etc., national highways, Forest, Sanctuaries and varied terrain types. As of December 2025, the total authorized length of major natural gas pipelines stands at about 34,273 km, of which approximately 27,427 km is operational¹.

PIPELINE INFRASTRUCTURE OVERVIEW



¹ PNGRB NGPL MIS Report

CGD networks distribute natural gas within defined Geographical Areas (GAs) to domestic PNG consumers, commercial establishments, CNG stations, and industrial units. CGD networks are critically dependent on the reliability of the upstream NGPL that feeds their network. A disruption in the feeder NGPL invariably cascades into a CGD supply outage unless alternative supply arrangements are in place. City Gas Distribution networks represent a critical, consumer-facing layer of energy infrastructure where the consequences of disruption are immediate and widespread. In the CGD segment where 307 GA were authorized, approximately 3.11 lakh inch-km of pipelines have been laid against a Minimum Work Program target of 5.4 lakh inch-km as of December 2025², indicating both the scale of network expansion and the growing reliance on uninterrupted gas supply. The extent of downstream dependence is reflected in the large number of domestic PNG connections and CNG stations serving household energy needs and urban transport demand. This close coupling between cross-country natural gas pipelines and city-level distribution systems implies that disruptions in NGPL feeder pipelines due to natural calamities can rapidly cascade into shortages of CNG, interruption of PNG supply to households, and adverse impacts on commercial and industrial gas consumers, resulting in multi-sector challenges and public service disruptions.

PPPL transports refined petroleum products such as gasoline, high speed diesel, aviation turbine fuel, and LPG from refineries and terminals to intermediate depots

/bottling plants and retail distribution networks. These pipelines are critical for national fuel logistics, and their disruption can directly affect fuel availability at retail outlets, airports, and defense installations. As of December'25, country has an operational length of about 10,029 km of PPPL against an authorized length³ of 15,148 km.

Collectively, all three categories of pipeline systems share a common and defining physical attribute that is central to the Committee's mandate: they comprise predominantly buried underground infrastructure traversing rivers, floodplains, highways, railway corridors, and geologically dynamic terrains. Accordingly, their design, construction, operation, and maintenance standards must be formulated to withstand not only routine operational stresses but also the full spectrum of environmental conditions and geo-hazard risks characteristic of the Indian subcontinent.

2.2 Emerging Risk Landscape: Natural Calamities and Climate Variability

Pipeline infrastructure across India is increasingly operating within a risk environment shaped by changing climatic patterns and more frequent extreme weather events. Scientific modelling by TERI⁴ on climate projections for India indicates a significant shift in both the frequency and intensity of extreme rainfall and flood events during 2020–2050 compared to 1970–2000, with corresponding increase in extreme rainfall days and overall flood exposure nationwide.

² [PNGRB CGD MIS Report](#)

³ [PNGRB PPPL MIS](#)

⁴ [Climate Risks to Oil and Gas - TERI](#)

These changes are projected to elevate risks to oil and gas operations through damage to infrastructure corridors, disruption of access routes, and constraints on maintenance and emergency response during flood conditions. Climate variability also includes slow-onset changes such as rising ambient temperatures and altered soil moisture regimes, which can adversely affect the geotechnical stability of buried pipeline systems.

Against this backdrop, pipeline exposure and rupture triggered by flash floods, river meandering, cloudbursts, intense rainfall, and seismic activity of medium to high magnitude represent more than isolated integrity failures. Publicly available incident reports and safety-learning publications reveal recurring patterns in which high flow velocities, altered river courses, and slope instability result in loss of pipeline cover or impose abnormal mechanical stresses, leading to exposure or rupture of pipelines. In several instances, restricted site access during flooding has delayed repair and restoration activities, thereby prolonging supply disruptions and amplifying impacts on public safety, the environment, and continuity of energy supply.

The Ministry of Earth Sciences has documented that India's surface air temperature has increased by about 0.7°C during the 1901–2018 period, and that climatic extremes including localized heavy rainfall events and flood occurrences have increased in recent decades⁵. International climate assessments similarly indicate that heavy precipitation is projected to intensify and become more frequent in parts

of Asia, increasing the likelihood of flood and landslide triggers in susceptible terrain⁶.

2.3 Impact of pipeline disruption on Safety and Supply Continuity

From a safety standpoint, the consequences of such disruptions extend well beyond the immediate asset. Pipeline exposure and excessive bending can result in coating degradation, elevated stress concentrations, and, ultimately, structural failure. Any leakage in gas or liquid hydrocarbon systems poses a significant risk of ignition or explosion, necessitating prompt isolation, activation of emergency response protocols, and coordinated intervention among relevant agencies.

From a supply continuity perspective, disruptions in Natural Gas Pipeline (NGPL) systems can lead to curtailment of gas supply to city gate stations and major industrial consumers. City Gas Distribution (CGD) entities may be compelled to implement demand curtailment measures, thereby affecting the availability of transport fuels such as CNG and piped natural gas supply to domestic consumers, with consequential impacts on economic activity and public convenience.

In the case of Petroleum and Petroleum Product Pipelines (PPPL), interruptions in product movement can place significant strain on alternate logistics arrangements, increase dependence on road and rail transportation, and heighten downstream supply risks in the affected regions for individual Oil Marketing Companies (OMCs).

⁵ [PIB](#)

⁶ [IPCC Regional Fact sheet](#)

Chapter 3:

Review of Pipeline Incidents and Recommendations

This chapter presents the Committee's review of the recently reported exposure / ruptures in various pipelines; and its recommendations to minimize recurrence of such incidents. Review of the recent incidents consists of:

- Review of failure analysis report of the entities (Pipeline Owners). Discussions with IOCL, BPCL, GAIL, IGL and PIL.
- Discussions with Engineering Consultants namely EIL and MECON.
- Discussions with HDD contractors ACE P/L & HDD Expert.

Based on the foregoing comprehensive review, the Committee has formulated a set of recommendations aimed at preventing, mitigating, and minimizing the risk of similar

failures in the future. While the majority of recent incidents have occurred in the vicinity of water bodies, the Committee deemed it necessary to undertake a broader assessment of prevailing design practices, including those related to resilience against seismic events.

Accordingly, the Committee has reviewed existing approaches to design for both hydrological and geotechnical hazards, including seismicity, and has identified areas where enhancements are warranted. The recommendations therefore encompass proposed modifications to current design practices and standards to strengthen system integrity against seismic and other geo-hazard risks.

3.1 Review of Incidents in Natural Gas Pipelines (NGPLs)

Incidents reviewed are tabulated below:

S. No	Pipeline Details	Entity	Incident Date	GAs Affected	Brief Details of Disruption
1	Karanpur-Moradabad-Kashipur-Rudrapur Pipeline (KMKRP)	GAIL	10.08.25	i. Udham Singh Nagar ii. Pithoragarh, Champawat, Almora, Chamoli and Bageshwar districts iii. Bijnor and Nainital Districts	97 industries, more than 56 commercial customers and supply to 19 nos. of CNG stations was disrupted.
2	Dadri Bawana Nan-gal pipeline (DBNP)	GAIL	16.08.25	i. Sonipat ii. Sonipat District (EAAA) & Jind District iii. Jhajjar District iv. National Capital Territory of Delhi	464 industries, more than 176 commercial customers and supply to 21 nos. CNG stations was disrupted.
3	Haridwar-Rishikesh-Dehradun Pipeline (HRDP)	GAIL	16.09.25	Dehradun District	Supply to 5 nos. of online CNG stations was disrupted.
4	RCF GAIL CHEMBUR TERMINAL in TROMBAY-MGL Pipeline (GCTP)	GAIL	16.11.25	Mumbai & Greater Mumbai	166 nos. CNG stations and 215 nos. Industrial/Commercial connections were disrupted.

Incident list at S. No. 4 in the above table was reported during the ongoing review of the committee. Each of the above incidents are elaborated as under:

i) Karanpur-Moradabad-Kashipur- Rudrapur Pipeline (KMKRPL):

Heavy rainfall in the Uttarakhand region in early August 2025 triggered flooding and a change in river course at the location where the 12"KMKRPL pipeline crosses river Ramganga between Sectionalizing Valves SV-1A and SV-2. The entity's internal report identifies that the change in river course resulted in hydraulic scouring and progressive erosion of the soil cover overlying the pipeline. As the soil cover got removed, the pipeline became exposed and the unsupported span was subjected to hydrodynamic forces in addition to the internal pressure resulting in higher static and / or dynamic stresses (due to vertex shedding) ultimately resulting in rupture of the pipeline. Committee concurred with the internal report of GAIL and would like to highlight the following points:

- Rupture occurred in downstream of SV-01A after crossing the river Ramganga and branch Nala across farmlands. This segment initially was at a distance of 150 to 200 m from river Ramganga / Nala.
- Portion of pipeline which was laid using trenchless technique was not affected due to flooding.
- No anti-buoyancy measures were provided in the portion where rupture occurred.

- Main cause of damage is change in course of river and excessive flooding.
- The supply disruption resulting from this incident affected 97 industries, more than 56 commercial connections and 19 CNG stations across the GAs served by the KMKRPL.

ii) Dadri-Bawana-Nangal Pipeline (DBNPL):

As per the report submitted by GAIL to PNGRB, incident triggered by a combination of heavy rainfall and heavy discharge of water from the Hathnikund barrage. Satellite pictures reveal that river bank (Gauna side) has shifted by more than 150 m towards Gauna side. In the year 2011 punch in location was about 150 m from the river bank while in 2025 it is observed to be at the river bank thereby implying that the river has shifted by almost 150 m. In the year 2023-24, some protection was provided in the form of gabion wall, but during 2025 flooding river has further shifted by about 70 m beyond the gabion wall. Failure mechanism in this case too is same as mentioned in Para 3.1(i) i.e scouring, followed by pipeline exposure resulting in unsupported span and failure due to increased stresses/vibrations. The resulting supply disruption affected 464 industries, more than 176 commercial connections and 21 CNG stations.

Committee concurred with the internal report of GAIL and would like to highlight the following points:

- No anti-buoyancy measures were provided in the portion where rupture occurred.

- Main cause of damage is flash flood resulting from heavy rainfall compounded with abnormal discharge from dam.
- Adhoc measures like providing gabion wall probably without proper study of hydrology has not given the desired protection.
- Shifting of the river by 150 m has occurred during the period of 14 Yrs (2011 - 2025). Committee is of the opinion that such incident unfolded progressively rather than occurring instantaneously.
- One of the reasons for course change of the river is probably due to lack of upstream desilting. This is generally more pronounced at river bends as in the present case.

iii) Haridwar-Rishikesh-Dehradun Pipeline (HRDPL):

As per the incident report submitted by GAIL, the pipeline at the Song-2 river crossing was ultimately installed using the open-cut method, following two unsuccessful attempts to execute HDD due to the presence of gravel and boulder strata. Adequate anti-buoyancy measures were provided in the form of inverted U-shaped saddles. Cause of failure is mentioned as flash floods resulting from heavy rainfall in the catchment area. No abnormality was observed through drone imagery of April and Aug. 2025. Lot of stones/boulders got swept from the upstream during flash floods. Some of the inverted U-shaped saddles were found in

tilted position. It appears that impact force of stones / boulders pushed the saddles from its position exposing the pipe to direct current of water. Five online CNG stations were disrupted as a result.

Committee would like to highlight the following:

- Unlike other reported failures, the incident in this case occurred in the section of the pipeline located within the riverbed.
- The pipeline was installed using the open-cut method rather than a trenchless technique.
- The anti-buoyancy measures implemented were such that, if soil erosion exposes the saddles directly to water flow, the pipeline may experience significantly elevated bending stresses, potentially leading to displacement of the saddle weights. Furthermore, if soil erosion reaches the base of the pipeline, additional stresses were imposed due to the weight of the saddles themselves.

iv) RCF GAIL Chembur Terminal in Trombay-MGL Pipeline:

This incident was reported during the Committee's tenure. On 16.11.2025, a gas leak occurred on GAIL's 18-inch Trombay-MGL Wadala pipeline within the premises of RCF Chembur, caused by drilling activities carried out by an RCF contractor. The leak was promptly isolated, gas was vented safely, and supply to MGL was maintained through alternate routes. No injuries or

property damage were reported.

The Committee noted that the pipeline traverses RCF premises. All operating plants maintain established Standard Operating Procedures (SOPs), which include issuing work permits to contractors, granting gate passes for bringing in equipment, and supervising contractor activities. According

to information provided by MGL, RCF did not communicate any planned drilling activities in that area to GAIL. While the Committee does not have direct insight into the internal proceedings at RCF, it is of the opinion that the pipeline rupture resulted from non-compliance with established SOPs.

3.2 Review of incidents in City Gas Distribution:

Following incident was reviewed:

S. No	Pipeline Details	Entity	Incident Date	GAs Affected	Brief Details of Disruption
1	8 Inch Steel Pipe at Golden Chowkadi, Vadodara	VGL	30.11.2025	Vadodara	Over 1.5 lakh D-PNG, 1200 Commercial and 3 Mother & 7 Online stations were affected.

i) 8 inch Steel pipeline of Vadodara Gas Limited

The incident occurred during micro-tunneling activity undertaken by a contractor. During the activity, the contractor punctured an 8-inch steel pipeline at Golden Chowkadi. The pipeline's high operating pressure intensified the severity of gas release once the damage occurred. The incident resulted in significant gas leakage, requiring isolation and venting of the affected pipeline section, and caused a wide service disruption in the area. While the committee has

not seen any detailed documents related to this event, it is clear that such events are outcome of lack of coordination between various entities local bodies (corporation, municipality etc.), contractors and CGD operator. Such events can be avoided with prior coordination and supervision. To avoid such incidences proper coordination between local bodies, CGD entities and contractors is recommended. Further there is need to inculcate culture of safety and adherence to procedures in local bodies all over the country.

3.3 Review of incidents in Petroleum Product Pipelines

Following incidents were reviewed:

Sr. No	Pipeline Details	Entity	Incident Date	Incident Brief
1	KRNPL	IOCL	21.08.2025	Heavy monsoon flow caused severe riverbed scouring, exposing the pipeline and subjecting it to hydrodynamic forces, resulting in suspected rupture.
2	MMBPL	BPCL	26.08.2025	River course change and erosion removed soil support at the crossing, creating unsupported pipeline span and bending stress. Possible coating damage and localized corrosion contributed to leakage.

i) Kurukshetra–Roorkee–Najibabad Petroleum Product Pipeline (KRNPL) of IOCL:

This pipeline was laid in 2003 using 1100 m long HDD to cross water channel of the river Ganga. Considering flooding of 2013, it was changed to 2100 m long HDD. In 2025, unprecedented heavy flood, high current of water and change in water course, massive erosion (approx. 300 m) on Najibabad side bank took place. This had exposed considerable portion of the pipeline and washed away nearby farm fields and mango orchard. At the time of flooding, pipeline was under shutdown as per the planned schedule in Roorkee-Najibabad section. On observing erosion of soil and exposure of the pipeline, immediate steps were taken to evacuate HSD by pushing water and the affected section was isolated after evacuation. Pipeline rupture took place after evacuation and isolation was complete. As a result, there was no product spillage. Committee would like to highlight the following:

- On observing soil erosion and pipeline exposure, immediate action was taken to evacuate the pipeline. This signifies the importance of regular monitoring,

particularly during rainy season.

- Action taken in 2013 to increase HDD even to 2100 m could not cater to heavy flooding. Prediction of HFL must account for impact of sudden heavy rain due to cloud burst – an area not easy to predict.

ii) Mumbai–Manmad–Bijwasan Multi Product Pipeline (MMBPL) of BPCL:

The said pipeline section was laid by open cut method using concrete coated pipeline for anti-buoyancy measures. In this case too, pipeline rupture was on account of heavy flooding and meandering of the river on both sides. This exposure resulted in unsupported span and failure due to increased stresses/vibrations.

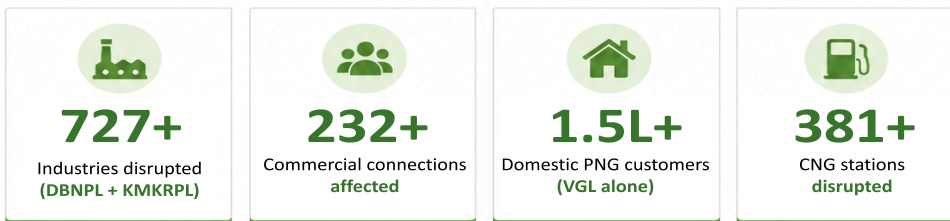
As per data projected by BPCL, Committee would like to highlight the following:

- Rainfall around river Mej from 2015 to 2024 varied from 2727 mm to 6056 mm. However, in 2025, it was 8312.5 mm. This again brings us to the issue of prediction of HFL taking into account impact of sudden heavy rains.

CHAPTER 3.1 — 3.3 — INCIDENT REVIEW

7 Pipeline Incidents Reviewed: Aug–Nov 2025

Across NGPL, CGD and PPPL — entities: [GAIL](#), [IOCL](#), [BPCL](#), [VGL](#)



Incident Log

10 Aug 2025	NGPL Karanpur–Moradabad–Kashipur–Rudrapur (KMKRPL) GAIL River Ramganga, Uttarakhand	97 industries 56 commercial · 19 CNG stations
16 Aug 2025	NGPL Dadri–Bawana–Nangal Pipeline (DBNPL) GAIL Yamuna river, Haryana–Delhi	464 industries 176 commercial · 21 CNG stations
16 Sep 2025	NGPL Haridwar–Rishikesh–Dehradun Pipeline (HRDP) GAIL Song-2 river crossing, Dehradun	5 CNG stations Dehradun district
16 Nov 2025	NGPL Trombay–MGL Wadala Pipeline (GCTP) GAIL RCF Chembur premises, Mumbai	166 CNG stations 215 industrial/commercial
30 Nov 2025	CGD 8-inch Steel Pipeline, Golden Chowkadi VGL Vadodara	>1.5 lakh D-PNG 1,200 commercial · 10 CNG stations
21 Aug 2025	PPPL Kurukshetra–Roorkee–Najibabad (KRNPL) IOCL Ganga crossing, Roorkee	No spillage Timely isolation prevented product loss
26 Aug 2025	PPPL Mumbai–Manmad–Bijwasan Pipeline (MMBPL) BPCL Mej river, Rajasthan	Rupture 8,312 mm rainfall (37% above prior peak)

3.4 Summary of causes of reported failures:

Based on above case histories and discussions with various entities, causes of failure can be categorized in two categories:

i) **Failure due to unpredictable water flow:**

Excessive water flow can happen due

to excessive and sudden rainfall in the catchment area or due to heavy discharge from upstream dam. There can be cases where dam is constructed after the pipeline has been laid.

Soil erosion of river bed (vertical erosion) due to excessive water flow or due to bank

erosion and channel migration leads to pipeline exposure. Thereafter pipeline is subjected to drag force of the water, impact of debris or boulders resulting in higher bending stresses and eventual failure. In some cases, soil gets eroded from the bottom of pipeline leading to unsupported span of pipeline. Such unsupported spans are subject to dynamic forces (in addition to drag forces) due to vortex shedding leading to vibrations. In case vortex shedding frequency matches with natural frequency of the unsupported span, it may result in resonance and eventual fatigue failure in a very short time.

Control of such failures through increase of thickness of pipeline is technically not

feasible due to unpredictability of the kind of static and dynamic forces which will get imposed on the pipeline. The only practical way to avoid such occurrences is to ensure non-exposure of pipeline through better prediction with regard to anticipated future water flow.

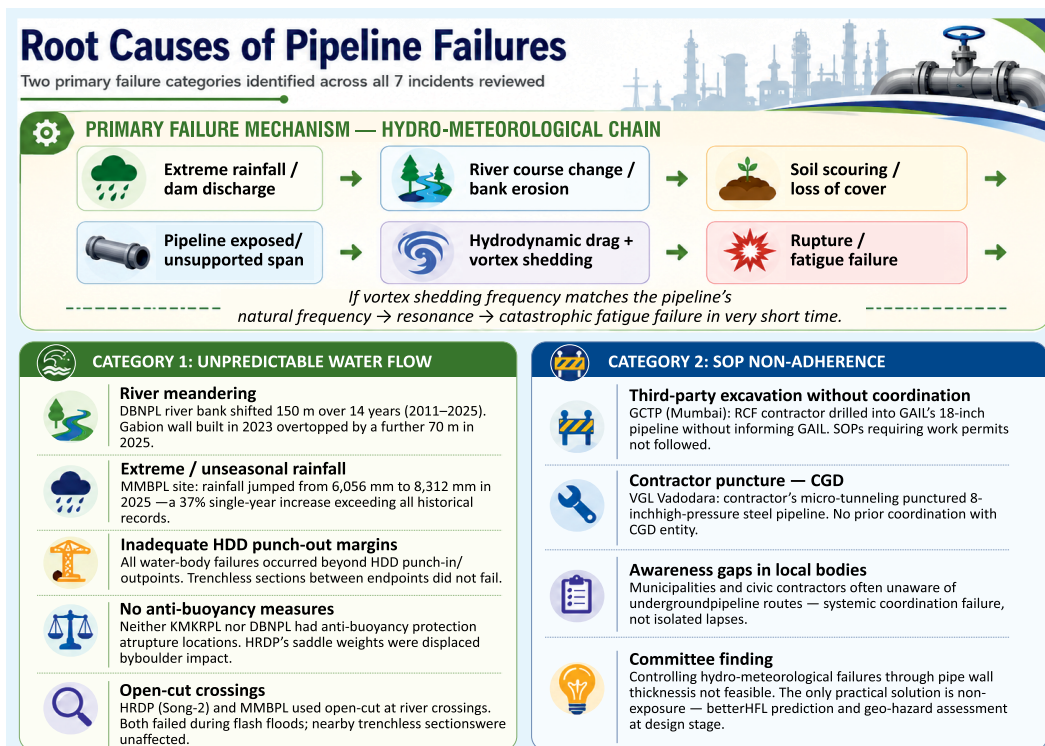
ii) Non-adherence to SOPs:

Major causes of such failures are:

- Lack of awareness amongst local bodies and contractors about safety aspects.
- Not following Standard Operating Procedures

Solution to above lies in creating awareness, close co-ordination among all associated stakeholders.

CHAPTER 3.4 — SUMMARY OF CAUSES



3.5 Committee's Deliberations on Design Practices and Systemic Gaps

Beyond the specific incidents, the Committee examined broader design practices and systemic conditions that contribute to the vulnerability observed across NGPL and PPPL river crossings. These deliberations are grounded in a comprehensive review of the reported incidents, together with the Committee's formal evaluation of prevailing industry & design practices and in alignment with applicable regulatory standards and compliance frameworks. The Committee noted that all recent failures reviewed were the result of excessive rainfall and river meandering. It further noted that except for the Haridwar–Rishikesh–Dehradun gas pipeline and MMBPL - Mumbai Manmad Bijwasan Product Pipeline, all water body crossings that experienced failures had utilized trenchless technique to lay the pipeline; and that wherever trenchless techniques were deployed, the failures were reported beyond the punch-in or punch-out points. This finding highlights critical importance of incorporating sufficient design margins in HDD length planning. The Haridwar–Rishikesh–Dehradun pipeline had used open cut technique to cross river Song-2, with inverted U-shaped saddle weights as anti-buoyancy measures instead of the more effective concrete-coated pipeline approach.

On current design practices/route selection / construction techniques, the Committee identified following areas of inadequacy or ambiguity.

1) Scour depth calculation:

The scour depth should be calculated based

on methodology provided in IRC 78 Part-I (STANDARD SPECIFICATIONS AND CODE OF PRACTICE FOR ROAD BRIDGES FOUNDATIONS AND SUBSTRUCTURE). However, IRC 78⁷ provides different multiplication factors for piers and abutments (Para 703.3.1.1), this leaves room for designers to arrive at different values of scour depth. It also calls for special studies under certain conditions (Para 703.4). These conditions are:

- i. *A bridge being located on a bend of the river involving a curvilinear flow, or excessive shoal formation, or*
- ii. *A bridge being located at a site where the deep channel in the river hugs to one side, or*
- iii. *A bridge having very thick piers inducing heavy local scours, or*
- iv. *Where the obliquity of flow in the river is considerable, or*
- v. *Where a bridge is required to be constructed across a canal, or across a river downstream of storage works, with the possibility of the relatively clear water inducing greater scours, or*
- vi. *A bridge in the vicinity of a dam, weir, barrage or other irrigation structures. where concentration of flow, aggradations/degradation of bed, etc. are likely to affect the behavior of the structures, or*
- vii. *An additional two-Lane Bridge when located near to the existing bridge, on major rivers.*

Further, Para 703.5 states “If a river is of flashy nature and bed does not lend itself readily to the

⁷ IRC 078

scouring effect of floods, the theoretical formula for d_{sm} , and maximum depth of scour as recommended shall not apply. In such cases, the maximum depth shall be assessed from actual observations"

Recommendation: *Maximum scour depth shall be calculated as per the applicable Para of IRC 78 - Para 703.2, 703.3, or 703.4 as the situation warrants. Where Para 703.2 applies, calculations shall be based on the multiplication factor for pier for the load case of flood without seismic combination. Special studies for scour depth shall be carried out wherever the conditions outlined in Paras 703.3 and 703.4 apply.*

2) Seismic design:

The seismic hazards which are directly related to pipeline failure are classified as:

- i. Permanent ground deformation related to soil failures:
 - Longitudinal permanent ground deformation
 - Transverse permanent ground deformation
 - Landslide
- ii. Buoyancy due to liquefaction
- iii. Permanent ground deformation related to faulting. (Abrupt PGD)
- iv. Seismic wave propagation

As of now, most of the agencies have taken measures to provide flexibility to pipeline at crossing of fault zone (point iii above). This is achieved by increased width of trench for certain distance on both sides of fault zone and use of engineered fill to permit pipe movement. While this approach is qualitatively correct, however quantification of increase of trench

width and distance up to which it has to increased must be based on probable fault displacement. All other aspects (Point i, ii & iv above) have not been taken into account during pipeline execution.

Committee notes that currently IS 1893 Part 7 titled Design Earthquake Hazard and Criteria for Earthquake-Resistant Design of Structures - Part 7 Long-distance Pipelines is under preparation. Once this is published, design of pipelines as per IS 1893 should be made mandatory. Till its publication, pipelines must be checked using IITK-GSDMA GUIDELINES for SEISMIC DESIGN of BURIED PIPELINES.

Recommendation: *All new trunk pipelines shall be checked against seismic damage using IITK-GSDMA Guidelines for Seismic Design of Buried Pipelines until IS 1893 Part 7 ('Design Earthquake Hazard and Criteria for Earthquake-Resistant Design of Structures Part 7: Long-distance Pipelines') is published, after which IS 1893 Part 7 shall be applied mandatorily.*

3) Water body crossing:

The Committee identifies following key parameter for considering safe design of pipeline to cross water body and suggest as under:

- i. Maximum width of water body and Highest Flood Level (HFL): This is established based on past data gathered from irrigation department, from past google earth imageries and/or by gathering relevant information from local population. Likely increase of intensity

and frequency of rainfall due to projected global warming is not accounted for while estimating HFL. Certain studies have already been undertaken, such as TERI's assessment on potential climate risks to oil & gas infrastructure and operations. The Committee is of the view that the findings and outcomes of such studies should be duly considered while estimating the HFL.

Recommendation in this regard is covered under Geo-hazard assessment.

- ii. Scour depth: Already discussed above (Refer point 1)
- iii. Geotechnical parameters below water body: These are required to calculate scour depth and are also required to decide on the technique to execute trenchless laying of the pipeline (HDD or Micro tunneling). As per present practice, geotechnical investigations along the pipeline route at every 500 m to 1000 m are generally carried out. For water bodies, hydrological investigations including soil geotechnical investigations for higher depths are carried out. However, there are enough instances where during execution, it has been found that actual soil parameters are different than what has been reported in soil investigation report.

Recommendation: Selection of entities for geo-technical investigation along the pipeline route and for hydrological investigations at water bodies may be based on the Quality and Cost Based Selection (QCBS) method rather than the L1 criterion, given the critical bearing of investigation quality on project design

and execution outcomes

- iv. Probability of river meandering: There is no comprehensive guideline or documentation for this activity, and since there is no way to estimate the likely future scenario due to global warming.

Recommendation: with regard to this is covered under Geo-hazard assessment.

- v. Techniques used for water body crossings: Over the years, trenchless techniques have improved a lot. Trenchless techniques are:

- Horizontal directional drilling (HDD): HDD up to 4 Km have been successfully carried out.
- Micro tunneling: This is used where HDD is not feasible due to presence of loose stones, crushed limestone, gravel, pebbles, cobbles, slate, gravels etc. To the best of the committee's knowledge, pipeline laid using trenchless techniques have not faced failures between punch in and punch out points. However, pipelines laid through open cut techniques have seen a significant number of failures. It is felt that use of open cut to cross water bodies must be avoided, if unavoidable, may be used only after formally recording valid technical reasons. However, delay in project implementation or increased cost shall not constitute valid justification for the same.

Recommendation: All water body crossings shall be executed using trenchless techniques (Horizontal Directional Drilling or Micro-tunneling). Use of open cut

technique shall be avoided. Open cut, if unavoidable, may be used only after formally recording valid technical reasons and approval from competent authority. However, delay in project implementation or increased cost shall not constitute valid justification.

4) Pipeline laying in close proximity to river:

To the extent possible, laying of pipeline parallel to river in close proximity (within 50 m or within the irrigation boundary whichever is less) should be avoided. Wherever, it is unavoidable, proper measures should be taken.

Recommendation: *Wherever it is unavoidable to lay pipeline parallel to river in close proximity, following measures are recommended:*

- ✓ Provide bank protection.
- ✓ Use concrete-coated pipes.
- ✓ Pipeline markers shall be installed at close intervals.
- ✓ Such stretches shall be monitored on the same frequency as mentioned in “Geo-Tagging and Periodic Monitoring”.

5) Length of HDD:

Punch-in and punch-out points are decided based on width of water body and permissible radius of curvature of the pipeline. Recent failures outside punch-in and punch-out points point to inadequacy of methods used to estimate maximum width of water body.

Recommendation: *Maximum possible width of the water body shall be established based on the Geo Hazard Study. Punch-in and punch-out points shall be established keeping the pipe straight for the maximum possible width with*

the permissible radius of curvature. The length of HDD shall thereafter be further increased on each bank by 10 per cent of the maximum possible width or 100 m, whichever is higher.

6) Minimum cover below scour depth:

Recommendation: *Noting the increasing frequency and magnitude of extreme rainfall events and improved construction capabilities, the Committee recommends that the minimum cover requirement below the computed scour depth for all hydrocarbon pipelines be increased to 2.5 metres uniformly, superseding the currently differentiated provisions for major/minor rivers across liquid hydrocarbon, LPG, and gas pipelines.*

7) Geo-hazard Assessment:

Looking at various failures, committee felt the need for systematic geo-hazard assessment. The objective of the Geo-Hazard Assessment is to identify and evaluate geological and geomorphological hazards along the proposed pipeline alignment that may adversely affect pipeline construction, integrity methodology, operation, and design life, and to recommend engineering mitigation measures.

It is considered essential that all potential risks due to extreme events related to water bodies and seismicity are identified during the design stage of the project and measures to mitigate such risks are taken during project execution. This calls for detailed Geo Hazard Assessment along the pipeline route for all trunk pipelines (excluding CGD networks). Such assessment shall include the following:

- i.) Hazard faced in crossing water bodies.

- ii.) Hazard pertaining to meandering of Rivers.
- iii.) Hazards in crossing through areas prone to landslides.
- iv.) Hazard in running pipeline parallel to water bodies.
- v.) Hazard due to seismicity along the pipeline route including wave propagation effects, soil liquefaction, fault displacement and soil displacement.
- vi.) Hazard due to change in rainfall pattern on account of global warming.

Recommendation:

The Committee recommends that a formal Geo Hazard Assessment as per ISO 20074 ('Petroleum and natural gas industry Pipeline transportation systems Geological hazard risk management for onshore pipeline') be made a mandatory element of design for all new trunk pipelines. At the Detailed Feasibility Report (DFR) stage, such assessment may be based on a desktop study. The DFR submitted to PNGRB shall necessarily include a chapter on Geo Hazard Assessment. A detailed quantitative assessment shall be carried out as part of detailed engineering. Apart from requirements of ISO 20074, study shall include effect of likely increase of rainfall intensity due to global warming.

For existing trunk pipelines, impact of likely increase of rainfall due to global warming should be studied and remedial action be taken within a time span of 5 years.

8) Controlled desilting on upstream of river crossings:

Excessive shoal formation on one side of the

river changes flow pattern. It may result in increase in flow velocity on the other side resulting into river meandering. Such behavior is very common on curvilinear path of water. As far as possible crossings at such locations should be avoided. However wherever it is not avoidable or the pipeline has already been laid, the solution lies in regular desilting. As of now NGT has imposed a blanket ban on desilting of most of the rivers.

Recommendation: PNGRB/Entity may approach National Green Tribunal (NGT) to permit controlled desilting up to 500 m upstream of pipeline crossing.

9) Other issues deliberated amongst the committee members:

Other issues deliberated amongst the committee members related to Geo tagging & monitoring, minimum cover requirement, geo-technical investigations along pipeline route, anti-buoyancy measures, location of SV stations etc. Committee's **recommendations** are as under:

a) Anti-Buoyancy Measures:

Wherever anti-buoyancy measures are required, they shall be provided in the form of concrete coating applied to the pipe. Anti-buoyancy measures in the form of placing discrete concrete blocks over the pipe shall not be used.

b) Sectionalizing Valves (SVs): Remotely operated SVs shall be located as close as practicable to major and perennial river crossings, on both banks. Both SV stations at such crossings shall be provided with hook-up connections along-with PRS/MRS upstream & metering skid for alternate supply in emergency situations.

c) Geo-Tagging and Periodic Monitoring:

- i. Riverbanks up to 500 m upstream of river crossings shall be geo-tagged and monitored at least every 7 days during the monsoon season, immediately after any abnormal off-season water flow, and at least once in every 60 days during the rest of the year for abnormal changes.
- ii. HDD hook-up points shall be geo-tagged.
- iii. Depth of riverbed or water body shall be monitored post-monsoon and after any abnormal water flow event.
- iv. Any flow above the designed Highest Flood Level (HFL) shall be treated as abnormal.

CHAPTER 3.5 — DESIGN PRACTICES AND SYSTEMIC GAPS

Design gaps identified by the committee

Infographic 1 of 2 | Source: Ch. 3.5, Report of the Industry Committee, PNGRB (May 2026)

The committee examined design practices and systemic conditions across NGPL and PPPL river crossings. All failures reviewed arose from **excessive rainfall and river meandering**. Wherever trenchless techniques were used, failures occurred **beyond the HDD punch-in/punch-out points** — pointing to inadequate design margins, not construction failure.

DESIGN AND ENGINEERING GAPS (6)

01 **Scour depth calculation - methodology ambiguous**
IRC 78 provides different multiplication factors for piers and abutments, leaving room for designers to arrive at varying scour depths. Special study conditions (bends, dam proximity, oblique flow) are inconsistently applied.

04 **Open-cut crossings still in use**
Open-cut river crossings have seen significantly higher failure rates than trenchless sections. HRDP (Song-2) and MMBPL both used open-cut - both failed during flash floods. Trenchless sections at the same sites were unaffected.

07 **No systematic geo-hazard assessment**
No formal requirement to identify geological and geomorphological hazards along pipeline alignment at the design stage. River meandering probability, landslide zones, and rainfall pattern changes are not systematically evaluated.

OPERATIONAL AND MONITORING GAPS (2)

02 **Seismic risk - largely unaddressed**
Only fault-zone flexibility has been partially addressed. Permanent ground deformation, liquefaction buoyancy, and seismic wave propagation are not systematically accounted for during pipeline design and execution.

05 **HDD punch-out margins insufficient**
Punch-in/punch-out points are determined based on current observed width of water bodies. Maximum possible flood-width under extreme conditions is not used, leaving pipelines exposed beyond trenchless extents.

PROCESS AND PROCUREMENT GAPS (1)

03 **HFL estimation ignores climate change**
Highest Flood Level is estimated from historical data alone. Likely increase in rainfall intensity and frequency due to global warming is not factored into HFL estimation at the design stage.

06 **Anti-buoyancy - discrete block weights inadequate**
HRDP used inverted U-shaped saddle weights instead of concrete-coated pipe. Discrete concrete blocks placed over the pipe can be dislodged by boulder impact or extreme flow - as observed during the Song-2 failure.

09 **L1 (lowest-cost) selection for geotechnical investigations**
Geotechnical and hydrological investigations are awarded on L1 basis. Actual soil parameters at execution stage frequently differ from investigation reports - a recurring design risk with significant failure consequences.

Chapter 4:

Review of Existing Regulations

The regulatory review covered PNGRB's T4S Regulations for Natural Gas Pipelines (NGPL), City Gas Distribution Networks (CGD), and Petroleum and Petroleum Product Pipelines (PPPL), along with the ERDMP Regulations and related amendments as listed on PNGRB's website. Latest amendments including CGD T4S and ERDMP Regulations, were examined to capture the latest regulatory intent on safety, integrity, and emergency preparedness. The review benchmarked provisions against international best practice on river crossing integrity, scour and exposure management, and water crossing monitoring, focusing particularly on natural calamity risks such as floods and extreme hydrological events. This framework enabled the Committee to distinguish between strengths of the current T4S Regulations and specific gaps that merit amendment or guidance. In the preceding chapter, we have already brought out the certain recommendations which need to be incorporated in the existing regulations related to trunk lines. Here we focus and discuss mainly with regard to CGD networks.

4.1 City Gas Distribution (CGD) Networks:

i) Adequacy of T4S Regulations relevant to CGD linked pipelines:

The CGD T4S Regulations (2008, with subsequent amendments) define the CGD network as the interconnected system of pipelines and equipment that transport gas from highpressure Pipeline to end consumers and CNG stations within an authorized geographical area, with CGS as the custody-transfer point. Recent amendments

clarify that if the CGS is located outside the authorized area, the connecting pipeline up to the CGD network is considered part of the CGD network, bringing such feeders under the CGD T4S regime. The CGD T4S Regulations specify design, construction, operation and maintenance requirements for both steel and PE pipelines, including risk assessment (QRA) for pipelines and provisions for valve spacing based on location class, with some flexibility outside municipal limits subject to compliance with NGPL T4S Regulations.

ii) Limitations in current safety and resilience provisions:

Despite the above mentioned strengths, the CGD T4S Regulations are largely focused on physical safety and integrity of distribution pipelines and consumer installations, with limited explicit treatment of supply resilience to upstream pipeline or supplychain disruptions. The regulations do not require CGD entities to design networks with multiple feeds, looped transmission grids, or predefined alternate supply mechanisms to withstand transmission outages, even though recent upstream incidents have demonstrated substantial impact on industrial, commercial and domestic PNG segments. Furthermore, while risk assessment is mandated for larger diameter pipelines, the Regulation is not yet systematically linked to supply continuity objectives (e.g. redundancy levels) or to specific contingency planning obligations for different consumer classes.

iii) Observations on emergency preparedness ERDMP Regulations:

Currently ERDMP apply across mid and downstream petroleum and natural gas entities and require entities to develop ERDMPs that classify emergencies, analyze risks, and prepare for events including floods, earthquakes, and other disasters. However, there is currently no CGD specific ERDMP annexure that models cascading upstream gas supply disruptions and prescribes minimum

emergency arrangements such as portable CNG cascades, inter connections with neighboring CGD networks etc. Recent upstream supply disruption show that companies are relying on ad hoc consumer communications rather than on a PNGRB standardized ERDMP template for such events. There is a regulatory opportunity to the linkage between CGD T4S, ERDMP, and PNGRB's consumer protection and supply security mandate.

What Exist	Key Gaps	Regulatory Opportunity
 CGD T4S Regulations define CGD network and CGS boundary	 Regulations focus primarily on asset safety and integrity.	 Introduce supply standards within CGD T4S Regulations.
 Feeder pipelines connected to off-GA CGS included under CGD framework	 No CGD-specific framework for upstream gas supply disruption scenarios.	 Mandate contingency planning and alternate supply mechanisms.
 Covers design, construction, O&M, QRA and valve spacing	 No prescribed emergency arrangements such as CNG cascades, interconnections, etc.	 Define minimum redundancy requirements for critical consumers.
 ERDMP mandates emergency preparedness and disaster response planning	 Reliance on ad hoc consumer communication during disruption events.	 Standardize emergency response protocols for supply disruptions.
 Risk assessment provisions exist for pipelines.	 No requirement for multiple feeds, network redundancy or alternate supply arrangements.	 Strengthen linkage between T4S, ERDMP and consumer protection objectives.

Chapter 5:

Measures to Strengthen Security of Supply

5.1 Supply networks

Supply networks extend from the source of supply to the ultimate consumer. For gas, sources of supply are indigenous as well as imported. From natural gas which is mostly a mix of C1, C2, C3 and C4. C2, C3 and C4 are recovered at various points and C1 is distributed to various regions of the country through a network of pipelines which operate at high pressures in the range of 90 bar. Feeder lines are laid to further distribute the gas to industrial consumers and to CGD networks. Another source of natural gas which has taken off in recent past is Bio-Gas plants which use agro waste or press-mud as feed stock. These plants produce Bio-Gas at a low pressure. In case of availability of CGD network in the area, they compress it to the required line pressure (around 04-05 bar) of CGD and inject into CGD network. In case of non-availability of CGD network, they compress it to pressure of around 200 bar and supply it in cascades to the CNG dispenser stations. Such plants are distributed in various states and are having capacity varying from as low as 0.4 ton per day to 30 ton per day. Central Govt. and various State Govts are encouraging installation of such plants to increase supply of CNG and to control pollution. Currently such plants are producing about 443 ton per day of CBG.

C3 and C4 are supplied as LPG to various bottling plants. C2 is primarily used as feedstock for petrochemical plants.

Another source of LPG fuel is petroleum refineries.

LPG produced in refineries is sent through pipelines / road tankers to LPG bottling plants and thereafter to consumers.

Petroleum Product Pipelines emanate from various refineries to various oil storage depots. From Oil storage depots, distribution of products to various dispensing stations is mostly through road transport.

From above, one can see that ensuring supply security through the complete network from source to consumer is a very vast topic. Ensuring supply security in main lines is not discussed in this report. Supply security of petroleum products is more simple as alternate of road/rail transport is mostly available.

Various steps which may be taken to ensure uninterrupted supply are discussed in the following paragraphs.

5.2 Precautions

First and foremost step is to take all possible precautions to avoid supply disruptions. Such precautions include:

- i) Identification of all vulnerable stretches (Road Crossings and High Traffic Areas, Congested Urban Areas, River, Drain, and Nallah Crossings, Utility Congested Corridors etc.) to be done on half yearly or any other proposed frequency. List of vulnerable stretches shall be updated based on new observations during patrolling carried out as per stipulated frequency.

- ii) Frequent monitoring of such areas through patrolling and aerial surveys using drones.
- iii) Immediate action in case any problem is encountered. Actions may include:
 - Sandbags/gro-bags/geo-tubes, gabion toe protection, riprap dumping, articulated concrete mattress over the crossing zone.
 - Temporary flow training (spurs/deflectors) only if hydraulic approvals feasible.
 - Temporary pipe support (if free spanning is significant): engineered supports/saddles (avoid hard point damage)
 - Emergency repair readiness.
 - Clamp/sleeve contingency, pre-fabricated spool, temporary bypass plan (project-specific).

a. Supply Source Redundancy and Adequacy:

CGD entities should progressively move from single-feed configurations to multiple-feed, looped steel transmission grids options within their authorized areas, especially in large metropolitan regions. This includes establishing more than one CGS where feasible, connecting to different NGPL corridors or supply sources, and creating interconnections between high pressure transmission lines to allow alternative flow paths during transmission outages. Within cities, ring mains and sectionalizing valves should be designed to isolate sectors in the event of local damage while maintaining supply to critical loads, with QRA and hydraulic simulations used to optimize the system. Priority sectors should be embedded into planning so that switching and curtailment actions can be executed quickly and consistently.

5.3 Multiple Injection Points and Network Looping

Networks should be adequately looped, with multiple gas injection points to enable operational flexibility through bi-directional flow in both steel and MDPE networks.

5.4 Alternate Supply Arrangements

Alternate supply mechanisms and contingency planning is required to mitigate dependence on continuous upstream gas flows. Regulation should mandate CGD entities to develop robust alternate supply mechanisms such as:

- LCNG/CNG mother stations capable of feeding the existing network requirements
- Mobile DCUs that can be used during upstream disruption scenarios.

5.5 Inter-Connectivity with Adjacent CGD

Interconnection with CGD networks with adjacent or nearby GAs should be explored and established to facilitate emergency support and enhance network resilience.

5.6 Comprehensive Supply Security Plan

A GA-wise Supply Security Plan should be developed by the entities covering:

- Identification of risks to supply continuity.
- Mitigation measures.
- Alternate supply mechanisms; and
- Mutual-aid arrangements with neighboring networks.

The plan may be periodically reviewed by the management to assess its effectiveness for addressing consumer requirements during supply disruptions.

5.7 Hook up connections at SV stations

All SV stations on both sides of the vulnerable stretches shall be provided with hook-up

connections along-with PRS & metering skid for alternate supply in emergency situations.

5.8 Focus on Bio CNG plants

Installation of more Bio-CNG plants in all districts where feed stock is available. As per a report published by World Biogas Association, total potential of bio-CNG generation in India is 62 MMT/annum. Even if 25% of the total potential is exploited, it will be a huge quantity when compared to current CNG + PNG consumption of about 9 MMT/annum. This new source will be spread almost all over the country leading to supply security in a big way.

5.9 CGD Specific Regulatory Recommendations

The Committee is of the opinion that PNGRB:

- Introduce explicit CGD T4S provisions on

network redundancy, multifeed design, and looped transmission grids for large GAs, with phased targets based on GA size and load.

- Mandate that CGD ERDMPs to include upstream disruption scenarios, alternate supply strategies, and internal looping scheme. Further, PNGRB may issue guidance recommending that CGD entities maintain a minimum level of strategic line pack and, where feasible, develop intra-Geographical Area storage solutions - such as line pack in large-diameter feeder pipelines or LNG/LCNG storage facilities and mobile DCUs - to cater upstream supply fluctuations, subject to applicable safety requirements and compliance with provisions of T4S Regulations.



Chapter 6:

Conclusions and Way Forward

6.1 Consolidated Findings Across NGPL, PPPL and CGD

- River crossings and vulnerable terrains as critical nodes:

Across NGPL, PPPL and CGD river crossings and geologically sensitive terrains emerge as high-risk locations. These segments are particularly susceptible to environmental and hydraulic uncertainties affecting pipeline stability.

- Influence of design assumptions and lifecycle monitoring:

Design-stage assumptions related to floods, scour depth, and river meandering, combined with ongoing lifecycle monitoring, play a decisive role in ensuring both operational safety and continuity of supply.

- Proactive crossing selection and optimized routing:

Best practices emphasize careful selection of crossing locations and alignment optimization to minimize exposure to erosion, shifting channels, and other long-term geotechnical risks.

- Adoption of deep trenchless installations: Deep trenchless techniques, such as HDD, are increasingly preferred where feasible, as they reduce direct exposure of pipelines to river-bed dynamics and enhance long-term structural integrity.

- Pre-engineered mitigation measures:

Incorporating mitigation measures such as bank protection, pipeline armouring, and stabilization structures at the design stage helps reduce reactive interventions and enhances resilience.

- Coordination with upstream suppliers: Close coordination with gas suppliers enables timely adjustments in allocation and supply planning, thereby reducing the impact of upstream constraints or disruptions.

- Use of alternative systems and re-routing strategies:

Deployment of network flexibility measures, including alternate supply routes and system interconnections, helps maintain service continuity during localized failures.

- Codification in ERDMP templates: These operational practices should be formally integrated into PNGRB-mandated ERDMP templates to ensure standardized emergency preparedness across entities.

- Incorporation into T4S provisions: These practices should also be embedded into T4S regulations to institutionalize design and operational safeguards at the regulatory level.

- Strengthening river crossing integrity management:

Enhanced focus on monitoring, design validation, and risk mitigation at river crossings is essential to address recurring vulnerabilities identified across systems.

- Need for system redundancy:
Building redundancy through loop lines, alternate feeds, and interconnections improves network robustness and reduces dependency on single critical assets.
- Importance of contingency planning:
Comprehensive contingency planning ensures that operators can respond effectively to disruptions through predefined actions, minimizing downtime and service impact.
- Embedding policy directions into T4S and ERDMP:
Institutionalizing these policy measures within T4S and ERDMP frameworks will ensure consistency, enforceability, and long-term adoption across entities.

6.2 Summary of Recommendations

i) Regulatory Strengthening

- Amend T4S regulations to explicitly incorporate:
 - ♦ **Geo-hazard assessment** as a mandatory design requirement
 - ♦ Enhanced criteria for **scour depth, minimum cover below scour depth, HFL estimation, and HDD length**
 - ♦ Checking of design against earthquakes
 - ♦ Mandatory use of **trenchless techniques** for water body crossings (with limited exceptions)
- Introduce CGD-specific provisions on:
 - ♦ Network redundancy and multi-feed configurations
 - ♦ Incorporation of supply security measures into regulatory framework

ii) Engineering and Design Enhancements

- Institutionalize geo-hazard assessment in line with international practices (e.g., ISO 20074) and IITK-GSDMA Guidelines for Seismic Design of Buried Pipelines.
- Increase design margins for river crossings, including:
 - ♦ Extended HDD lengths
 - ♦ Conservative Scour depth as per IRC 78, Controlled desilting upto 500m in Monitoring & preventive measures
- Standardize use of **concrete coating for anti-buoyancy** and avoid open-cut methods wherever feasible
- QCBS method may be adopted for the selection of competent entities for geotechnical investigation.

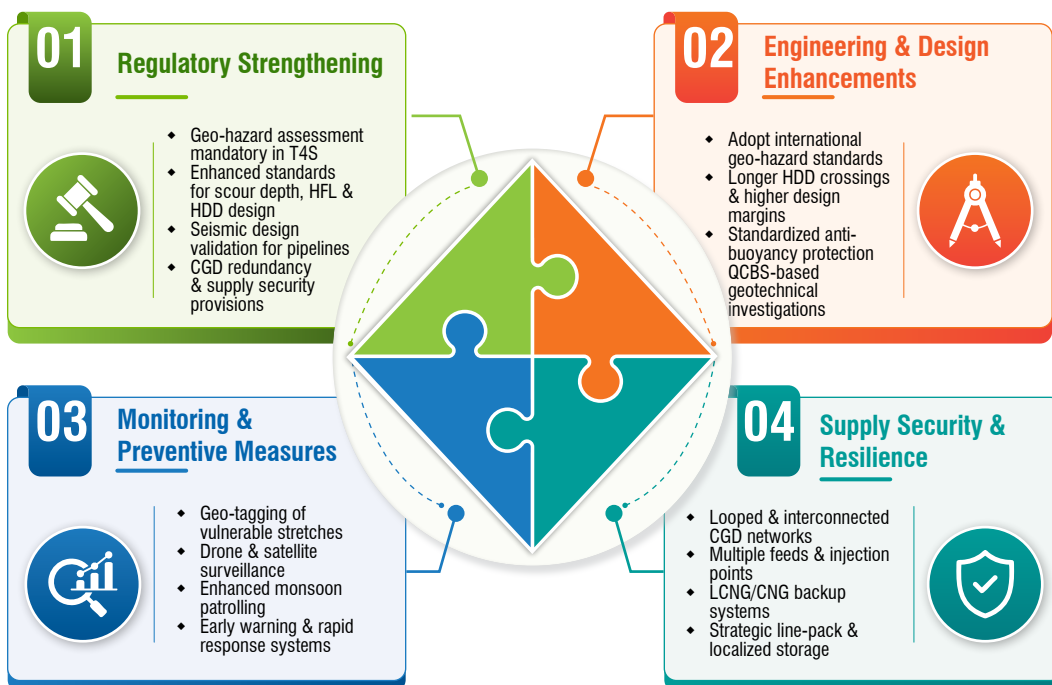
iii) Monitoring and Preventive Measures

- Implement **risk-based monitoring** of vulnerable stretches through:
 - ♦ Geo-tagging
 - ♦ Drone and satellite surveillance
 - ♦ Increased patrolling during monsoon periods
- Establish early warning and rapid response systems for abnormal hydrological conditions

iv) Supply Security and Resilience

- Transition CGD networks towards:
 - ♦ **Looped and interconnected systems**
 - ♦ Multiple supply sources and injection points
- Develop alternate supply arrangements such as:
 - ♦ **LCNG/CNG backup systems**

- Maintain strategic line pack and localized storage, wherever feasible, to buffer short-term disruptions



Annexure I: Copy of PNGRB Order dated 07.10.2025



पेट्रोलियम एवं प्राकृतिक गैस विनियामक बोर्ड
Petroleum and Natural Gas Regulatory Board
ई-400, चतुर्थ तल, एनबीसीसी डब्ल्यूटीसी, नौरोजी नगर, नई दिल्ली - 110029
E-400, 4th Floor, NBCC WTC, Nauroji Nagar, New Delhi – 110029

PNGRB/Tech/18-IndustryComm./CGD,NGPL,PPPL/(7)/2025 Date: 07.10.2025

Order

Subject: Constitution of an Industry Committee to review and propose amendments to PNGRB (T4S) Regulations for City Gas Distribution (CGD), Natural Gas Pipelines (NGPL) and Petroleum & Petroleum Product Pipelines (PPPL) —with specific focus on damages being recorded in various types of pipelines due to natural calamities etc.

As per the PNGRB Act, 2006, the objective behind enactment and creation of the Board is “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”.

2. In the last several years, due to unseasonal rain and unexpected large flow in streams, the pipelines crossing the latter have been breached in unusual numbers and disrupted the supply of both petroleum products and natural gas. In order to ensure uninterrupted and adequate supply of petroleum, petroleum products and natural gas in all parts of the country and to obtain guidance from industry experts, the Board has decided to constitute a committee consisting of following members to undertake an expedited review of PNGRB (Technical Standards and Specifications including Safety) for CGD, NGPL and PPPL Regulations.

Sr. No.	Name	Designation and Organisation	Position
1	Shri R D Goyal	Ex Director-Projects (GAIL (India) Ltd)	Chairman
2	Shri D S Nanaware	Ex Director (IOCL -Pipelines)	Member
3	Shri R K Grover	Ex Director Projects (EIL)	Member
4	Shri G V Walimbe	Ex ED (MECON Limited, India)	Member
5	Shri Ganesh S Wankhade	Ex ED (BPCL)	Member
6	Shri Gagan Aggarwal	DD (I/C) Technical Division, PNGRB	Convener

3. The Terms of Reference of the Committee shall be as under:

- a. Analysis of root causes/factors contributing to recent instances of pipeline exposure/rupture at or near river crossings etc. and recommend short-term and long-term Engineering/Technical solutions to minimize recurrence of such exposures/ruptures,

- b. Review and recommend amendments in PNGRB Regulations to make them more effective to prevent incidents of pipeline exposures/ruptures especially due to natural calamities,
 - c. Recommend suitable measures for strengthening security of supply for Natural Gas and Petroleum & Petroleum Products in the country, in case of any disruption in main pipeline network by way of alternate supply pipelines and other measures.
4. The Industry Committee will submit its final report within three months from date of issuance of this order.
5. Honorarium of Rs 35000/- for the Chairman and Rs 25,000/- for each member will be admissible for attending any meeting. For outside meetings, they will be entitled to the same entitlements as they were drawing before their superannuation in respective CPSEs.

This has been issued with the approval of the competent authority.

Yours faithfully,



(Anjan Kumar Mishra)
Secretary

Copy:

1. All Committee Members
2. Internal Circulation

Annexure II: Summary of Pipeline Incidents Reviewed

S. No	Pipeline Details	Entity	Incident Date	GAs Affected	Brief Details of Disruption
1	Karanpur-Moradabad-Kashipur-Rudrapur Pipeline (KMKRP)	GAIL	10.08.25	i. Udham Singh Nagar ii. Pithoragarh, Champawat, Almora, Chamoli and Bageshwar districts iii. Bijnor and Nainital Districts	97 industries, more than 56 commercial customers and supply to 19 nos. of CNG stations was disrupted.
2	Dadri Bawana Nangal pipeline (DBNP)	GAIL	16.08.25	i. Sonipat ii. Sonipat District (EAAA) & Jind District iii. Jhajjar District iv. National Capital Territory of Delhi	464 industries, more than 176 commercial customers and supply to 21 nos. CNG stations was disrupted.
3	Haridwar-Rishikesh-Dehradun Pipeline (HRDP)	GAIL	16.09.25	Dehradun District	Supply to 5 nos. of online CNG stations was disrupted.
4	RCF GAIL CHEMBUR TERMINAL in TROMBAY-MGL Pipeline (GCTP)	GAIL	16.11.25	Mumbai & Greater Mumbai	166 nos. CNG stations and 215 nos. Industrial/Commercial connections were disrupted.
5	8 Inch Steel Pipe at Golden Chowkadi, Vadodara	VGL	30.11.25	Vadodara	Over 1.5 lakh D-PNG, 1200 Commercial and 3 Mother & 7 Online stations were affected.
6	KRNPL (Kurukshetra-Roorkee-Najibabad Pipeline)	IOCL	21.08.25	-	Heavy monsoon flow caused severe riverbed scouring, exposing the pipeline and subjecting it to hydrodynamic forces, resulting in suspected rupture.
7	MMBPL (Mumbai-Manmad-Bijwasan Pipeline)	BPCL	26.08.25	-	River course change and erosion removed soil support at the crossing, creating unsupported pipeline span and bending stress. Possible coating damage and localized corrosion contributed to leakage.

Annexure III – Proposed amendment in PNGB Technical Regulations in NGPL / PPPL

S. No.	Proposed change area	Suggested amendment / requirement	Applies to
1	Geo-hazard assessment during DFR stage	DFR shall include a chapter on Geo hazard assessment as per ISO 20074. Such study shall be a desktop study. Apart from requirements of ISO 20074, study shall include effect of likely increase of rainfall intensity due to global warming. Detailed study shall be carried out during detail engineering.	NGPL, PPPL
2	Geo-hazard assessment during Detailed engineering	For all trunk pipelines, environmental conditions shall be established through a detailed geo-hazard assessment as per ISO 20074. Desktop Geo-hazards assessment carried during DFR stage shall be further detailed on a quantitative basis during detail engineering. Apart from requirements of ISO 20074, study shall include effect of likely increase of rainfall intensity due to global warming.	NGPL, PPPL
3	Scour depth calculation	Maximum scour depth shall be calculated as per the applicable Para of IRC 78 - Para 703.2, 703.3, or 703.4 as the situation warrants. Where Para 703.2 applies, calculations shall be based on the multiplication factor for pier for the load case of flood without seismic combination. Special studies for scour depth shall be carried out wherever the conditions outlined in Paras 703.3 and 703.4 apply	NGPL, PPPL
4	Water body crossing method	All water body crossings shall be executed using trenchless techniques (Horizontal Directional Drilling or Micro-tunneling). Use of open cut technique shall be avoided. Open cut, if unavoidable, may be used only after formally recording valid technical reasons. However, delay in project implementation or increased cost shall not constitute valid justification	NGPL, PPPL
5	HDD Length and Punch-In/Punch-Out Margins	Maximum possible width of the water body shall be established based on the Geo Hazard Study. Punch-in and punch-out points shall be established keeping the pipe straight for the maximum permissible width with the permissible radius of curvature. The length of HDD shall thereafter be further increased on each bank by 10 per cent of the maximum possible width or 100 meters, whichever is higher.	NGPL, PPPL

6	Minimum cover below scour depth	Minimum cover below computed scour depth shall be 2.5 m for all hydrocarbon pipelines, replacing differentiated requirements for major/minor rivers and product categories.	NGPL, PPPL
7	SV station location at major river crossings	Remotely operated Sectionalizing Valves (SV) shall be located as close as practicable to major and perennial river crossings, on both banks. Both SV stations at such crossings shall be provided with hook-up connections along-with PRS & metering skid for alternate supply in emergency situations.	NGPL, PPPL
8	Anti-buoyancy measures	Wherever anti-buoyancy measures are required, they shall be provided in the form of concrete coating applied to the pipe. Anti-buoyancy measures in the form of placing discrete concrete blocks over the pipe shall not be used	NGPL, PPPL
9	Geo-tagging and periodic monitoring	i. Riverbanks up to 500 meters upstream of river crossings shall be geo-tagged and monitored at least every 7 days during the monsoon season, immediately after any abnormal off-season water flow, and at least once in every 60 days during the rest of the year for abnormal changes. ii. HDD hook-up points shall be geo-tagged. iii. Depth of riverbed or water body shall be monitored post-monsoon and after any abnormal water flow event. Any flow above the designed Highest Flood Level (HFL) shall be treated as abnormal.	NGPL, PPPL
10	Pipeline in Close Proximity to Rivers	To the extent possible, laying of pipeline parallel to river in close proximity (within 50 meter or within the irrigation boundary whichever is less) shall be avoided. Wherever, it is unavoidable or has already been laid, following measures shall be provided: i. Provide bank protection, ii. Use concrete-coated pipes iii. Pipeline markers shall be installed at close intervals iv. Such stretches shall be monitored on the same frequency as the river-bank geo-tagging protocol above.	NGPL, PPPL

11	Seismic design	All new trunk pipelines shall be checked against seismic damage using the IITK-GSDMA Guidelines for Seismic Design of Buried Pipelines until IS 1893 Part 7 ('Design Earthquake Hazard and Criteria for Earthquake-Resistant Design of Structures Part 7: Long-distance Pipelines') is published, after which IS 1893 Part 7 shall be applied mandatorily	NGPL, PPPL
12	Controlled Desilting Upstream of Crossings	PNGB/Entity may approach the National Green Tribunal (NGT) to permit controlled desilting up to 500 m upstream of pipeline crossings	NGPL, PPPL
13	Selection of Entities for Geo-technical investigations	Selection of entities for geo-technical investigation along the pipeline route and for hydrological investigations at water bodies may be based on the Quality and Cost Based Selection (QCBS) method rather than the L1 criterion, given the critical bearing of investigation quality on project design and execution outcomes	NGPL, PPPL



Proposed amendment in PNGRB Technical Regulations in CGD

S. No.	Proposed change area	Suggested amendment / requirement	Applies to
1	Precautionary measures	a. Identification of all vulnerable stretches. b. Frequent monitoring of such areas through patrolling and through aerial surveys using drones. c. Maintaining digital record of patrolling and aerial surveys. d. Immediate action in case any problem is discovered. Actions may include: - d.1 Sandbags/gro-bags/geo-tubes, gabion toe protection, riprap dumping, articulated concrete mattress over the crossing zone - d.2 Temporary flow training (spurs/deflectors) only if hydraulic approvals feasible - d.3 Temporary pipe support (if free spanning is significant): engineered supports/saddles (avoid hard point damage) - d.4 Emergency repair readiness - d.5 Clamp/sleeve contingency, pre-fabricated spool, temporary bypass plan (project-specific).	CGD
2	Supply Source Redundancy and Adequacy	CGD entities should progressively move from single feed, configurations to multiple feed, looped steel transmission grids within their authorized areas, especially in large metropolitan regions. This includes establishing more than one CGS where feasible, connecting to different NGPL corridors or supply sources, and creating inter connections between high pressure transmission lines to allow alternative flow paths during transmission outages. Within cities, ring mains and sectionalizing valves should be designed to isolate sectors in the event of local damage while maintaining supply to critical loads, with QRA and hydraulic simulations used to optimize the Priority sectors should be embedded into planning so that switching and curtailment actions can be executed quickly and consistently.	CGD
3	Inter-Connectivity with Adjacent CGD	Explore interconnection with CGD networks in adjacent or nearby GAs to facilitate emergency support and enhance network resilience	CGD

4	Supply Prioritization Framework	A graded, pre-approved segment-wise and consumer wise supply plan should be formulated to ensure continuity of supply to priority segments in case of disruptions	CGD
5	Comprehensive Supply Security Plan	A GA-wise Supply Security Plan should be developed covering: • Identification of risks to supply continuity; • Mitigation measures; • Alternate supply mechanisms; and • Mutual-aid arrangements with neighboring networks	CGD
6	Focus on Bio CNG plants	Installation of more Bio-CNG plants in all districts where feed stock is available	CGD
7	ERDMP enhancement	Mandate that CGD ERDMPs include upstream-disruption scenarios, alternate supply strategies, and prioritization schemes.	CGD
8	Strategic line-pack / storage guidance	Issue guidance to maintain minimum strategic line-pack and, where feasible, in-city storage such as line-pack in large-diameter feeders or LCNG storage, subject to safety constraints.	CGD



Annexure IV: Revised PNGRB Order Dated 13.05.2026



पेट्रोलियम एवं प्राकृतिक गैस विनियामक बोर्ड Petroleum and Natural Gas Regulatory Board

ई-400, चतुर्थ तल, टॉवर ई, वर्ल्ड ट्रेड सेंटर, नौरोजी नगर, नई दिल्ली - 110029
PNGRB E-400, Fourth Floor, Tower E, World Trade Centre, Nauroji Nagar, New Delhi - 110029

PNGRB/Tech/18-IndustryComm./CGD,NGPL,PPPL/(7)/2025 (E-6193)

13.05.2026

ORDER

Subject: Constitution of an Industry Committee to review and propose amendments to PNGRB (T4S) Regulations for City Gas Distribution (CGD), Natural Gas Pipelines (NGPL) and Petroleum & Petroleum Product Pipelines (PPPL) with specific focus on damages being recorded in various types of pipelines due to natural calamities.

This is in furtherance to the order dated 07.10.2025 regarding Constitution of an Industry Committee to review and propose amendments to PNGRB (T4S) Regulations for City Gas Distribution (CGD), Natural Gas Pipelines (NGPL) and Petroleum & Petroleum Product Pipelines (PPPL) with specific focus on damages being recorded in various types of pipelines due to natural calamities.

2. It is informed that Shri Pradeep Tanwar, Director (Technical) has been nominated as Convener of the Committee w.e.f. 08.05.2026 instead of Shri Gagan Aggarwal, Deputy Director (I/C) Technical.

3. This issues with the approval of the Competent Authority.



(Anjan Kumar Mishra)
Secretary

Copy:

- 1.All Committee Members
- 2.Internal Circulation

PNG no stop
Zindagi

PNG Drive
January 1, 2026 to June 30, 2026

CNG no stop
Zindagi

[illegible]



पेट्रोलियम एवं प्राकृतिक गैस विनियामक बोर्ड
Petroleum and Natural Gas Regulatory Board

ई-400, चतुर्थ तल, टॉवर ई, एनबीसीसी वर्ल्ड ट्रेड सेंटर, नौरोजी नगर, नई दिल्ली-110029

E-400, 4th Floor, Tower-E, NBCC World Trade Center, Nauroji Nagar, New Delhi - 110029

Website: <https://pngrb.gov.in/>

