



# Pipeline Integrity for CGD

## – Key issues and challenges

*2nd Knowledge Sharing Workshop  
for CGD*

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# INTRODUCTION

- The rapid growth of business all over the India requires increasing hydrocarbon transport capacity which requires special attention towards its safety for uninterrupted supply
- A pipeline is actually a system of equipment designed to allow material to flow continuously from one location to another with a proper safety in operation.
- With sophisticated technologies providing increased applications, pipelines are gaining advantage over other means of transport due to economic and safety considerations.





# KEY FEATURES ON IMS

- IMS ensure the integrity of the CGD network by employing various techniques to address the likely cause of threat to the system and their mitigation. The IMS regulations follow the system of schedule for addressing specific issues pertaining to IMS.
- These regulations shall apply to all the entities laying, building, operating or expanding city or local natural gas distribution networks.
- These regulations shall cover all existing and new city gas distribution networks including sub-transmission pipelines, city gas station, distribution mains and piping facilities downstream of inlet isolation valve of city gas station including consumer meter for commercial or industrial customer and up to the final isolation valve including connecting hose to gas appliances for domestic consumer.





# The objectives of IMS regulations

1. Evaluating the risk associated with city gas distribution networks and effectively allocating resources for prevention, detection and mitigation activities.
2. Improving the safety of city gas distribution networks so as to protect the personnel, property, public and environment.
3. Bringing more streamlined and effective operations to minimize the probability of CGD network failure.





## What is probability....

Probability is defined as how likely is it that the risk will occur? Or in other words, what are the chances of failure?

## What is consequence....

The result of the failure is defined as consequence.

**Example:** A pipeline failure close in proximity to areas of high density population or near a school, hospital, or any other public places can cause an explosion and fire with a considerable loss of life and damage to properties.





# CODES AND STANDARDS

*This Code is specifically designed to provide the operator with the information necessary to develop and implement an effective integrity management program utilizing proven industry practices and processes.*

- ASME B 31.8S :Managing System Integrity of Gas Pipelines.
- PNGRB (Integrity Management System for Natural Gas Pipelines), Regulations 2012
- PNGRB (Integrity Management System for City Gas Distribution Netowrk), Regulations 2013
- As per the IMS regulations issued by PNGRB, it is mandatory for all the operating and authorized CGD entities to conduct IMS compliance audits at an interval of every three (03) years



## REGULATORY REQUIREMENT

### Governing Standard:

1. **ASME B31.8**: Gas Transmissions and Distribution Piping Systems
2. **PNGRB Guideline** : (T4S) Technical standard and specification including safety standards for Natural Gas Pipeline
3. **API 1104** : Standard for Welding of Pipelines and Related Facilities
4. **API 1109** : Specification for Pipeline route Marker
5. **API 1102** : Crossing of Rail tracks & Highways
6. **ASTM E 94**: Radiographic Test
7. **API 1110**: Hydrotesting





## MAJOR CHALLENGES:

1. Constructional challenges
2. Operational Challenges
3. Maintenance & Safety challenges





## CONSTRUCTIONAL CHALLENGES:

**1. Confined Space:** Limited space to lay the pipeline, non availability of dedicated corridor for CGD pipeline, enough space is not available to construct pipeline assets like valve chamber and SV station

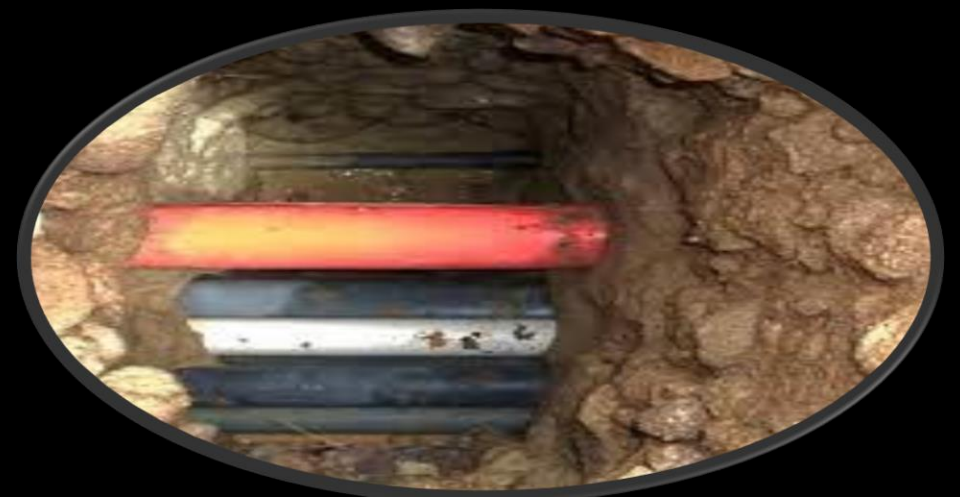
**2. Utility Unconformity:** Foreign agencies are not aware about their utility and gets damage during excavation work, which plays a vital role for delaying CGD work and financial losses

**3. Local Influence:** Residents create trouble to excavate in front of their premises

**4. Statutory issues:** Land owing agencies takes much time to issue permission for CGD work

**5. Contractor Issues:**

- a: Lack of Resources
- b: Knowledge
- c: Machinery
- d: Inconsistency of work





## OPERATIONAL CHALLENGES:

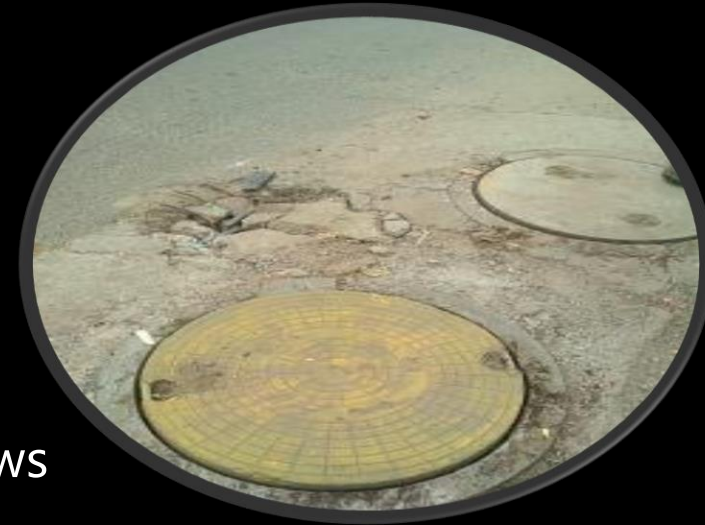
1. **Training inadequacy:** Contractual man power are not stable at their work, attrition ratio is high, which effects the smooth operation
2. **LCV HCV Accidents:** Risk involved in transportation of CNG meet road accident in operation of DB setups
3. **Third Party Damage :**Casual approach of third party CGD network are always at risk
4. **Negligence by Vehicle owner:** For not testing the cylinder & maintenance on time





## MAINTENANCE & SAFETY CHALLENGES:

1. **Valve Chambers on road:** Sometime people park vehicle on valve chambers which damages chamber and also restricts schedule activities and emergency handling of valves if arises.
2. **Signal Interference :** Due to several buried utilities, pipeline locator shows inaccurate data
3. **Lack of space for SV station :** Remains at risk to hit by vehicle at any moment
4. **ABD :** Due to urbanization ABD of network becomes obsolete and requires frequent update of ABD's
5. **Damage of assets:** Notorious elements keep destroying assets like markers ,TLP and valve chambers
6. **Emergency response:** Due to heavy traffic in peak hours emergency response time increases





One of Murphy's famous law states that "left to themselves, things will always go from bad to worse."

Edward Aloysius Murphy Jr.  
(January 11, 1918 – July 17, 1990) was an **American aerospace engineer** who worked on safety-critical systems.



# PIPELINE INTEGRITY & SOLUTIONS

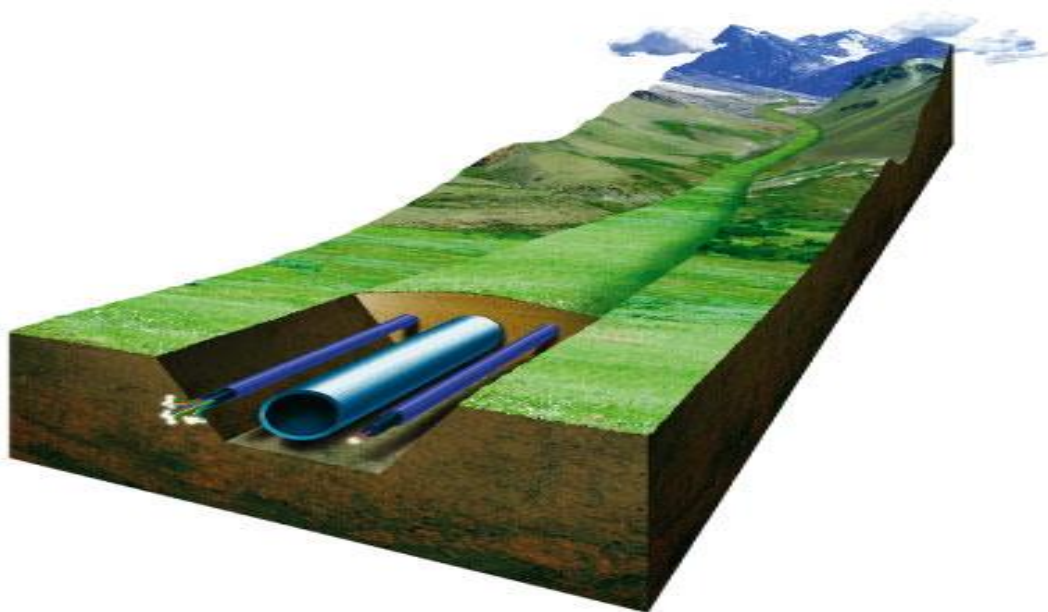




# What is Pipeline Integrity ?

## Definition of Pipeline Integrity -

- “Ability of a pipeline to contain the product in required circumstances”





# Why Pipeline Integrity is required ?

Safe operations

Customer satisfaction

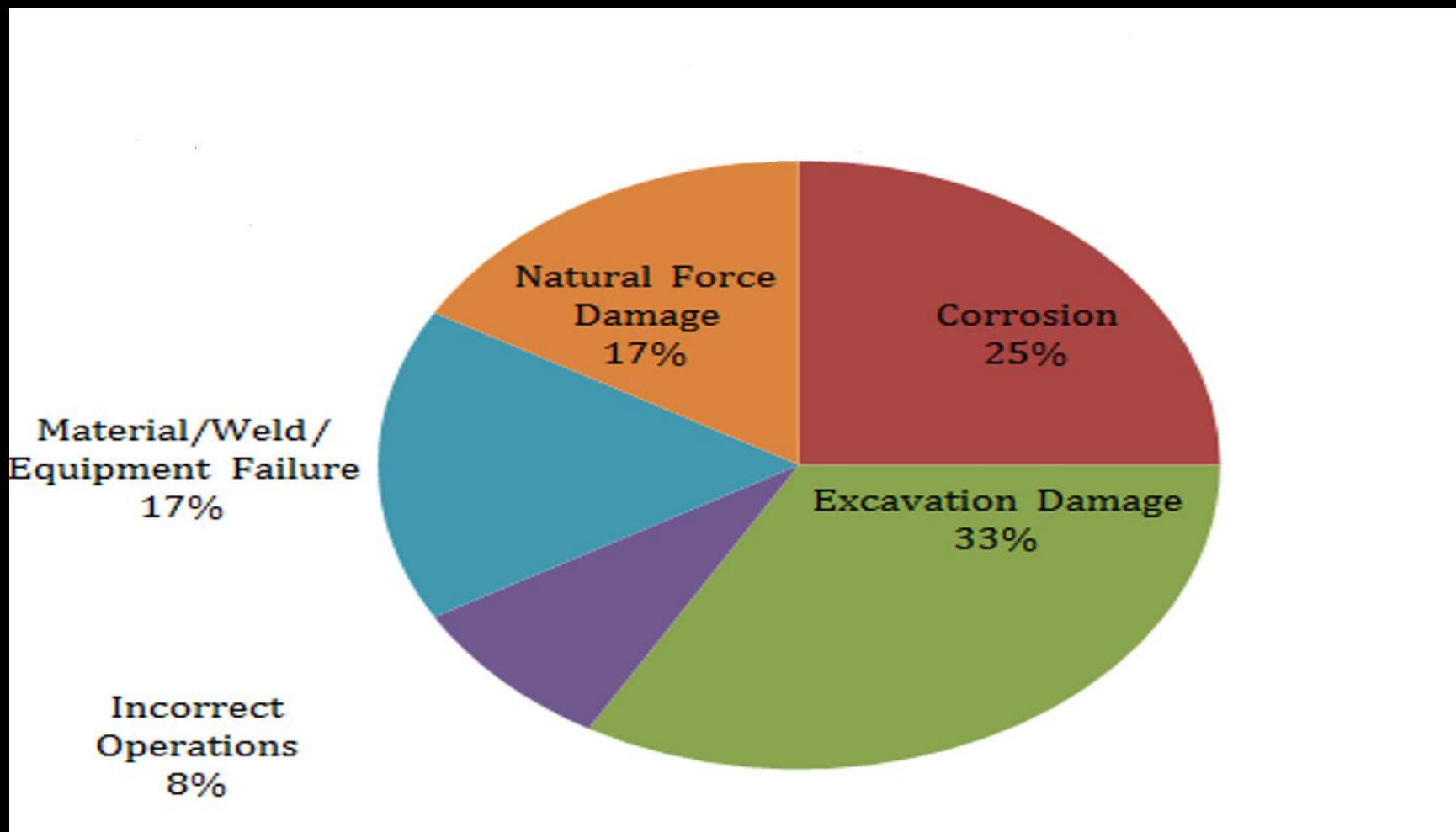
Profit maximization

Environment protection

Good company reputation



# Causes for Gas Pipeline Failure





# Pipeline Integrity Management Plan

## Pipeline Integrity Management

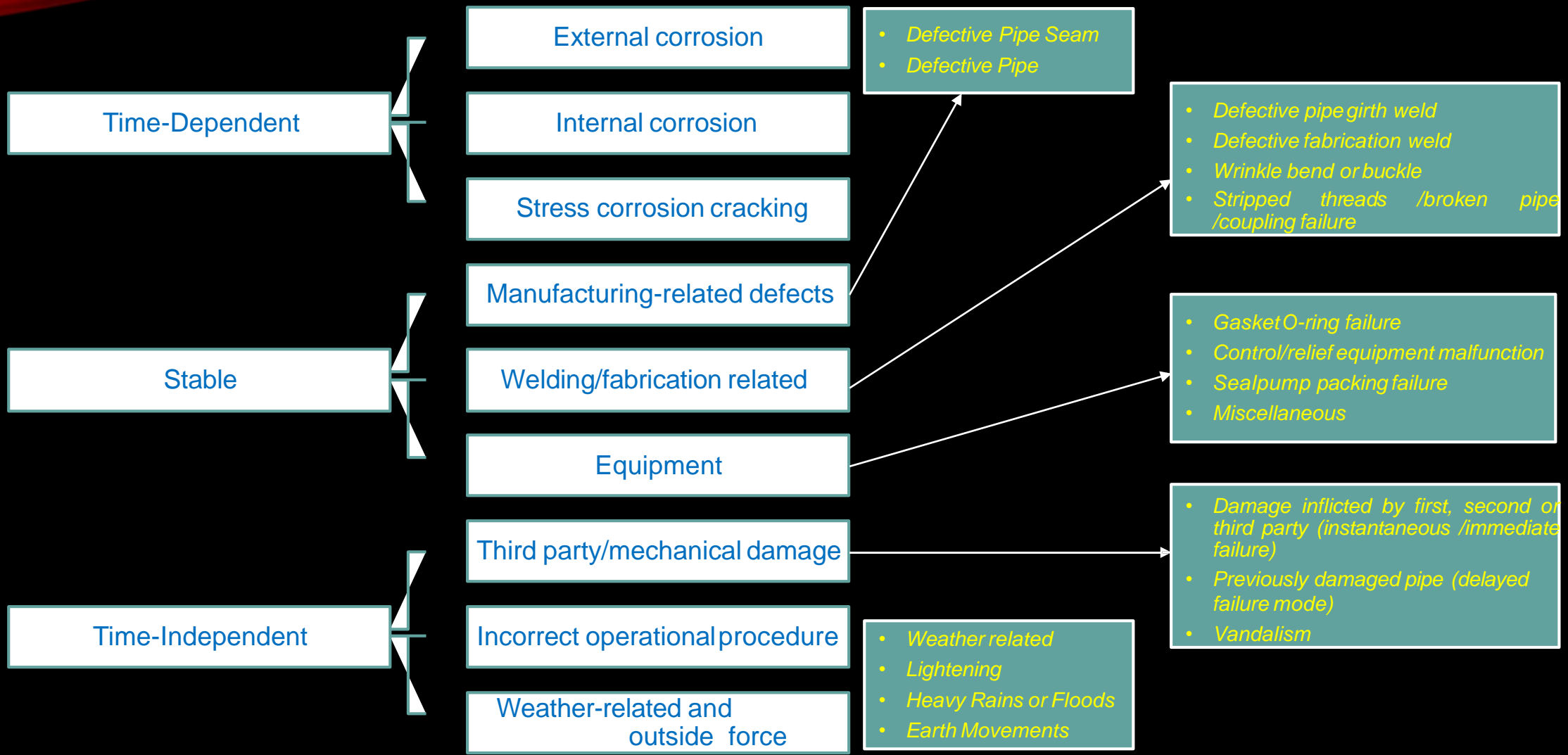
- Proper Planning
- Sound Design
- Right Material Selection
- Good Construction Practices

## Integrity Management Plan

- Identifying potential pipeline threats
- Gathering, reviewing and integrating data
- Carrying out risk assessment
- Carrying out integrity assessment
- Monitoring & Maintenance to ensure Pipeline Integrity



# PIPELINE THREATS





# Time Dependent Threat





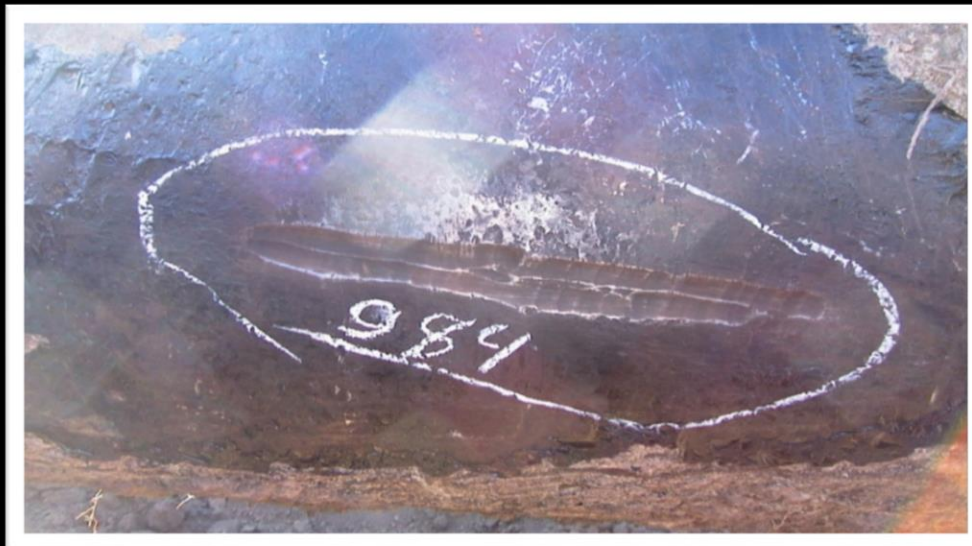
# Time Independent Threats



**Mechanical Damage**



**Mechanically Damaged Pipeline**





# Stable Threats



**Axial Groove**



**Cavern**



**Circumferential Groove**



**Abnormal Girth  
Weld**



# PIPELINE-INCIDENTS





# INTEGRITY MANAGEMENT TOOLS

*Inline Inspection*

*Cathodic Protection*

*Surveillance*

*Hydrotest*

*Direct Assessment &  
Evaluations*

*Magnetic  
Tomography  
Method*

*Pipeline Equipment  
Health Monitoring*

*Thickness Assessment and Periodic Reviews*



# Pipeline Integrity Assessment for Non Piggable Pipeline

At present following methods are available in industry for Health Assessment of steel pipeline network.

<b>Destructive Method</b> – By doing Hydro testing	<b>Intrusive Method</b> – By doing In-line inspection using Immersed Ultrasonic inspection technique	<b>Non-intrusive Method</b> – By doing scanning of Pipeline using Magnetic Tomography Method (MTM)	<b>Direct Assessment (DA)</b> - By doing ECDA,ICDA
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# Destructive Method - Hydro Testing

## Pressure Test Program

Determines the strength of the pipe

ASME B31G based on remaining strength as confirmed by pressure testing

May be most appropriate for stable threats and time-dependent threats ,but it is destructive way of testing



# In-Line Inspection - Immersed Ultrasonic inspection technique

In-line inspection by using Immersed Ultrasonic inspection technique is the latest technology for inspection of non-piggable pipeline

- ❑ The free-swimming tools used in this technology are extremely light weight, extremely short in length, easy to handle, capable of negotiating back to back 1D bends and should not require any trailing umbilical / tether for bi-directional navigation.
- ❑ This technology is capable of identifying the mechanical damage, external/internal corrosion, heat affected zones etc using a direct measurement principal in a single inspection pass.
- ❑ After inspection of pipeline, the Fitness for Service (FFS) assessment is conducted as per API 579 and this FFS assessment results allow us to make immediate decisions about whether to operate as-is, repair certain section, retire or rerate the inspected pipeline



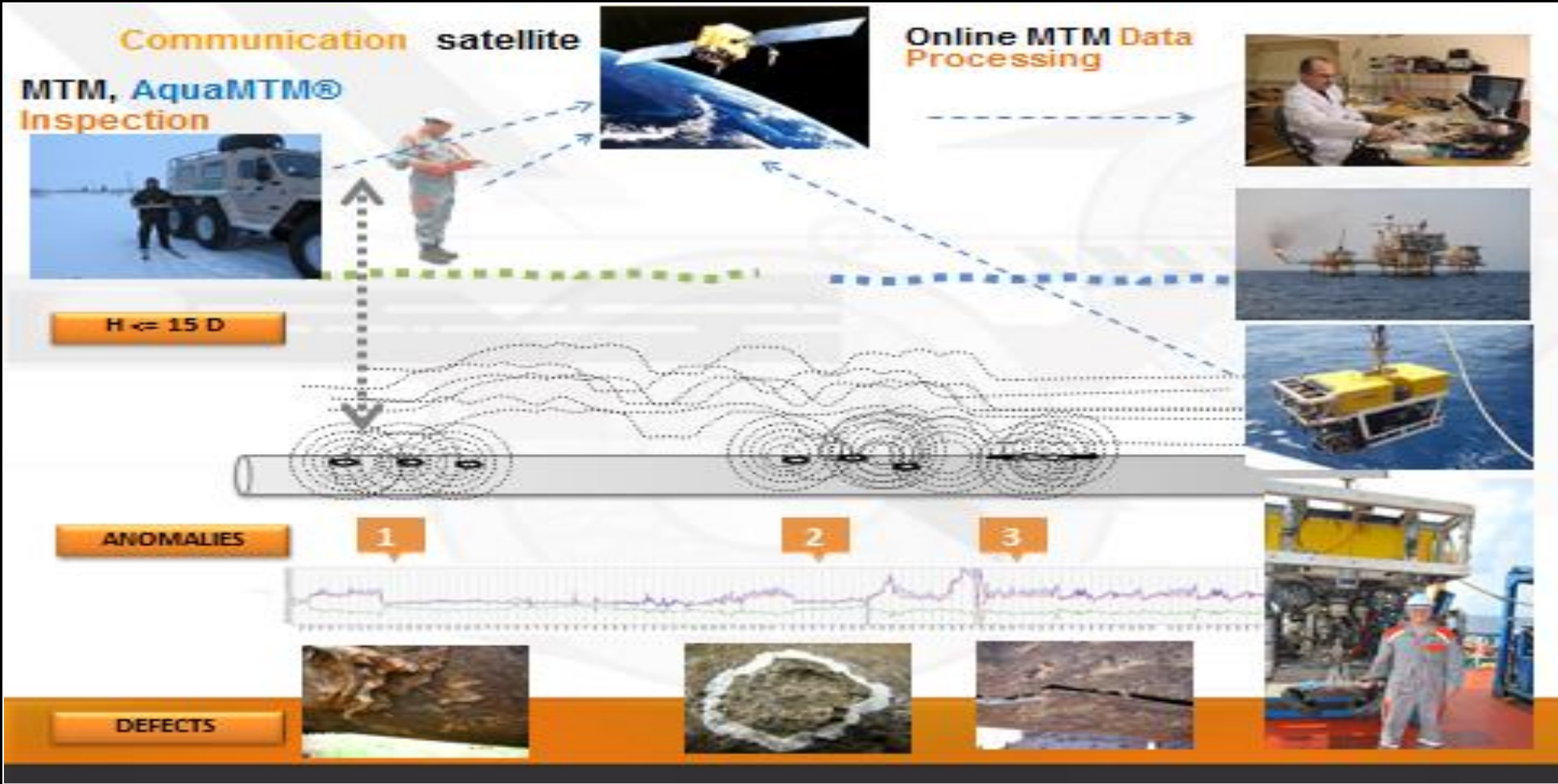
# Health Assessment of Pipeline by using Magnetic Tomography Method

- The Magnetic Tomography Method (MTM) works on magnetic stress technology, is a non-intrusive solution for health assessment and defect identification of old steel pipeline network.
- This technology is based on magnetic stress principal and is able to detect all types of defects whether internal or external. The detectable defects are as follows:

*Metal loss anomalies, Crack like defects anomalies, Geometry changes anomalies, Discontinuity anomalies, Weld anomalies, Elevated Stress Deformed State Anomalies, Mechanical damages like dent etc.*



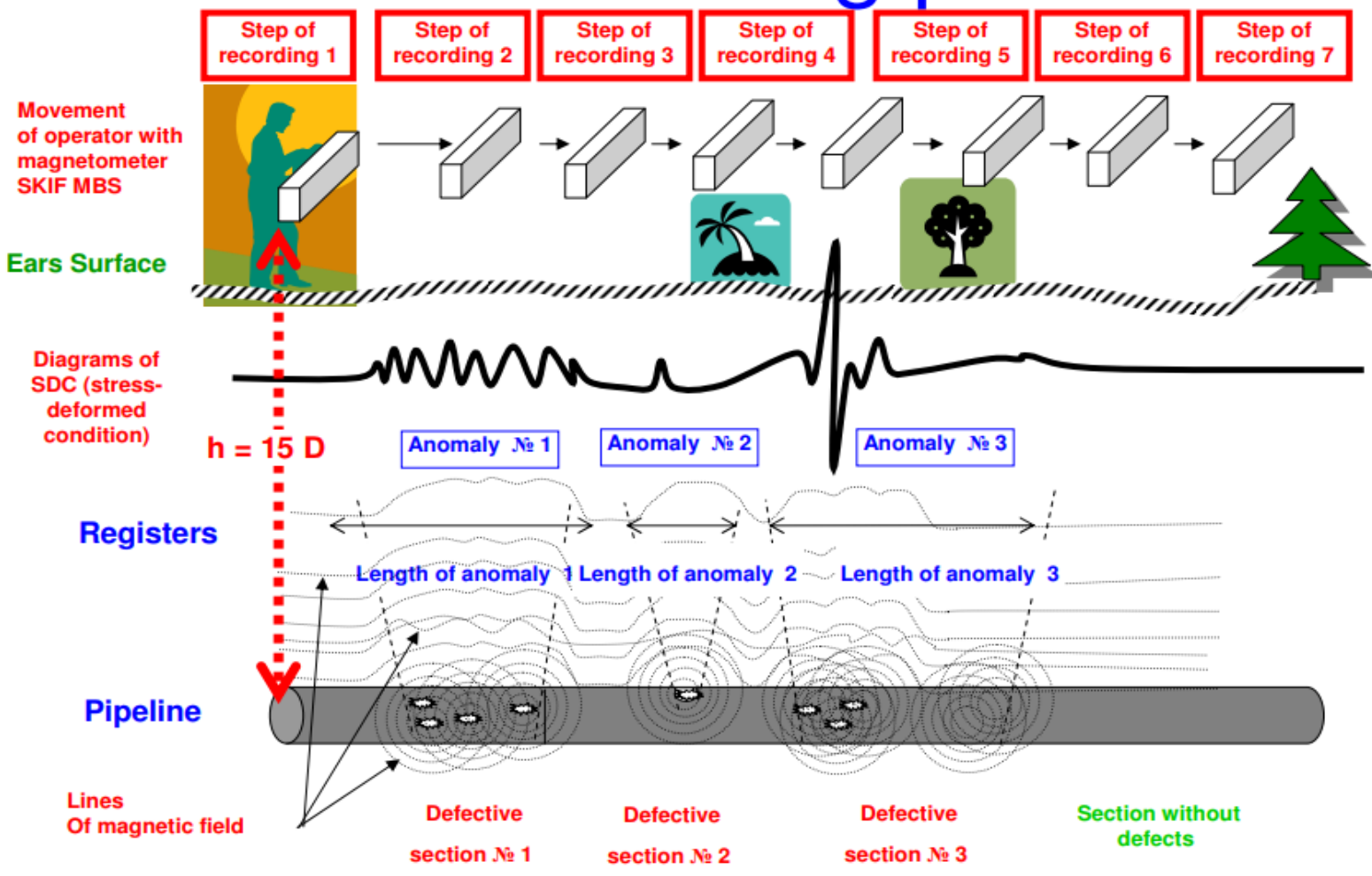
# MAGNETIC TOMOGRAPHY METHOD





# MAGNETIC STRESS TECHNOLOGY

## MTM scanning process



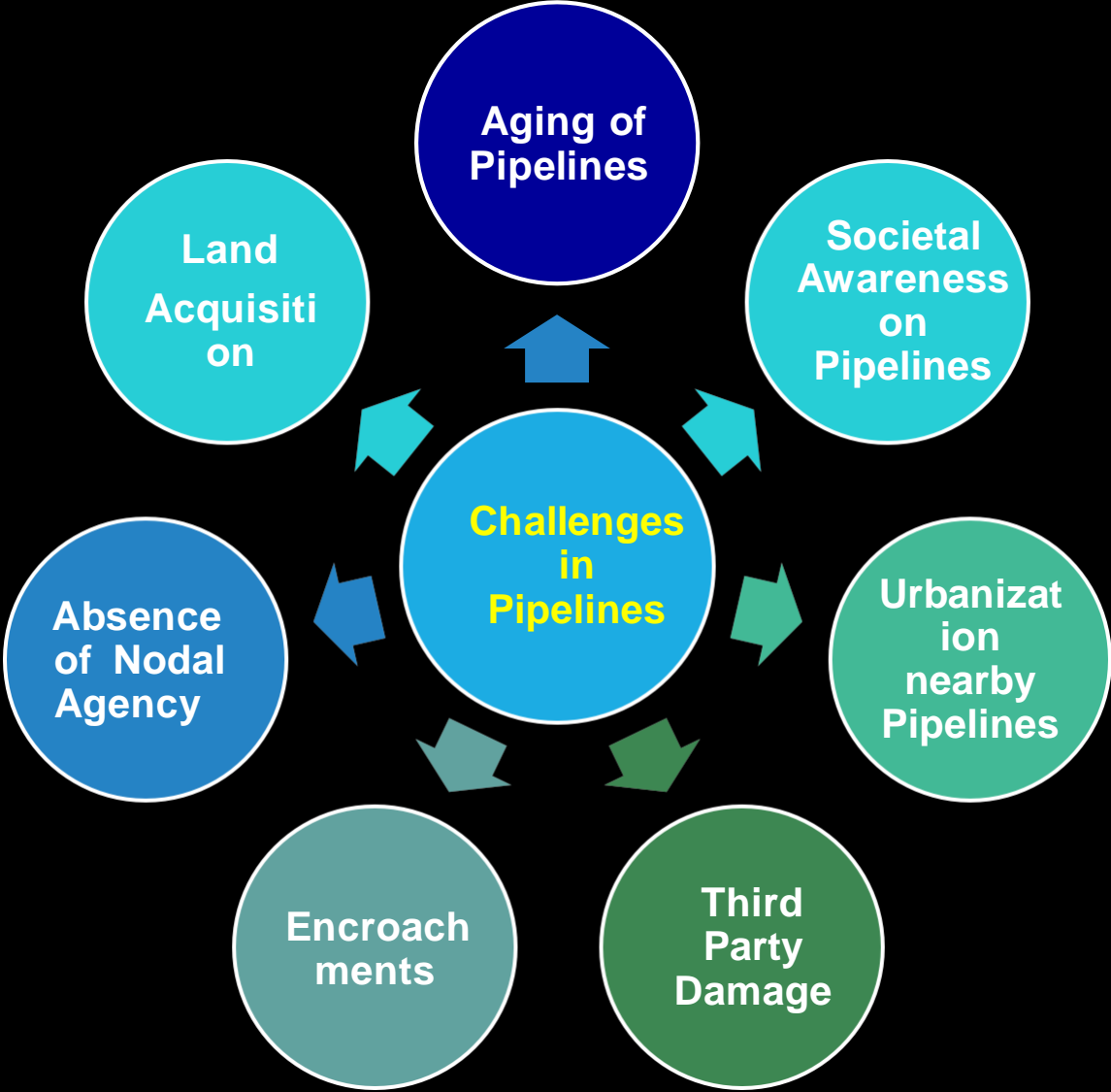


# Health Assessment of Pipeline by using Magnetic Tomography Method

- The Magnetostriction is a property of Ferromagnetic material that causes them to change their shape or dimensions during the process of magnetization.
- When metallic pipeline is buried in earth it got magnetized by earth's magnetic field and if any metal loss or dent occurred on the pipe ,it will change it natural magnetic field (ie. inverse Magnetostriction) and this distortion in natural magnetic field can be detected by MTM tool.



# FUTURE CHALLENGES





*The integrity of Natural Gas Pipeline System is achieved through continuous efforts at all stages to ensure that pipeline is designed, commissioned, operated and maintained as per stipulated codes, standards and guidelines.*

*Pipeline challenges and integrity are limitless.....*



**Thank you**



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