



# 8<sup>th</sup> CCPS ASIA PACIFIC REGIONAL MEET ON PROCESS SAFETY

## Chennai

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Hirak Dutta  
ED-OISD



# Introduction

## Mode Of Transport Thru Pipeline

- Safe & Environment friendly and economic mode of transport of HC compared to other modes of transportation - rail/road/ coastal etc.,
- Safety hazards associated with transportation of hydrocarbon through pipelines can be from leakages, spillages, fires etc., if not designed, maintained & operated as per the standard practices.



# Pipeline Network In India

**INFRASTRUCTURE: IOCL, HPCL, BPCL, OIL, ONGC, GAIL, BORL, CAIRN, RGTIL, CPCL**

**CRUDE / PRODUCT : 20,000 KM**

**LPG : 2,000 KM**

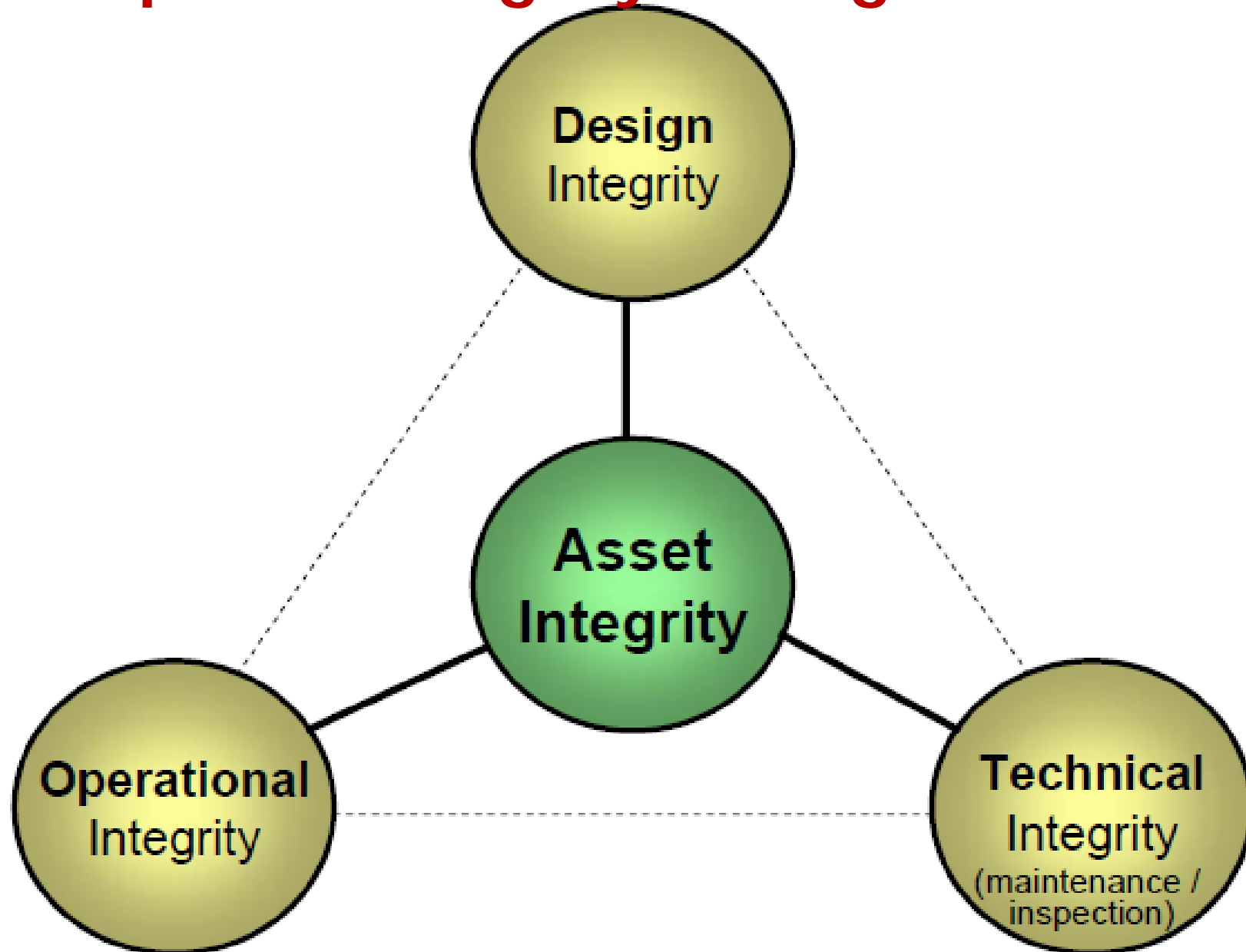
**NATURAL GAS : 12,500 KM**

**TOTAL LENGTH : 34,500 KM**

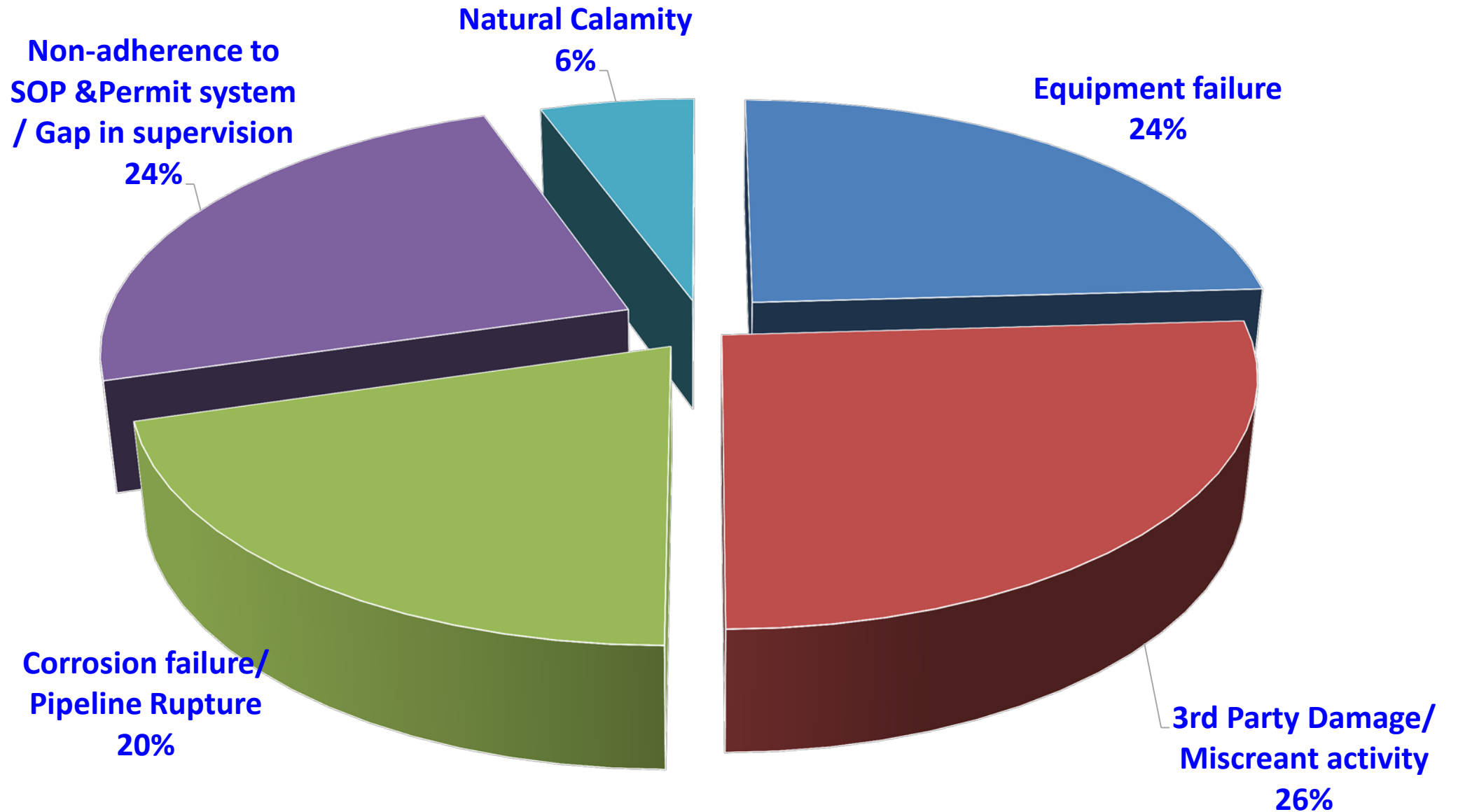
**TOTAL SPMS : 23 NOS.**

**TOTAL JETTYS : 14 NOS.**

# Pipeline Integrity Management



# Types of Failure





# Deficiencies In Pipelines



# Some Deficiencies In Pipelines

- In some of the pipelines regular cleaning pigging is not carried out.
- Pig residue analysis is not carried out.
- The health of non-piggable & jetty lines - an area of concern.
- The pipes are laid close to each other thus M&I work becomes very difficult.
- Intelligent pigging survey is not carried out for some of the pipelines.



# Some Deficiencies In Pipelines

- A well defined pipeline integrity management system is not in place.
- Basic design and engineering - surge analysis, stress & network analysis etc., are not carried out properly.
- Adequate SOPs are not in place for activities like pigging, mud plugging, hot tapping, cold cutting etc..
- Standard operating procedures are not being followed.





# Some Deficiencies In Pipelines

- Improper pipe supports at some locations - results in development of excessive stress on the pipelines.
- Sectionalising valve maintenance is ignored.
- ROU violations - encroachments are on the rise.
- Increasing pilferage activities - an area of concern

# Fatal Incident In A High Pressure NG Pipeline





# Fatal Incident In A High Pressure NG Pipeline

- An incidence of fire followed by explosion took place in a pipeline (18" Dia.) carrying natural gas.
- The incident resulted in multiple fatalities & substantial loss of property.
- The fire took place in the early morning - the source of ignition was from a nearby shop – the shopowner lighted the stove for making tea.
- It took almost 2 hours for fire-fighters to extinguish the fire.
- The pipeline was passing below a canal.



# Observations On The Incident

- It was observed that there was water & condensate along with the natural gas.
- The test report of the gas indicated presence of CO<sub>2</sub>.
- The pipeline was operating at lower thruput.
- Internal corrosion noted in the pipeline.
- Some damage noted in the external coating.
- There were past incidences of leak at 6-o'clock position- repaired by clamping by contractors.





# Root Cause Of The Incident

- Internal corrosion in the pipeline lead to failure.
- Corrosion due to carbonic acid – accumulation of water , CO<sub>2</sub> mix in the line.
- Proper pigging was not carried out at regular intervals - instead of using scrapper pigs foam pigs were used.
- Pig residue analysis was not carried out.
- Improper maintenance philosophy adopted by the operator – clamps in high pressure pipeline ??



# Root Cause Of The Incident

- The IPS was conducted 04 years prior to the incident indicated metal losses at the vicinity of the canal.
- The report suggested dosage of corrosion inhibitor to mitigate internal corrosion – was not done.
- The pipeline was designed for handling dry natural gas - it handled wet natural gas.



# Lessons Learnt

# Lessons Learnt

- Scrapper pigging must be done regularly as per OISD-STD-226 followed by pig residue analysis.
- Instrumented pig survey must be carried out once in ten years and its recommendations must be liquidated.
- Corrosion coupons must be installed in all pipelines; in case the internal corrosion rate is  $> 1$  MPY, corrosion inhibitor must be injected in the line.
- A pipeline integrity management system should be prepared, institutionalised & followed for assuring the health of the pipeline.





# Lessons Learnt

- Comprehensive procedure shall be developed for repair of pipeline in case of leak.
- Leak detection system should be provided in the line.
- Over-dependence on third party agencies should be avoided – supervision need to strengthened.
- All encroachments/ construction in the ROU must be removed - presence is a major hazard for safe pipeline operation.



# Lessons Learnt

- Any changes wrt design parameters must only be incorporated after carrying out a detailed technical analysis – MOC.
- Dehydration facility must be provided for removal of water and condensate.
- Pipeline which are in service for >25 years - “residual life assessment” must be done.
- Feed analysis, IPS, pressure testing, internal corrosion monitoring, CP monitoring, CAT/DCVG/CIPS, soil testing, risk assessment, fatigue testing, design conformity test etc.



# Suggestions For Improvement



# Suggestions For Improvement

- Basic data of all pipelines must be done.
- Regular cleaning pigging to be carried out with proper cleaning pigs followed by residue analysis
- IPS must be carried out regularly for ascertaining the health of the pipelines.
- Maintenance of non-piggable lines to be carried out in line with OISD-GDN-233.
- Internal & external corrosion monitoring to be carried out for both piggable & non-piggable lines



# Suggestions For Improvement

- Residual life assessment to be done for all ageing pipelines.
- Corrosion coupons must be used, wherever, applicable.
- All block valves/ sectionalizing valves preferably be remote operated.
- All pipelines must have leak detection system.



# Suggestions For Improvement

- Any change W.R.T. Basic design conditions should be done after management of change procedure
- Line patrolling must be done by using modern techniques like G.P.S., G.I.S. Based decision support system etc.,
- Adequate supervision & inspection to be ensured by the operator for maintenance works carried out by the contractors



# Suggestions For Improvement

- Inspection at pipe mill & coating mill shall be carried out by experienced & trained persons.
- Jetty lines need focused attention for maintenance of the pipelines.
- Regular training shall be imparted to employees to improve their knowledge and skill.



# Suggestions For Improvement

- Intelligent pigging survey/ direct assessment to be carried out for all the sub-sea pipelines for assessing the health of the pipelines.
- All the operators must have a well defined pipeline integrity management





# Suggestions For Improvement

- Basic design and engineering activities such as surge analysis, stress analysis, network analysis etc., Must be carried out properly
- Proper pipe supports must be provided
- Right of way should be made free from encroachments.
- Valve maintenance to be given focused attention



**Questions???**

**Thanks!!!**