

# Steel Pipeline Network Integrity in MGL

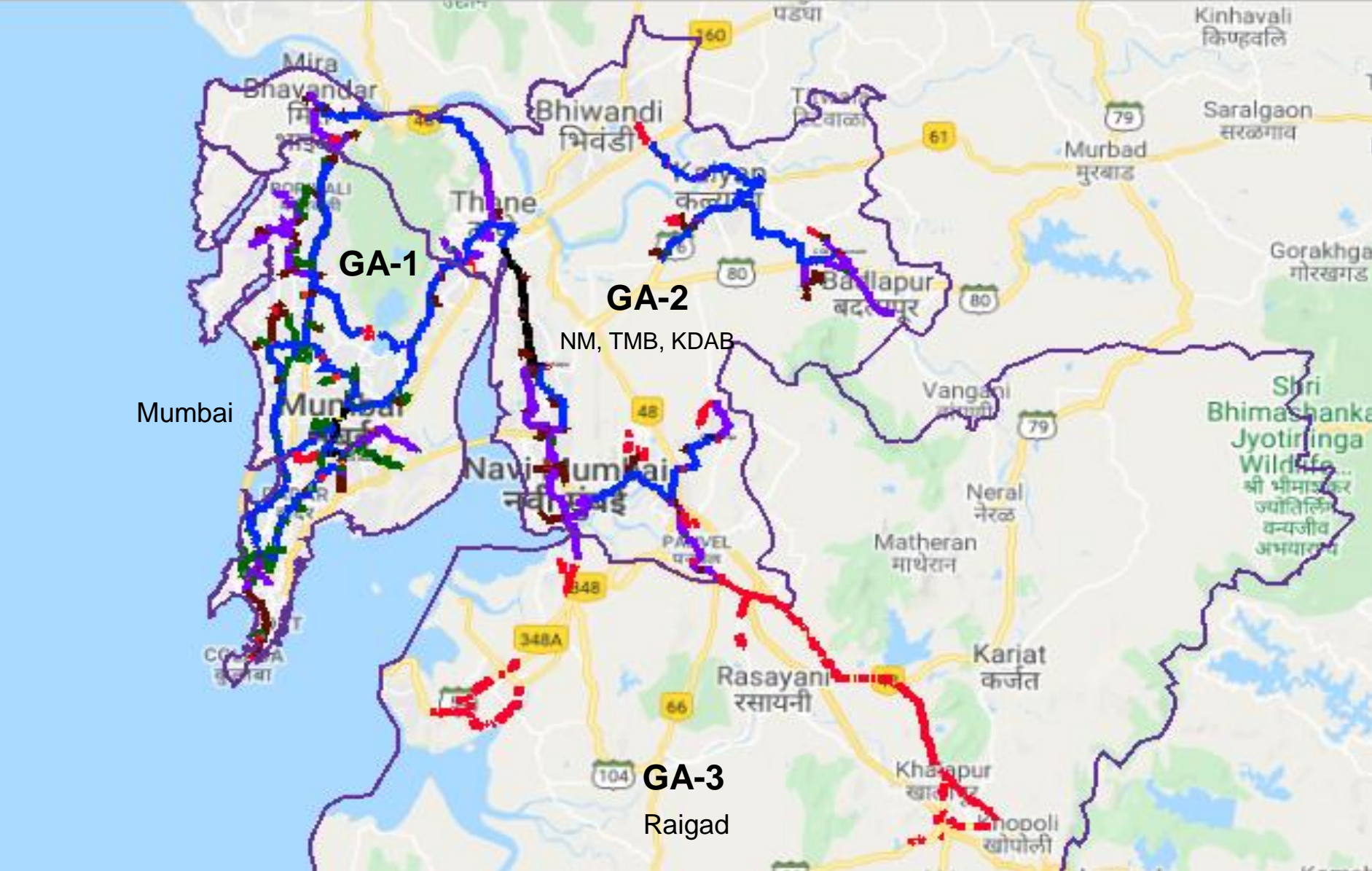


# Agenda

- ❑ *MGL High Pressure Steel Pipeline Network*
- ❑ *Pipeline Threat & Mitigation Plan*
- ❑ *CGD Network - Integrity Threats*
- ❑ *Routine Network Monitoring*
- ❑ *Network Surveillance*
- ❑ *Pipeline Integrity Management System (PIMS)*
- ❑ *Integrity Assessment - ECDA & AC Interference studies*



# MGL Steel Network

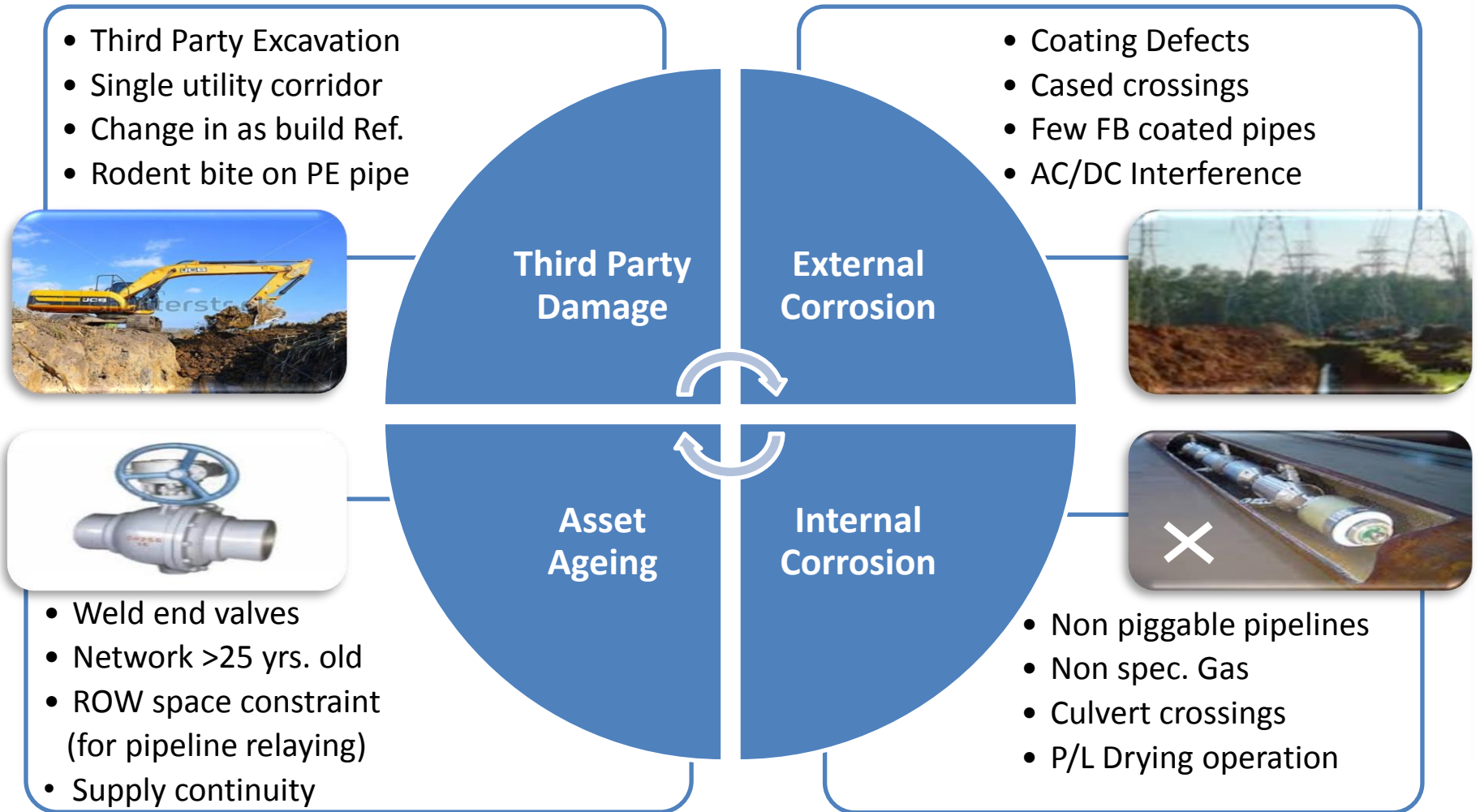


# Pipeline Threat & Mitigation Plan



Threat	Cause	Consequence	Mitigation Plan
Mechanical Damage	<ul style="list-style-type: none"> <li>Third party Excavation</li> <li>Theft / Sabotage</li> </ul>	Gas leak, Fire	<ul style="list-style-type: none"> <li>Daily Patrolling</li> <li>Excavation Monitoring</li> <li>Leak detection</li> <li>Dial before Dig</li> </ul>
External Corrosion	<ul style="list-style-type: none"> <li>Coating defect</li> <li>AC/DC Interference</li> </ul>	Metal loss, pin hole	<ul style="list-style-type: none"> <li>DCVG survey</li> <li>ICCP</li> <li>Interference study</li> </ul>
Internal Corrosion	<ul style="list-style-type: none"> <li>H<sub>2</sub>S</li> <li>Moisture</li> </ul>	As above	<ul style="list-style-type: none"> <li>Gas analysis</li> <li>Opportunistic Coupon test</li> </ul>
Construction	<ul style="list-style-type: none"> <li>Weld defect</li> <li>Coating defect</li> </ul>	As above	<ul style="list-style-type: none"> <li>Radiography</li> <li>Holiday test</li> <li>Quality Assurance through PQR, WPS</li> </ul>
Equipment related	<ul style="list-style-type: none"> <li>Defective valves</li> </ul>	As above	<ul style="list-style-type: none"> <li>Routine Maintenance of Valve &amp; valve chambers</li> <li>Management of change</li> <li>Risk audits - Safety Critical equipment</li> </ul>
Manufacturing defect	<ul style="list-style-type: none"> <li>Inadequate inspection</li> </ul>	Poor quality material	<ul style="list-style-type: none"> <li>QAP review</li> <li>Vendor assessment</li> </ul>
Incorrect operation	<ul style="list-style-type: none"> <li>Non availability of SOP</li> <li>Incompetency</li> </ul>	<ul style="list-style-type: none"> <li>Gas leak</li> <li>Supply failure</li> </ul>	<ul style="list-style-type: none"> <li>STC Training</li> <li>COP / SOP review</li> </ul>

# CGD Network Threats



# Routine Network Monitoring

Network Surveillance  
(Patrolling - On day basis)

CP Monitoring  
(PSP: -0.85 to -1.2 V)



Dial Before Dig  
(1800229944 / 24012400)



Corrosion coupon  
Corrosion rate (<5mpy)



Leak Survey  
(Identify leak spot)



DCVG Survey  
(Coating defect)

# Network Surveillance



Patrolmen keep watch over pipeline network. Entire Steel & PE network is monitored everyday



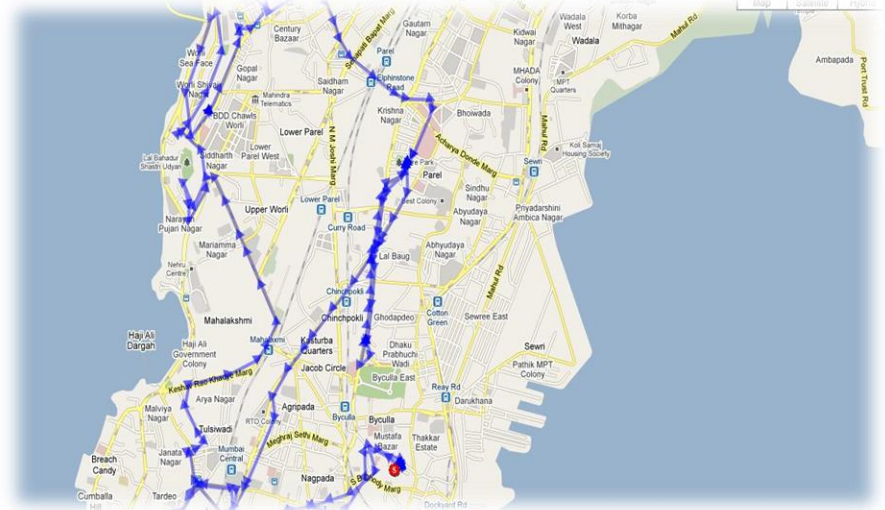
Excavation site supervisors deputed on major / critical sites

# VTS - Effective Patrolling & Monitoring

- Ability to track Patrolman bike from Point to Point in real time
- Visual representation of the geographical location
- Real time two-way communication between the base, Operations and vehicles
- Ability to provide accurate network wide location information of the entire fleet
- Grouping of Vehicles by user



VTS instrument installed on Motor bike



VTS shows route taken by Patrolman

# Pipeline Integrity Management System (PIMS)



### Pipeline Threat

Reference Standard - ASME B 31.8S

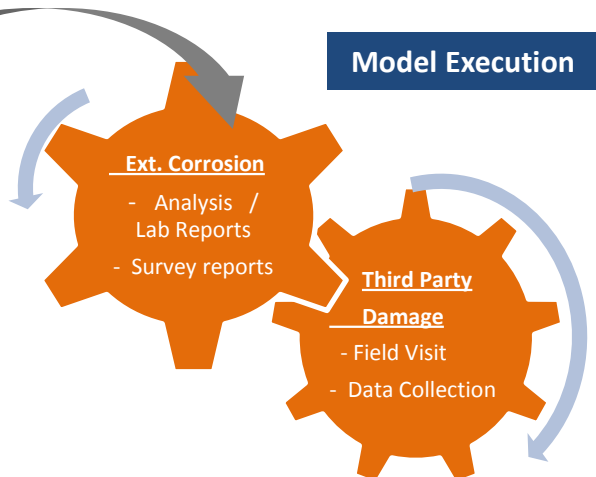
TR Segment

Mains Tap

-1- -2- -3-

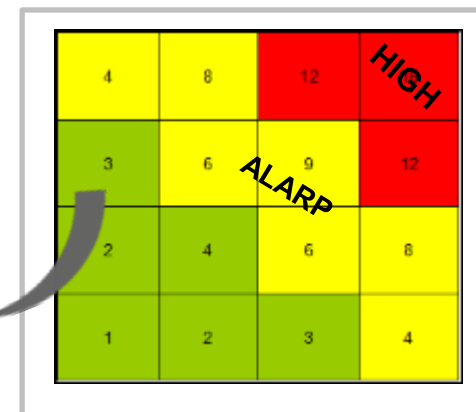
### Threats

- Third Party Damage
- External Corrosion



Assessment & Estimation of risk level of each pipeline segment & identification of critical segments within MGL gas pipeline network.

Third Party Damage		External Corrosion	
Factor	Weight	Factor	Weight
Patrolling	0.3	Soil resistivity	0.2
Pipe wall thickness	0.25	Coating defect	0.2
Pipeline top cover	0.25	CP system failure	0.2
Road Surface above Pipeline	0.2	AC / DC Interference	0.2
		Cased crossing	0.1
		CIPS / DCVG Survey	0.2



Risk Matrix

### RISK RATING

- HIGH RISK SCORE
- Local authority Requirements

### MANAGEMENT REVIEW

- PNGRB Norms
- Upgradation
- Business Requirements

Identification of Critical Segmen

Description	Action plan
Steel pipeline (12"/18") behind Wadala CGS)	Diversion
Steel pipeline (2") at NHTC, Amar Mahal	Up gradation to 6" NB
Steel pipeline (12") at Dahanukar Kandivali	Diversion
Steel pipeline (4") at Majas Depot, JVLR	Diversion
Steel pipeline (2") at MTA Kurla	LRUT & Remaining life study

Mitigation Plan

# Pipeline Segmentation & Risk Assessment - Semi-Quantitative Approach



## Likelihood

Factor	Wt.	Criteria
Patrolling	0.25	Patrolling - 2 trips
		Daily patrolling - 1 trip (day & night)
		Patrolling 1 trip in 3 days
		Patrolling frequency > 3 days
Pipe wall thickness	0.15	Pipe thickness exceeding standard
		Pipe thickness as per standard
		Pipe thickness less than standard thickness (less up to 12.5%).
		Pipe thickness not known
Road Surface above Pipeline	0.15	Below 300 mm thickness RCC
		Below Asphalt
		Below Un-made ground - dirt track, field, soil surface.
		Pipeline exposed
Pipeline top cover	0.25	Top cover as per spec (1.2 m )
		Top cover 0.85 m to 1.2 m
		Top cover < 0.85m but ≥ to 0.5m
		Top cover less than 0.5m
Level of third party activities	0.20	Road already developed & improved
		Road not improved
		Highly congested & close proximity to other utilities
		Major Infrastructure development work

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## Consequence

Factor	Weight	Criteria
No. of Buildings in PIA	0.25	No. of buildings < 100
		No. of buildings 100 - 200
		No. of buildings 200-300
		No. of buildings > 300
No. Buildings where population with impaired mobility	0.25	No. of buildings =0
		No. of buildings 1-2
		No. of buildings 2-5
Property Damage	0.25	No. of buildings >5
		Worth upto Rs.1,00,000
		Rs.1,00,000 - 10,00,000
		Rs.10,00,000 - 1,00,00,000
Reputation loss	0.25	Worth > Rs.1,00,00,000
		No attention
		Local area attention
		State level attention
		International attention



## Risk Analysis

Segment location	Indus filling station (IBP Wadala)	Lucky Auto Sion
Likelihood	1.85	1.6
Consequence	1.75	1.5
Score	3.2	2.4
	ALARP	LOW

# Pipeline Segmentation & Risk Assessment - Semi-Quantitative Approach



Third Party Damage				
Factor	Weight	Criteria	Criticality	Score
Patrolling	0.3	2 trips (day & night)	Low	1
		Daily patrolling - 1 trip	Below Avg.	2
		1 trip in 3 day	Avg.	3
		3 days or no patrolling	High	4
Pipe wall thickness	0.25	Exceeding standard	Low	1
		As per standard	Below Avg.	2
		Less than standard	Avg.	3
		Not known	High	4
Pipeline top cover	0.25	as per spec (1.2 m )	Low	1
		0.85 m to 1.2	Below Avg.	2
		< 0.85m but ≥ to 0.5m	Avg.	3
		less than 0.5m	High	4
Road Surface above Pipeline	0.2	Below 300 mm thick RCC	Low	1
		Below Asphalt	Below Avg.	2
		Below un-made ground - dirt track, field	Avg.	3
		Pipeline exposed	High	4

External Corrosion				
Factor	Weight	Criteria	Criticality	Score
Soil resistivity	0.2	Soil 20 to 100 ohms-m	Low	1
		Soil 10 to 19 ohms-meter	Below Avg.	2
		Soil 5 to 9 ohms-meter	Avg.	3
		Soil 0 to 4 ohms-meter	High	4
Coating defect	0.2	Unattended defect (<1 month)	Low	1
		1 - 6 month	Below Avg.	2
		6- 12 month	Avg.	3
		> 12 month	High	4
CP system failure	0.2	For 3 days	Low	1
		4 - 15 days	Below Avg.	2
		16 - 30 days	Avg.	3
		> 30 days	High	4
AC / DC Interference	0.2	< 5 amps	Low	1
		5 - 50 amps	Below Avg.	2
		51 - 99 amps	Avg.	3
		> 100 amps	High	4
Cased crossing	0.1	No cased crossing	Low	1
		Casing with spacer	Below Avg.	2
		Casing without drain	Avg.	3
		Improper casing	High	4
CIPS / DCVG Survey frequency	0.2	Once in 3 years	Low	1
		Once in 5 years	Below Avg.	2
		Once in 10 years	Avg.	3
		> 10 YEARS	High	4

# AC Interference Study

- **Objective**

Possibility of AC Induced corrosion on Steel pipeline network due to its proximity to overhead HT Transmission lines, Railway Traction system etc.

- **Purpose**

To bring the impacts of AC interference voltages to tolerable levels on the pipeline and reduce the possibility of AC corrosion.

- **NACE Criteria**

Max Induced Voltage - 15V, Max Induced Current Density - 30 A/m<sup>2</sup>

- **Activities**

Field survey, Gathering power line data from utility, Software simulation, Data logging for 24 hrs (Voltage & Current measurement), mitigation design etc.

- **Mitigation measures**

Anode beds, Ribbon anode, Deep well etc.

# External Corrosion Direct Assessment (ECDA)

- **Objective**

ECDA is one of Integrity assessment technique for Non-piggable pipelines, recommended by PNGRB IMS regulation & ASME 31.8 S

- **Purpose**

ECDA is a continuous improvement process targeted to identify and address locations where external corrosion activity has occurred, is occurring, or may occur.

- Priority given for older pipeline segments in Phase 1.
- Undertaking the assignment in 04 stages as per NACE standard
  - Pre assessment : Pipeline Data gathering, Identifying ECDA Regions
  - Indirect Inspections : CP Surveys (*Current Attenuation Test, DCVG*)
  - Direct Examination : Field excavations, Soil test, Peel test, Thick. measurement etc
  - Post assessment : Thickness loss, Remaining life

*Thank You...*



**MAHANAGAR  
GAS**