

HVDC INTERFERENCE ON MGL PIPELINE



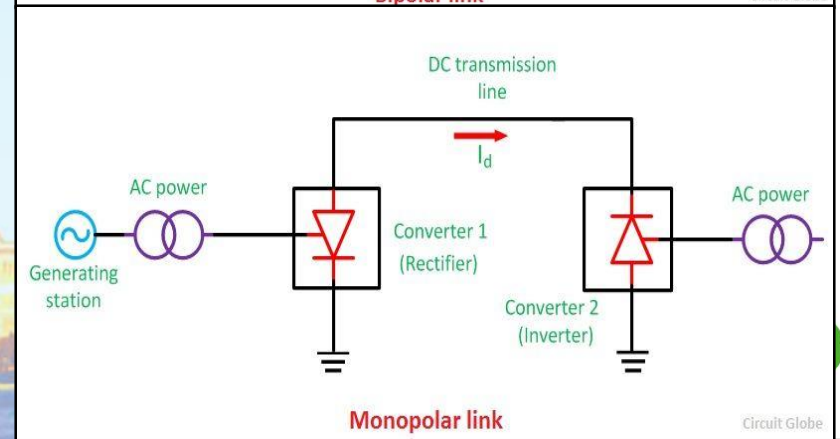
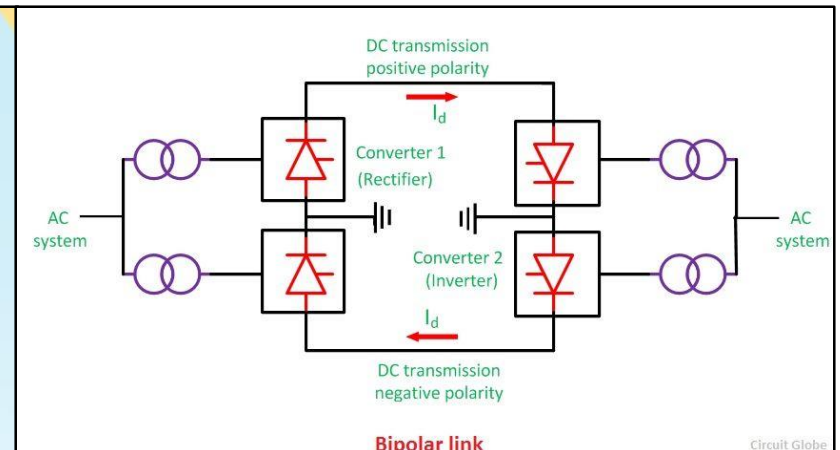
INTRODUCTION



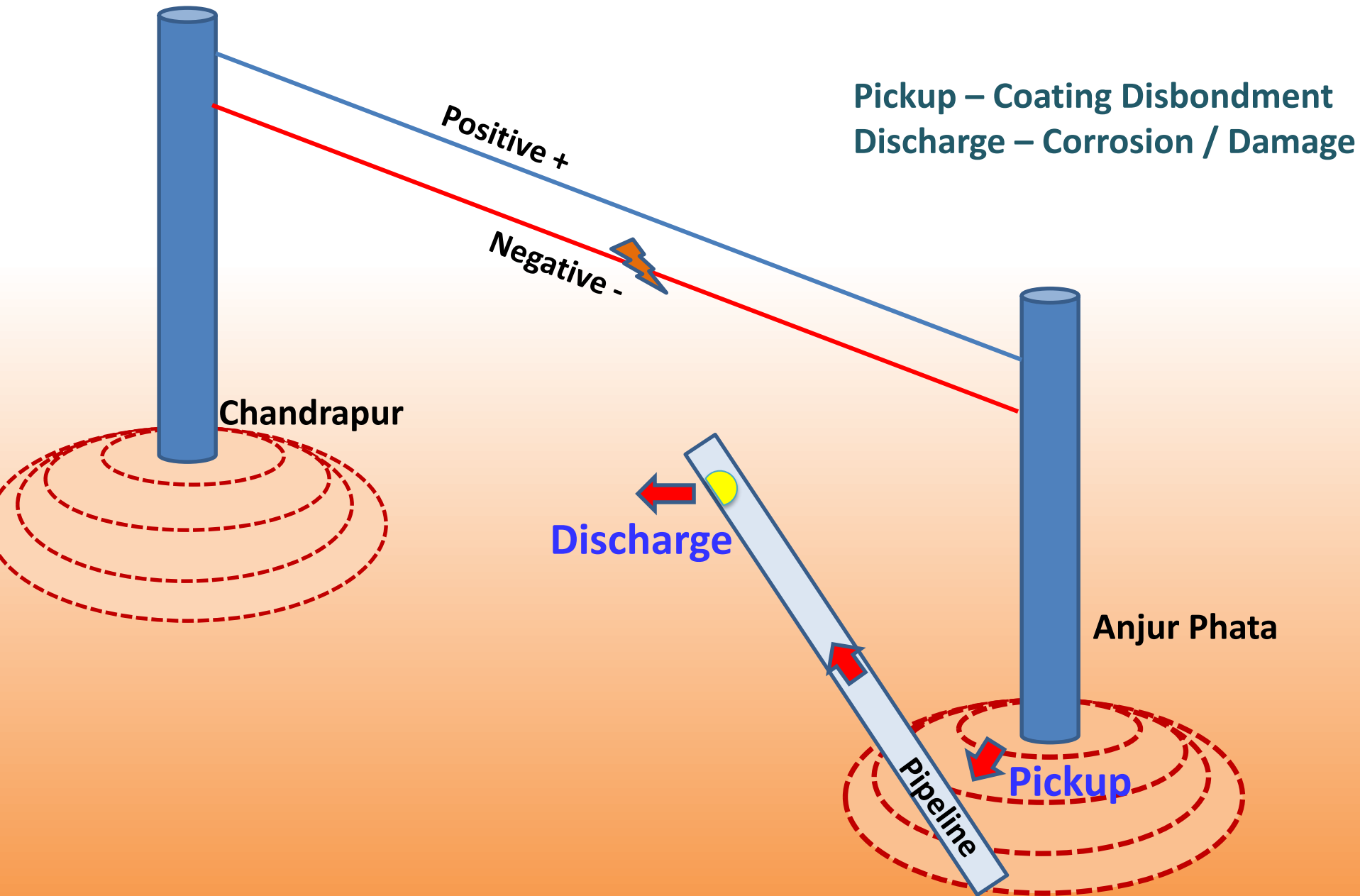
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Introduction

- HVDC – High Voltage Direct Transmission
- Used for bulk transmission of electricity
- Normally operates in bipolar mode – Positive & Negative conductor
- One of the conductor non-operational – Monopolar Mode – Earth is used as second pole



HVDC Interference on Pipelines



HVDC SUBSTATION

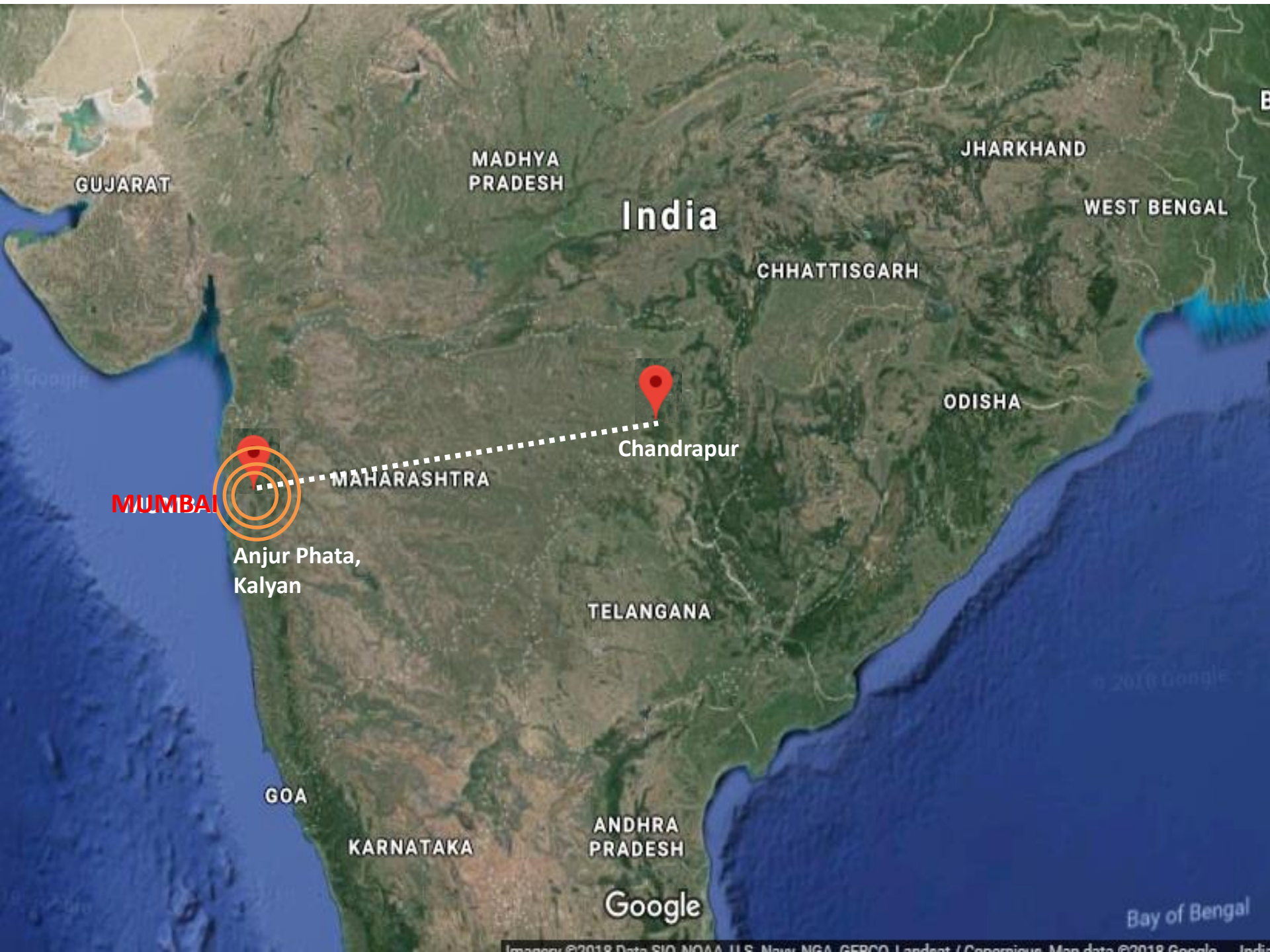


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HVDC Substation –

- Location – **Padhge Village, Bhiwandi**
- Grounding Electrode – **Anjur Phata, Kalyan**
- Current grounded – **1500 A**
- Operator – **MAHATRANSCO** (Maharashtra State Electricity Transmission co. Ltd.)
- In service since – **1999**
- Total Length – **752 kms**
- Receiving station – **Chandrapur**
- Ratings : **+/- 500 kV ; 1500 MW**





MUMBAI

Anjur Phata,
Kalyan

Chandrapur

Google

Bay of Bengal

Effect on MGL Pipeline



Recent HVDC monopolar operations



Date	Start Time	End Time
07.04.2018	07:45	18:55
08.04.2018	07:15	19:15
13.04.2018	01:15	05:30
22.04.2018	22:00	02:30
01.05.2018	05:00	13:45
11.05.2018	21:35	08:30 (next day)
12.05.2018	21:50	07:00 (next day)
14.05.2018	16:35	20:45
17.05.2018	18:00	23:00
22.05.2018	11:45	16:15
28.05.2018	08:45	08:50
02.06.2018	19:20	22:45
06.06.2018	22:15	04:45
15.07.2018	06:55	15:15
17.07.2018	13:35	13:35
08.10.2018	17:30	18:15
27.10.2018	15:22	18:41

24-hrs continuous monopolar operation during:

First Pole : 19th Nov to 25th Nov 2018

Second Pole: 30th Nov to 7th Dec 2018

Effect on MGL pipeline

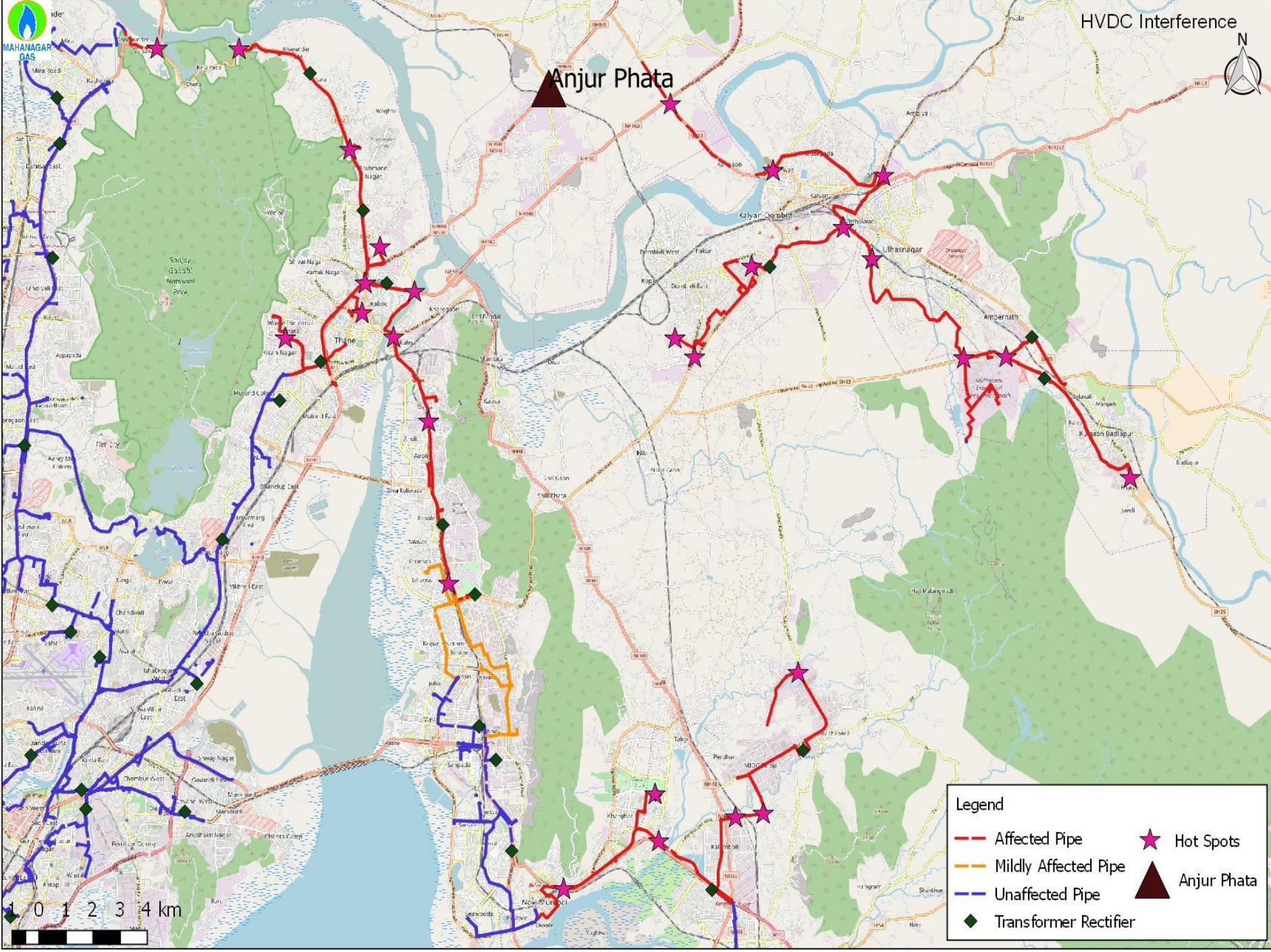
- ❖ Affected MGL Pipeline – 145 kms
- ❖ Maximum pickup : -2.4 Vdc (Ambernath).....Without TR
Maximum Discharge : + 1.2 Vdc (Thane).....Without TR
- ❖ Expected PSP : -0.44 Vdc (Natural Potential of Steel)
- ❖ Pickup and discharge swapped when polarity got reversed
- ❖ Insulating joints became hotspots for interference
- ❖ Oldest affected pipeline is laid in 2005
- ❖ Went unnoticed due to DC traction interference



HVDC Interference



Anjur Phata



Legend

- Affected Pipe
- Mildly Affected Pipe
- Unaffected Pipe
- Transformer Rectifier
- Hot Spots
- Anjur Phata

TR Parameter	Normal conditions	During HVDC Interference
DC O/P Voltage	1.0 V	2.0 V
DC O/P Current	0.6 A	0.2 A
On PSP at TR	-1.41 V	-1.68 V
Instant Off PSP at TR	-1.18 V	-1.18 V
Mode of Operation	AUTO	Manual

SN	TLP NO.	Location	PSP (Without TRU)	PSP (With TRU)	Remarks
1	2801	Suraj Water park IJ	-2.141	-2.300	Pickup location
2	C-113	Cased crossing after Suraj Water Park	-2.069		
3	2802	Opp. Coral Square building	-1.865		
4	2803	Royal Plaza	-1.732		
5	C-115	Cased crossing near Kasarvadavali police station	-1.068		
6	2805	Garib nagar bus stop	-1.319		
7	2806	Vision restaurant	-1.007		
8	2807	Sanjay Kadam CNG, Owla	-0.951	-1.180	TR location
9	2808	Saffron restaurant	-0.951		
10	2809	New Garvaa hotel	-0.944		
11	2810	Jai Santoshi Mata automobiles	-0.611		
12	2811	VC at Dwarka Hotel/Swagat Hotel	-0.519		
13	2813	Dhanlaxmi Enterprises IJ	-0.378		
14	C-114	Cased crossing at Gaimukh	-0.246		
16	2814	Opp. Hotel Yaadgaar restaurant	-0.140	-0.260	Discharge location

Performance of CP system during HVDC monopolar

- ❖ TRs could not run in AUTO mode
- ❖ Operated in AVCC/manual mode
- ❖ Criteria for -850 mV PSP w.r.t. CSE could not be achieved
- ❖ Criteria for 100 mV polarization was achieved by 70% of TRs
- ❖ 30% TRs operated on maximum rated capacity (50 V / 50A)
- ❖ Coating defects – major hurdle in polarizing pipeline against HVDC
- ❖ Limit on TR output: -1.2 Vdc not exceeded at drain point
- ❖ Remote monitoring at TRUs worked only in 20% cases

Consequences



Pickup locations – Coating Disbondment

Discharge locations – Corrosion / DAMAGE

Corrosion rate for steel – 9.5 kG/A-yr

Affected areas - Thane, Kalwa, Rabale, Mahape, Ambernath, Ulhasnagar, Kalyan, Dombivali, Bhivandi, Kharghar, Kalamboli & Taloja

Highly populated areas; High consequences

Pipeline catering to

- CNG stations – 66 Nos.
- Domestic Customers – 1,94,000 Nos.
- Industrial Customers – 58 Nos.
- Commercial Customers - 364 Nos.



Alternative to Grounding of HVDC

1. During breakdown of one conductor

Sr. No.	Type of Fault		Operation of Metallic Return Path	Operation of Earth return Path	Remarks
1	Substation Fault		Possible	Possible	
2	Line Fault	Transient faults	Not required	Not required	Same system can be operated with reduced voltage
		Permanent Faults	Not Possible	Possible	

2. During Preventive Maintenance

- Operation of Metallic return Path is not possible
- Earth return is operated for 7 days per pole (Total 14 days)
- Substation operates at half the rated capacity – 750 MW
- Discharges 1500A continuously for 24 hrs

Power Losses : Metallic Return – 4 %

Earth Return – 2%

Actions Taken

- Meetings with MAHATRANSCO to reduce grounding
- Co-ordination with other affected parties (GAIL, REL, BPCL & HPCL)
- Technical consultancy services
- Pickup and discharge locations found out during annual outage

Future Action Plan

- Bonding of Insulating Joints
- Pickup locations – Grounding mechanism to be installed
- Discharge locations – Additional TR units to be installed
- Thickness testing wherever possible
- Remote Monitoring inside TLPs at pickup and discharge
- Coating defect rectification
- Survey results to be jointly discussed with MSETCL; Next meeting in Jan'19

CHALLENGES:

1. Pickup and discharge locations shift after taking remedial action
2. No positive response from MSETCL to stop grounding
3. Affected pipeline runs through densely populated areas
4. Methodology for determining life expectancy of steel pipeline
5. Coating disbondment or pipeline damage?
6. Insulating Joints being targeted by HVDC
7. Pickup-Discharge combination with foreign pipelines
8. Non-Uniformity of interference effect
9. Only pickup; No Discharge or vice versa
10. 100 mV polarization criteria – applicable during HVDC?
11. No concrete rules/guidelines/standards

Thank You...



**MAHANAGAR
GAS**