'Safety in Natural Gas and LPG Pipeline Operations & GPU’s' 

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GAIL STARTED AS MID STREAM COMPANY

ENTERPRISE OBJECTIVE

INTEGRATED COMPANY

SUPPLY CHAIN INTEGRATION

- E&P
- LNG
- CNG BY SHIP
- CBM
- HYDRATES
- TRANS-NATIONAL GAS PIPELINES
- COAL GASIFICATION

MID STREAM

- PIPELINES & TRANSMISSION SERVICES
- OTHER SERVICES

VALUE CHAIN INTEGRATION

- LPG & LIQUIDS
- PETROCHEM
- POWER GENERATION
- RETAIL
- OTHERS

COMPETE EFFICIENTLY, PLAY MARKET, SUSTAINABLE GROWTH, MAXIMISE RETURN ON INVESTMENTS, CAPITAL MARKET PERFORMANCE
GAIL – OPERATIONAL SCALE

**NG PIPELINES**
Length : 9500 KMS  
Capacity : 172 MMSCMD  
Spread : 11 STATES

**LPG PIPELINE**
Length : 1978 KMS (1355 + 623)  
Capacity : 3.2 MMTPA  
Spread : 6 states

**GAS PROCESSING**
No. : 7 PLANTS  
Capacity : 1.4 MMTPA LPG  
Spread : 5 states

**PETROCHEMICALS**
4,40,000 TPA ETHYLENE  
4,10,000 TPA POLYETHYLENE
DIVERSIFICATION

**E&P:** 31 Blocks (02 oversees)

**LNG:** PLL-DAHEJ & Cochin, RGPPL, DABHOL (10 MMTPA)

**GAS RETAILING:** IGL, MGL, BGL, TNGCL, CUGL, GGL, MNGL

**PETROCHEMICAL:** BCPL (70%-280,000TPA), OPAL (17%-1.1MMTPA)

**WIND-POWER:** 118MW (GUJ, MAH & KAR)
PIPELINE SYSTEM SALIENT FEATURES

1. Route Description:
   A) HAZIRA- VIJ- AUR-BABRALA-DADRI-DELHI------ HVJ
   B) From VIJ- VIA SHIVPURI, AGRA TO DADRI------ GREP
   C) From DAHEJ TO VIJAIPUR ----- DVPL

2. P/L Size & Length
   36” – 12” DIA – 1873 Km (HVJ)
   36”VJPR – DADRI - 499 Km (GREP)
   42” DAHEJ- V’PUR – 611 Km (DVPL)

3. Design Parameters
   Pressure - 92KG/CM²
   Temperature- 55°(MAX)

4. Operating Parameters
   Max. Pressure 92KG/CM²
   Max. Temperature 45°C
5. **Pipeline External Coating**: Provision of 3 Layer PE (Polyethylene) Coating (EPOXY, ADHESIVE & PE)

6. **CATHODIC PROTECTION**: ICCP (IMPRESSED Current Cathodic Protection)

7. **Communication System**:
   Dedicated UHF, SATELLITE, VHF & OFC SYSTEM

8. **SCADA** Monitoring & Control from MCC & NGMC: Provision of automatic control of all critical operations of the pipeline from remote, through a dedicated on-line SCADA system.

9. **Sectionalizing Valve Station**
   SV-Stations are installed at every 20-TO 25 Km for Isolating the pipeline sections if required.

10. **Intermediate Pigging stations**:
    These stations are situated at a distance of around 75 - 80 Km. These stations facilitates the PIGGING activities.

11. **RADIO REPEATER STATIONS**: These RR Stations are situated at a distance of 35 -40 KM. These Stations are used for CP & Communication purpose.
12. Provision of impressed current / sacrificial anode Cathodic protection system with dedicated power supply, as additional protection from corrosion.


14. Provision of a dedicated voice & data communication system all along the cross country pipelines.
15 Provision of dedicated fire fighting systems at all intermediate installations, including CO2 / Argon flooding, portable fire extinguishers, fire tenders and trained personnel etc. for meeting any eventuality.

16 Dedicated security system for P/L by deployment of Ex-servicemen as Security Guards on round-the-clock basis.

17 Regular foot patrolling & aerial surveillance of P/L as per safety codes.

18 Specialized maintenance teams equipped with all emergency tools, equipments etc. kept on alert to meet any emergency.
MULTIPLE LEVELS OF SAFETY


20. Regular Mock Drills are conducted to maintain effective & efficient preparedness for handling an emergency, and continuous upgrading of safety & security systems is done.

21. Automatic water spray system with HC detectors.

22. Training /awareness to villagers along the pipelines.
Integrated Safety Systems

Natural Gas, LPG Pipeline & GPU’s

- Process Design & Layout as per latest International Standards
- Electrical & Instrumentation Systems as per Area Classification
- Fire proofing of Major structures
- Blast Proof Control Room
- Process Safety Interlocks
- Restriction of ignition sources at the security entry gate to the premises
- Emergency Communication System
- Auto sequential startup of Fire Water Pumps
- Regular Trainings to all employees
- Work Permit System as per OISD-105 in ERP-SAP
- Mutual Aid with neighboring Industries
- Internal & External Safety Audits
- Onsite & Offsite Emergency Action Plans
Integrated Safety Systems

Natural Gas, LPG Pipeline & GPU’s

- Smoke, Heat, Fire and Gas detection and Alarm System.
- Various types of Communication Systems
- Hydrants, Monitors (including HVLR) all around
- Auto & remote operated Fire water spray systems
- Sufficient Fire Water Storage as per OISD - 116/117/226 with pressurized Network and Fire pumps in auto mode.
- LEL Gas detection system
Communication System

• Proper Communication System within GAIL by G-Net.

• STM Phone connectivity at all SVs

• Good Connectivity through mobile and DOT lines.

• VHF sets for internal communication.

• Inmarsat set.
Pipe Line Safety

- MONTHLY HELICOPTER SURVEILLANCE FOR POSSIBLE ENCROACHMENT IN ROU, SOIL EROSION ETC.
- HALF YEARLY CPL SURVEY OF CREEK AREA IS BEING DONE.
- REGULAR PHYSICAL INSPECTION OF THE ABOVE GROUND INSTALLATIONS (SV & IP STATIONS) ALONG THE PIPELINE ROUTE.
- QUARTERLY PERFORMANCE TEST OF ALL VALVES INCLUDING REMOTE OPERATIONS.
- QUARTERLY MONITORING OF PIPE TO SOIL POTENTIAL AND ANALYZING THE PSP TREND. CORRECTIVE ACTIONS TAKEN ACCORDINGLY.
- POST-MONSOON FOOT PATROLLING ALONG THE PIPELINE.
Pipeline Patrolling in GAIL

1. Air surveillance by GAIL Employees: Major pipelines once in a month.
2. Foot patrolling by GAIL Employees ones in a year and as and when required.
4. Daily/Weekly/Monthly/ bimonthly foot patrolling (as per requirements of particular lines or jurisdictions by contract security Guards.
5. Foot patrolling by GAIL Employees and contract security personnel (as and when required)
6. Patrolling by vehicle at the time of CP reading (Quarterly) and as and when required.
Checks during Line Patrolling

- Pipeline Exposure
- Soil Erosion
- Encroachments
- Excavations
- Developmental Activities Nearby
- Kilometer Markers Status
- Suspected Gas Leak locations
- Grown up Trees / Bushes / Structures in ROU
Prevention of Sabotage to Pipeline

Sabotage of a land-based pipeline can, to a large extent, be prevented;

**first**, by burying the pipeline well below the ground;

**second**, by having an optical fibre sensing facility to detect any break or leak in the line;

**third**, by an overhead satellite monitoring system;

**fourth**, by pipeline patrolling.

Positioning repair teams at regular intervals and limited underground gas storage can take care of short-term supply disruptions.

When put into service, pipelines are patrolled by at least two people.

The patrols look for leaks and signs of a leak. They report all leaks promptly. PatROLS also prevent or hinder sabotage or theft.

They are sent out often and at different times each day so that no one can predict when a patrol may be in a specific area. Usually, patrols are not sent out during the night because leaks are hard to spot.
Fire & Safety Systems

Gas Processing Units

- Auto-actuated water spray system for Loading Gantry, Storage vessels/tanks etc. flammable liquid/gas handling pumps.

- Clean agent flooding system for control rooms and gas turbines.

- Fire fighting & Rescue Tenders and other Mobile & Portable equipments
Typical Challenges

• Gas handling conditions: Extreme Pressure & Temperature
• Gas Leakage Detection Difficulty
• Gas Leakage Isolation Difficulty
• Prevention of Vapour Cloud Formation
• Fire Prevention
• High Pressure Jet Fire
• Mixture of Gas, Liquid & Solid Fire
• Approach to Seat of Fire due to high temp.
• Extinguishing Media: Extinguish & Cooling
Typical challenges faced during pipeline leakages

- Interior & inapproachable locations

- Water-logged fields round the year due to paddy crops

- Continuous water seepage in the pit makes working difficult

- Loose soil keeps on caving inside the pit
EXTREME CHALLENGES & CONCERNS

Gas handling conditions:

- Extreme Pressure conditions
- Extreme Temperature conditions
- Large Volume Storage:
  - Horton Sphere
  - Bullet
  - Mounded Bullet
- Loading & Un-loading
- Cross Country Pipeline:
  - Online Pigging
  - Crossings – Rail, Road, River, Canal, LT/HT lines
CHALLENGES & CONCERNS

Gas Leakage Detection Difficulty

- Odor – Adding Stage, Toxicity & Flammability
- Wind Direction, Weather & Layout
- Volume of Leakage
- Hydrocarbon Gas Detectors:
  - Selection of suitable type of Detector
  - Location of Detectors: Obstruction by other equipments
- Covering Area
- Wind Direction
- Vulnerable Leakage Points
- Reliability & Calibration of Detectors
- Data Storage
- Remote Location of Cross Country Pipelines – SCADA
CHALLENGES & CONCERNS

Gas Leakage Isolation Difficulty

• Approach to the valve – in leakage path
• Remote Operation
• Fire Proofing of Valves
• Isolation in Processing Units
• Isolation in Pipelines
CHALLENGES & CONCERNS

Prevention of Vapour Cloud Formation

• Timely Detection
• Weather condition & wind direction
• Land Contour
• Layout
• Dispersion System & Procedure
CHALLENGES & CONCERNS

Fire Prevention

- Adhering to Work Permit System
- Presence of Fuel & Air
- Source of Ignition:
  - Friction – Grinding, Chipping - Non sparking tools
  - Electrical – Spark, Arc, Static Charge
  - Open Flame – Gas Cutting, Welding
- Vehicle Entry Restriction
- Intrinsically safe & flame proof enclosures
- Static Charge: Earthing & Bonding
- Insulation of hot lines
CHALLENGES & CONCERNS

Fire Fighting:
• Flash back to the leakage point
• High Pressure Jet Fire
• Mixture of Gas, Liquid & Solid Fire
• Multi Location fire
• Approach to Fire Seat due to high temp.
• Approach to top of the Column & Vessel Fires
• Extinguishing Media: Difficulty in extinguishing & Cooling
• Cloud Formation & Explosion if Extinguished but supply not stopped
• Response time for cross country pipeline
What is appealed to the local populace?

• Valves should not be operated inadvertently.
  • As per P&MP Act 1962, the digging of ground / wells, construction of buildings, planting of trees etc., are prohibited.
  • Safeguard of warning boards.
  • Any attempt of sabotage should be intimated to the given address and telephone no.
  • Precautions to be taken in case of leakage such as:
    • removing all inflammable materials from the vicinity.
    • Not to operate any vehicles.
    • Inform about leakage to nearest police station, fire station and GAIL office.
    • Not to panic and act calmly.
OFF-SITE EMERGENCY ACTION PLAN

External Agencies Involved

• District Collector- Head of District Crisis Group
• Police- Evacuation and Security
• Fire Brigade- Emergency and Rescue Operations
• Hospitals- Treatment and ambulances
• Civil Defense/Army/Navy- for assistance
• Mutual Aid Members – for assistance
OFF-SITE EMERGENCY ACTION PLAN

Offsite Emergency Plan additionally consists of following information:

- Shelters Details
- Telephone Numbers of District / Civil Authorities
- Evacuation plan
BEST SAFETY PRACTICES IN GAIL

- **Incentive on Near Miss Reporting**
- **HSE is important agenda point in Management Review Meetings, including Board of Directors Meeting**
- **Monthly Critical safety Campaigns at Sites**
- **EHS Module of SAP implemented**
- **No safety interlock bypass without written authorization**
- **Counter signing of safety officer in all Work Permits**
BEST SAFETY PRACTICES IN GAIL

- Safety talk to employees on daily basis before starting of job.
- Task Risk Assessment by Committee consisting of various discipline to access the risk and recommend the precautions to carry out job safety in hazardous area.
- Structured HSE Training to O&M employees. Regular training is imparted to contractors, tanker drivers & nearby villagers.
- Extensive use of Bicycles within plant premises.
BEST SAFETY PRACTICES IN GAIL

- **Internal safety audit and its review for compliance of each plant/section are being conducted on quarterly basis.**
- **External safety audit of the complex is being conducted on annual basis.**
- **Monthly compliance of audits is being reviewed by OIC.**
- **Safe operating and maintenance procedure & Safety Manual have been developed, documented and followed.**
- **Material Safety Data Sheet of all plant chemicals prepared and made available on LAN**
BEST SAFETY PRACTICES IN GAIL

- Safety guidelines to be followed in various activities being carried out by contractors were issued for strict compliance.

- In case of non-compliance of safety recommendations in spite of repetitive advise punitive fines are being imposed with the consent of competent authority.
Assessment of SAFETY Performance

HSE Policy states “GAIL accords highest priority to set tangible and measurable targets for monitoring the performance on HSE”.

HSE index is the yardstick for evaluating HSE performance of all 28 O&M work centers. HSE index is calculated based on 9 measurable parameters which are allotted weightage out of maximum 100 percentage according to their importance.
GAIL Management has formulated Annual HSE Award Scheme to reward the “Best in Class” work center for the best HSE Performance.

All O&M installations have been categorized in the following three classes for this award scheme.

- **Gas Processing Plants**
- **Gas Compressor Stations & LPG Pumping Stations**
- **Natural Gas & LPG Despatch Terminals**

The HSE Performance of the work centers are evaluated on monthly basis for each financial year and scores averaged for assessing the yearly performance.
THANK YOU