Maintenance and Operation of Dahej LNG Terminal

PETRONET LNG LIMITED
October 20, 2011
Introduction

- The 10 MMTPA LNG Terminal at Dahej, is state of art technological infrastructure and plays a crucial role in fulfilling the energy requirement of the country.

- 16~18% of Indian gas demand is met by PLL’s Dahej terminal.

- Terminal is equipped with 2.4 Km long Jetty, which can handle upto 160 ship berthing in a year.

- The terminal is operated round the clock, maintaining required sendout to meet the customers requirement.
Introduction cont...

- To maintain almost Zero downtime timely preventive maintenance activities are carried out on the installed equipments.

- The operating and safety procedure are constantly reviewed and modified as per requirement and operating experience.

- The highly experienced and dedicated operating and maintenance team is self sufficient to cater any operational or maintenance related problems.
OPERATIONS

Our AIM 100 % Safe & Continuous Operation

Petronet LNG Ltd.
## Operational highlights

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Ships</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003-04</td>
<td>4</td>
</tr>
<tr>
<td>2004-05</td>
<td>41</td>
</tr>
<tr>
<td>2005-06</td>
<td>79</td>
</tr>
<tr>
<td>2006-07</td>
<td>92</td>
</tr>
<tr>
<td>2007-08</td>
<td>101</td>
</tr>
<tr>
<td>2008-09</td>
<td>104</td>
</tr>
<tr>
<td>2009-10</td>
<td>124</td>
</tr>
<tr>
<td>2010-11</td>
<td>136</td>
</tr>
<tr>
<td>2011-12</td>
<td><strong>165</strong> Expected (93 received up to 19-10-11)</td>
</tr>
</tbody>
</table>
ISO Certified Company

ISO 9001: 2008 QMS

ISO 14001: 2004 EMS

OSHAS 18001: 2007
MAJOR JOBS Of Operating LNG Terminal

- Unloading LNG from ship
- Storage of LNG in tanks
- Regasification of LNG
- Custody transfer of NG as per nomination
- Joint Ticket/Reconciliation
- Loading LNG in Road Tankers
- Maintaining equipment/system fit to work
- Monitor and control operating parameters
- Optimization
- Co-ordination with internal/external agencies
- Start up/Shut Down & emergency handling
OPERATIONAL CONTROL

- Standard Operating Procedure
- Training
- Field Round
- Patrolling Sheet (Engineer & Operator)
- Permit System
- Fluid Lock Out system
- Bypass procedure
- Performance Management System
- Abnormalities Identification and Reporting System
- Internal/External audits
- Health Monitoring
- Communication Procedure
- Incident analysis
Process Flow diagram of LNG Terminal, Dahej
LNG Vaporizers
RLNG Distribution to Consumers

RLNG from Phase-I

GSPL Metering

Phase-I PLL Metering Station

GAIL Metering Station

DUPL Metering (GAIL)

To DUPL

To DVPL

To GSPL

RLNG from Phase-II

Phase-II PLL Metering Station

24"

42"

30"
Jetty Trestle
Facilities for Ship Berthing

- State of the Art Ship Berthing & Mooring system including
  - Ship Docking assistance Unit Including:
    - Sensors (Sea current sensor, Wave & tide sensor, Wind sensor)
    - Radars
    - Display Units
    - Portable Display Units
    - Tension Monitoring arrangement

- Constant Tension Hydraulic winches
Ship maneuvering
Jetty Features

- The 2.54 Km Jetty facilitates the safe unloading operation.

<table>
<thead>
<tr>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>LNG Unloading Arms FMC</td>
<td>3 X 16” Total Flow Rate = 10360 m3/hr</td>
</tr>
<tr>
<td>NG Loading Arm FMC</td>
<td>1 X 16” Flow Rate = 14000 m3/hr (at 0.13 barg, -87.7 Deg C)</td>
</tr>
<tr>
<td>LNG Drain Drum</td>
<td>V-101 Capacity = 53 m3</td>
</tr>
<tr>
<td>Berth Aid System Weather, Tide,</td>
<td>Marimatech</td>
</tr>
<tr>
<td>Current Monitoring</td>
<td></td>
</tr>
<tr>
<td>Unloading Arm Safety System</td>
<td>FMC</td>
</tr>
<tr>
<td>Unloading Lines</td>
<td>2 X 30”</td>
</tr>
</tbody>
</table>
LNG Storage Tanks: 4 x 148,000 m³
LNG Storage Tanks

Capacity: 1,48,000 m³
Outer Dia.: 81 m
Height: 55 m
LNG HP Pumps
LNG Truck Loading Facility

- Truck Loading facility at Dahej terminal was commissioned in August 07.

- Facility can handle 2500 loadings per year
VAPORISATION FACILITIES AT CUSTOMER’S END
Maintenance Activities
Philosophy

- Preventive maintenance philosophy is followed for all critical equipments like Unloading arms, BOG compressor, Diesel engines and GTGs. Periodic overhauling is done for LNG Pumps.

- A combination of Preventive maintenance and Condition based maintenance philosophy for all other equipments in the terminal like GW Pumps, FW Pumps etc.
Critical equipments

- Jetty and Unloading arms
- In tank and HP LNG pumps
- BOG compressors
- Fire Water pumps
- Instrument air compressors
- GTG & EDG
Jetty

- 4 Breasting Dolphins and 5 Mooring Dolphins
- Can berth ships from 65000M³ to 215000M³ size
- Facility for berthing tug boats at Port craft Jetty
Un loading arms

- FMC France make

- 16” Dia 3Nos Liquid arms and one Vapor arm

- Rated capacity of 3640M3/hr liquid and 14000M3/hr BOG at -87.7 Deg C & 0.13mbarg.
LNG Pumps

- NIKKISO Japan make

- 12Nos In tank pumps, 3in each tank and 2 ware house stand by

- 10Nos HP LNG pumps and 1 ware house stand by
BOG Compressors

- Dresser rand, France Make
- 3 Compressors Installed
- 12000M3/hr at 1.013bar and 0Deg C
GTG & EDG

- 5 Nos SIEMENS GTG 7.5MW ISO rating.
- 3 Nos commissioned in phase-1 and 2 Nos commissioned in phase-2
- 1 No EDG 1875KVA capacity.
Challenges for maintenance

- Maintenance in Unloading arms and jetty equipments in view of more number of ships unloading from single jetty.
- Availability of trained manpower.
Electrical maintenance
POWER SYSTEM LAYOUT

- Our main power system consists of 5 GTGs (Gas Turbine Generators) and 2 lines from GEB.
- Each GTG has a rated power generation capacity of 7.5 MW.
- Our provision for GEB is for 2.5 MVA i.e. we can draw this much power from GEB at a time.
EMERGENCY DIESEL GENERATOR SET

- Emergency diesel generator set of 1.875 MVA rating.

- Useful in case of a blackout and emergency.
Instrumentation
Instrumentation

• Field instrumentation
  ➢ Primary measuring elements
  ➢ Transmitters
  ➢ Switches
  ➢ On-Off Valves and its accessories
  ➢ Control Valves and its accessories
  ➢ Analyzers
  ➢ Gas Chromatograph, etc...
Main Control system

- DCS (Distributed Control System)
- ESD (Emergency shutdown system)
- FGS (Fire, gas and spill detection system)
- ULA (Unloading Arm system)
- BAS (Berth Aid System)
- TFMS (Tank farm management system)
- Gas Metering System
ESD Philosophy

In our terminal ESD is split into 3 main groups as below:-

• ESD # 1 – Takes care of the Jetty Operations & Receipt.
• ESD # 2 – Takes care of the Send out operations
• ESD # 3 - Takes care of both the operations i.e jetty and send out i.e combination of ESD1&2 also gives permissive for complete depressurizations of STV/SCV.
FGS System

- Components of Fire, Gas, Spill Detection & Prevention System

1. Fire, Gas, Spill detectors, Manual call points (Break glass), Deluge valves, beacons lamps and hooters etc..
2. FGS PLC:
   - ICS Triplex for phase – I
   - Triconex for Phase - II
3. FGS HMI # 1,2 & FGS printer.
5. Fire Detection Mimic Panel.
6. Inergen / Clean agent gas systems.
7. Building Fire detection system.
FGS Shutdown system

ESD#1 is activated in case of:

- Activation of any two gas detectors – 60 % LEL. (GSD + GSD)
- Activation of any two fire detectors. (FSD + FSD)
- Activation of any two spill detectors. (TSD + TSD)
- Activation of any two types of detectors. (GSD + TSD or GSD + FSD or TSD + GSD)
Berth Aid System

Berth Aid System consists of:

- Weather monitoring system
  Consists of
  - Wind Speed & Direction sensor
  - Current speed & Direction Sensor
  - Tide/Wave Sensor
- Laser docking system
  Consists of
  - Telescopic Lift
  - Distance sensors
  - Level Sensor
  - Level Switch
  - Large Digital Display
- Mooring Load Monitoring System
  Consists of
  - Quick release mooring hook with load cell
Tank Farm Management System

System supplier and manufacture: M/s Whessoe S.A. France

Each tank consists of:
- Redundant servo level gauges
- High/high level alarm gauge
- LTD gauge
- Product spot temperature sensing elements
- Temperature element transmitters

Redundant SCADA system:
Features:
- Data handling/control software
- LNG tank management software
- Report Manager
- Data Historisation
- Communication with DCS on Modbus
Gas Metering System (Phase-I)

System supplier: Oval, Singapore

Gas Metering system Consists of:

- Turbine meter
  - Make: Elester-Instromet
  - Model: SM-RI / X-L / 4000G

- Gas chromatograph
  - Make: ABB
  - Model: PGC 2000

- Flow computer
  - Make: OMNI
  - Model: 6000

- PLC
  - Make: Allen-Bradley
  - Model: Logix 5555 (redundant)

- SCADA Software
  - RS View 32 of Allen-Bradley
Gas Metering System (Phase-II)

System supplier : Daniel, Singapore

Gas Metering system Consists of :

• Ultrasonic meter
  ➢ Make : Daniel
  ➢ Model : 3400

• Gas chromatograph
  ➢ Make : Daniel
  ➢ Model : 570 series

• Flow computer
  ➢ Make : Daniel
  ➢ Model : FloBoss S600

• PLC
  ➢ Make : Allen-Bradley
  ➢ Model : Logix 5555 (redundant)

• SCADA Software
  ➢ Ifix of GE-Fanuc
Gas Metering System (GSPL)

System supplier: FMC, Singapore

Gas Metering system Consists of:

- **Ultrasonic Flow meter**
  - Make: FMC
  - Model: MPU1200

- **Gas chromatograph**
  No GC at present. Gas quality data given from phase-II GC.
  - Make: Daniel (Proposed)
  - Model: 570 series (Proposed)

- **Flow computer**
  - Make: OMNI
  - Model: 6000
Calibration of Instruments

Periodic calibration / Preventive maintenance of instruments are carried out.

Transmitter : Yearly
Control Valve : Yearly
Pressure switch : Half Yearly
Gas Detector : 4 Monthly
Fire Detector checking : 4 Monthly
Spill Detector : 4 Monthly
On-Off Valve : Yearly
Analyzer : 4 Monthly
Metering station instruments : Monthly
Challenges for maintenance

- Maintenance of Unloading arms and jetty equipments in view of more number of ships unloading from single jetty.
- Maintenance of Jetty equipments like Fenders, current sensors and CT winches is a big challenge in view of non availability of lifting equipment like cranes.
- Maintenance of LNG pumps requires highly skilled man power.
Challenges for maintenance

- Maintenance of Berth aid system as highly specialized equipments are there.
- Maintenance of Cathodic protection system of jetty, inspection of pile condition under water in view of high currents and muddy water in sea.
- Maintenance of LNG submerged motors.
- Maintenance of Tank level gauging and density meters.
Thank you