Safety Overview of Indian experiences with LNG Road Transportation, Distribution and operation of small LNG storages

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IndianOil in Cryogenics

- IndianOil is Global Fortune 500 company, ranking 105, and India’s largest commercial enterprise.
- IndianOil has more than 30 years experience in Cryogenics:
  - Design & manufacturing of Cryogenic pressure vessels
  - For transport and storage applications upto 140 KL capacities
  - For Liquid Nitrogen, Oxygen & Argon applications
LNG at Doorstep System

- The Natural gas is normally being supplied in the country to various consumers through Pipelines.
- For the first time in India, Indian Oil has pioneered the supply of Natural gas in liquefied form using cryogenic movement of LNG to the customers, who are away from NG pipelines.
- The system has been named as “LNG at Doorstep”.
- LNG in stored at customer premises in Cryogenic Storage tank and on-site regassification done using ambient air vaporizers for Natural Gas supply to the end use equipment.
Concept predominantly in use

Natural Gas Resources → Liquefaction → Cryogenic Vessels (like Dahej) → Terminals → Re-gasification → End Gas Consumers

Pipelines transport
LNG At Doorstep concept

Natural Gas Resources → Liquefaction → Cryogenic Terminals (like Dahej) → Cryogenic Truck/Rail transport → Cryogenic Storage tanks → End Users

Pipelines transport → Gas Consumers → Re-gasification
‘LNG at Doorstep’ activity

- LNG road transportation through ‘LNG at Doorstep’ started for the first time in the country, in August 2007
- Being supplied to two customers:
  - M/s H & R Johnson, Pen, Maharashtra
  - M/s Schott Glass, Jambusar, Gujarat
- Five LNG cryogenic road tankers (40 KL) and two LNG storage tanks (105 KL) are presently in use
- Expansion of activity to more consumers under implementation
LNG – A safe fuel

- Lighter than air – quickly dissipates
- High ignition temperature – 537 deg Celsius
- Small flammability range - 5 to 15%
- Low Pressure transportation in double walled cryogenic tankers
- No possibility of en-route pilferage of LNG
LNG – Safe transportation

- As on January 2010:
  - Total road distances covered are more than 9.75 lacs Kilometers safely
  - Total LNG delivered over 22,000 MT
- Incident free transportation for over 30 months
- LNG road transportation has proved to be very safe worldwide
- The double walled construction of tanks make the LNG transportation safer
- The incidents which have occurred are more related to the vehicles than the tanks
Safety features – LNG tankers

- All the requirements of NFPA and SMPV complied for safe operations
- LNG fill and withdrawal connection having two isolation valves; one manual and one air operated
- Facility for remote operation of isolation valve
- Anti-tow away system
- Speed monitoring of each vehicle through GPS
- Built in Grounding mechanism on the tanker for emergency LNG transfer
Safety features – LNG storage

- Double walled Perlite filled vacuum insulated tank
- Tanks equipped with automatic fail safe product retention valves
- All the requirements of NFPA & SMPV are complied
- Low level alarm and High level alarm & shut down system to eliminate overfilling
- All the venting of any safety valve, thermal relief valve, vent valve, vent regulator etc. are directed to the common vent stake, 24 Metre high

Contd..
Safety features – LNG storage

- Safety distances followed as per SMPV requirement which are more stringent than other international standards like NFPA
  - 30 Metres from tank, as per SMPV
- 1 Metre high Dike constructed covering >110% of volume
- Sump pump for water removal from Dike provided with safety interlock for LNG
Safety features—LNG regasification

- All the valves with automatic fail safe construction
- Complete automated operation, with all safety interlocks
- Gas detectors & flame detectors provided
- ESD provided at different locations
- Fire fighting system
• A Joint Working Group (JWG) of PESO & IOC, under the Chairmanship of Chief Controller of Explosives was formed
• JWG worked on developing reference document relating to Guidelines and Safety Standards for LNG at Doorstep
• International standards were studied and reference document developed
Regular training on ‘LNG handling & emergency response’ imparted to all the personnel involved in the LNG supply chain:

- Drivers
- Transport Supervisors
- Customers’ Operators
- IOC Personnel involved

Only well experienced and trained drivers deployed

En-route IOC LPG bottling plant personnel are involved in emergency response

On-site and Off-site Emergency Response Plans (ERP) and ERP for LNG transportation are in place
Some Photographs of the system...
Loading Skid
Tanker on loading bay
Tanker loading facilities at Dahej - totally concealed
Site facilities at customer’s end - superior design of the system with the latest gadgets provide trouble free / hassle free re-gasification
Site facilities at customer’s end with LNG Tankers
LNG TANKER AT CUSTOMER’S SITE
Totally concealed unloading operation of LNG at customer end - No contamination, adulteration & pilferage
In summary

- IndianOil utilized its 30 years experience in Cryogenics to pioneer ‘LNG at Doorstep’ in India
- A humble step towards more equitable distribution of Natural Gas in the country
- LNG road transport, on site storage & regasification started for two customers, 2½ years back
- LNG a safe fuel to transport, due to its inherent properties: Lighter than air, high auto ignition temperature and low flammability range
- Almost 10 lacs Kms LNG road transportation completed safely, supplying over 22000 MTs
- All safety requirements meticulously fulfilled
- Expansion of ‘LNG at Doorstep’ in implementation
Thank You