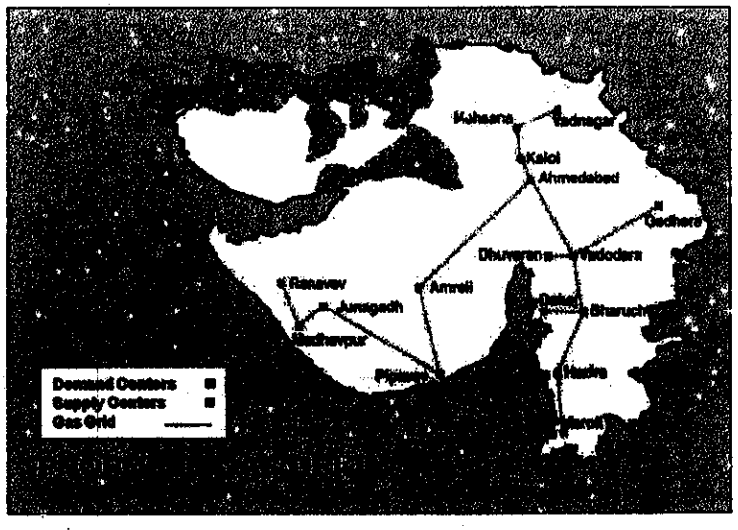
GUIDANCE MANUAL
ON
SAFETY, HEALTH & ENVIRONMENT
OF
NATURAL GAS DISTRIBUTION PIPELINES



INTERIM PROGRESS REPORT

JANUARY, 2001

Submitted to

[redacted]

GUJARAT STATE PETRONET LTD.

Block 15, 3rd Floor, Udyog Bhavan,
Sector - 11, Gandhinagar - 382011.

Prepared by

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PROJECTS LTD.

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ACKNOWLEDGEMENT

Preparation of the Interim Progress Report was the result of a teamwork of professionals on the subject. It would not have been possible but for the co-operation & full support extended by Mr. Ravindra Agrawal, GSPL. We are extremely thankful to Dr. P.V. Krishna for his total involvement & guidance.

Dr. Krishna's co-ordination work with Mr. C.G. Pandya & Mr. S.H. Sharma, Project consultants & members of SAKET PROJECTS LIMITED, working on this particular project has produced this interim report. All this would not have taken shape without the active participation of all concerned.

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CHAPTER-1
EXECUTIVE SUMMARY

1. EXECUTIVE SUMMARY

The rapid industrialisation & the fluctuating global petroleum scenario has made the use of cleaner fuels almost a neccessity in our day to day lives. As we enter the 21st century the effects of the use of earlier available fuels, is distinctly visible. The expanding horizon of large & medium scale industries & the use of piped gas for the domestic purposes has necessitated the use of Natural Gas / Revapourised LNG for one and all as the increase in crude oil prices, deficit in national supply has put more burden on foreign exchequer and financial budget.

Gujarat State Petronet Ltd. set up with the sole objective to transport Natural Gas / Revapourised LNG to industrial & domestic consumers has being engaging various agencies to monitor the effect of the project on the SAFETY,HEALTH & ENVIRONMENT. In line with the above SAKET PROJECTS LTD. has been assigned the job to prepare a guidance manual for the network distribution systems.

The following report represents the framework of a detailed literature & in-depth study of the systems operating in India and abroad. The legislative provisions as existing for the same have also been studied & included. Guidance for the setting up of the safety standards with reference to the existing ones have been highlighted while keeping into mind the essential aspects of the network distribution systems.

The interim progress report is a step towards the magnanimous work which remains, and is a directional approach towards the same.

CHAPTER-2
INTRODUCTION

- USE OF NATURAL GAS/REVAPORIZED NG
- ADVANTAGES IN GUJARAT
- DISTRIBUTION NETWORK SYSTEM ADVANTAGES AND APPLICATIONS
- HAZARDS INVOLVED IN RECENT TIMES

2. INTRODUCTION

1. Natural gas sales, which was 3.62 billion cu.m in 1988-89, has increased to 28.7 billion cu.m in 1999-2000. Gas production in India is 21.63 billion cu.m and it will not be able to meet the demand. Therefore, it is now essential to import Liquified Natural Gas (LNG) to meet the country's growing requirement of Natural Gas.

2. Gujarat, having a large coast-line, definitely would be stepping towards port development for LNG imports and subsequently, would require to develop pipeline network for transportation and distribution of natural gas. This needs development of ports in Gujarat to serve as terminal point, laying of gas pipe line for transportation, distribution and marketing of Natural gas/revaporized LNG.

3. The State of Gujarat has already taken steps to meet the challenge by forming its own state level body i.e. Gujarat State Petroleum Corporation Ltd. (GSPC). Its role is to explore and exploit smaller oil & gas fields allotted to it in onshore and offshore blocks under the National Exploration Licensing Policy (NELP). A Seperate body – Gujarat State Petronet Ltd. (GSP) is set up with a specific responsibility to develop a cross-country network of pipe lines for transportation and distribution of natural gas/revapourised LNG in the State.

4. Keeping pace with the growing demand for appropriate fuel to meet the energy demand in Gujarat, estimated to grow at the rate of 6 per cent import of LNG appears to be a feasible option. Four LNG import terminals have been given Locational Clearance by Government of Gujarat. A state wide high pressure trunk transmission network and gas grid for the transportation of natural gas/ revapourised LNG from the supply point to the demand centres would also need to be set up. In December 1998, Gujarat State Petronet Limited (GSP) was incorporated to implement the GAS GRID Project. The individual gas distribution net-works in the rural or urban centres would be subsequently taken up by separate implementing agencies.

5. Having got the priorities of establishing a high pressure transmission system based on common carrier principle, plan and develop pipeline corridors for gas transmission system in the state, GSP has shown interest in the study of various issues related to safety, health and environment in respect of the distribution network meant for natural gas/revapourised LNG. It is implied that conceptualizing and establishing the distribution network in the rural and urban areas will be based on established practices of design, operation and maintenance. GSP desired to have an enabling document for their use at the time of appraising any of the proposals submitted by the interested agencies. Therefore, it is our understanding that the FINAL output of this study is to be a guidance document incorporating essential elements of safety, health and environmental issues that may be encountered while establishing, operating and maintaining the distribution pipeline net works. Further, as an outcome of the Study, this document is expected to bring out questionnaire/check-list that reflect the mechanism by which the regulating authorities would be in a position to assess adequacy of measures that are provided in the design/project report and the manner in which compliance of safety, health and environment provisions are visualized to be achieved.

6. SAKET PROJECTS LTD. having established an Environment & Safety Management Division (ESMD) has shown interest in conducting a study to develop Guidance Document on Health, Safety & Environment aspects of National Gas Pipe-line net work systems. Accordingly, a proposal was prepared by Saket Projects Limited and submitted to Gujarat State Petronet Ltd. on 18th August, 2000 (Copy at Annex-1).

7. Gujarat State Petronet Ltd., after due review of the proposal, issued WORK ORDER vide their letter No. GSPL/00/446 dt. November, 20, 2000 (Copy at ANNEX-2).

8. Saket Project Ltd., had constituted a Project Team and took up the assignment.

9. This document is the "INTERIM PROGRESS REPORT" of the study on hand submitted to Gujarat State Petronet Ltd., for their information, interna! review and comments.

10. With the further progress of the assignment, SAKET PROJECTS LTD., will prepare the Draft Report and submit within 4 weeks of submitting this progress report.

11. Outline of Transportation Pipeline and Distribution of Natura! Gas include high pressure trunk transmission network and gas grid for the transportation of Natural gas/ revapourised LNG from the supply point to the demand centeres. Briefly the LNG supply chain can be summerized as below.

Stage–1 : Gas from field and Gas liquifaction. (Establishing plant for converting NG to LNG and Cryogenic Storage.)

Stage–2 : Transfer loading the tanker (Establish loading facility for LNG at port including storage of LNG)

Stage–3 : Movement of LNG in tankers to identified ports (Transport)

Stage–4 : Unloading LNG and Storage regasification (unloading, transfer, cryogenic storage, pumping, regasification and tanker return to originating port for refilling etc.)

Stage–5 : Distribution of NG.

The various types of pipelines which are laid for distribution oF Natural Gas can be broadly categorised as under :

- Those built within the gas field for the collection know as infield lines.
- Those built to cover longer distances between the point of production and consumption known as cross-country pipelines.
- And smaller diameter pipelines used for distribution and supply. These smaller diameter and usually low-pressure, pipelines are normally associated with the distribution of natural gas.

12. Natural gas is used as a primary fuel and source of heat energy because of its clean burning characteristics. The pipeline industry has, in the main been free of major disasters. There have, of course been pipeline failures leading to pollution and in some cases to fatalities. Some accidents of gas pipeline systems are as follows :

(1) There was a major rollover incident at La Spezia, Italy, which was clearly identified as being due to compositional stratification, which could have been avoided by mechanically stirring the liquids to make density stratification impossible.

(2) In recent years, the most publicized incident has occurred in Russia (Gritzenko and Kharionovsky, 1994) where problems associated with pipeline monitoring had become acute because of the age of the pipelines, their length and the fact that they are subject to severe climatic regimes.

(3) The worst incident was when a Trans-Siberian train ignited a gas cloud from a pipeline. The massive explosion that resulted left a reported 706 people hospitalized and 462 dead or missing. The incident on 3 June, 1989 happened when a pipeline from the gas fields of Western Siberia to Ufa in the Urals developed a leak. Instead of investigating the leak, engineers increased the pumping rate to keep up the pressure. The escaping LPG formed pockets in two low-lying areas, Two trains were in the area when the incident happened. The turbulence they caused mixed the LPG with the air to form a flammable cloud and one of the trains sparked off the cloud. Two massive explosions were followed by a wall of fire and the trains were blown apart.

CHAPTER-3
PLANNING A GAS PIPE LINE DISTRIBUTION NET WORK : GENERAL CONSIDERATIONS

- CONCEPTUALIZATION
- NATURAL GAS PRODUCTION AND PROCESSING SYSTEM
- INTERNATIONAL SCENARIO & (SALIENTS)
- HEAD WAY IN NATURAL GAS/REVAPOURISED NATURAL GAS USE
- PLANNING AND DEVELOPMENT OF PROJECT
- SAFETY AND HEALTH/ENVIRONMENT POLICY AND RESPONSIBILITIES
- PIPELINE INSTALLATIONS
- ENVIRONMENT
- OCCUPATIONAL HEALTH MONITORING IN GAS INDUSTRY

3 PLANNING A GAS PIPE LINE DISTRIBUTION NET WORK : GENERAL CONSIDERATIONS

3.1 CONCEPTUALIZATION :

Natural Gas

Natural Gas is simply a naturally occuring mixture of combustituble hydrocarbon (HC) gases and impurities. The nonhydrocarbon components of Natural Gas are of two types of materials dilluents, such as N_2, CO_2 and water vapor and contaminants such as H_2S and other Sulfur compounds. Dilutants are noncombustible gases that reduce the heating value of the gas. They are not very harmful and may actually be used in fillers to reduce the heat content of the supply of gas. The disadvantages include greater horse power and pipelining for same energy content of the gas, greater internal corrossion and freezing, contaminants are very detrimental to production and transport equipment (some are hazardous pollutants and the primary reason for gas conditioning and processing is to remove them as soon as possible from the gas stream. Hundreds of process and processing plants have been developed to deal with this problem. Some of the major contaminants in Natural Gas are :

1. Acid gases chiefly H_2S and to some effect CO_2
2. Water vapour as excess of 5-7 lbm/MMCF
3. All entrained free water, or water in condensed form.
4. Any liquids in the gas, as well as inhibitors, lubrication oil, scrubber oil, methanol and heavier end hydrocarbons.
5. All solid matter, some lines called "pipe line trash" that may be present. This includes silica (sand) pipescale and dirt.

Like all gases, Natural Gas is a homogenous fluid of low density and viscosity. It is odorless, odor generating additives are added to it during processing to enable detection of gas leaks. Natural Gas is one of the more stable flammable gases. It is flammable within the limits of 5-15% mixture with air and its ignition tempurature ranges from 1100 to 1300°F (compare with H_2S which is flammable within 4-46% in air at a much lower ignition temperature. Typically, Natural Gas has an energy content of 1,000 Btu/sct which is an important parameter because gas these days is very often priced in terms of its energy content, rather than its mass or volume.

Typical constituents Table of Natural Gas (modified after MC cain 1974)

Category	Component	Amount %
Parraffinic HC's	Methane (CH_4)	70-98%
	Ethane (C_2H_6)	1-10%
	Propane (C_3H_8)	traces - 5%
	Butane (C_4H_{10})	trace - 20%
	Pentane (C_5H_{12})	trace - 1%
	Hexane (C_6H_{14})	trace - 0.5%
	Heptane & higher (C_7+)	none - trace
Cyclic HC's	Cyclo propane (C_3H_6)	traces
	Cyclo hexane (C_5H_{12})	traces
Aromatic HC's	Benzene (C_6H_6), others	traces
Non hydrocarbon	Nitrogen (N_2)	trace - 15%
	Carbon-di-oxide	trace - 1%
	Hydrogen Sulfide (H_2S)	trace - occassionally
	Helium (He)	trace - 5%
	Other sulfur and nitrogen Compourds	trace - occassionally
	Water (H_2O)	trace - 5%

Sources of Natural Gas :

- Subsurface strata of sedimentary basins.
- Some may be gas reservoirs.
- Oil reservoir with some amount of Natural Gas associates with it or (either free gas or gas in solution in the oil)
- Non associated is richer in Methane CH_4 poorer in heavier components
- Dissolved or associated gas in solution in crude oil is called dissolved gas.
- Gas condensates have high amounts of hydrocarbons liquids and may occur as gas in the reservoir.

The naturally occuring reservoirs are termed as

(1) Proved, reserves quantities found by drilling, and estimates are updated by reservoir characteristics (production data, pressure transient analysis, reservoir modelling & other data)

(2) Potential Reserves these are the additional resources of gas believed to exist in the earth, as inferred from the prevailing geologic evidence, but not actually found by the drill yet.

Other sources of Gaseous Fuel :

Tight sands
Tight shales
Geopressured aquifers
Coal

3.2 NATURAL GAS PRODUCTION AND PROCESSING SYSTEM :

- Reservoir Module that deals with flow of gas (and oil) through sub-surface strata.
- Flow module for flow of fluids from the reservoir to well head at the surface.
- Gas gathering system module, this module calculates the flow of gas through the pipeline network at the surface of that is used to collect gas from several wells for separation and processing.
- Separation module for calculating the amount of gas, oil and water generated by the well stream, and their compositions.
- Metering devices for measuring amount of gas and oil from the separators.
- Gas conditioning module for removal of contanminant from the gas.
- Natural Gas liquids recovey module.
- Gas compression/liquification for economic transport by tankers, rail road, and road transport.
- Flow module for pipe line transport of gas to consumption sites.

Liquified Natural Gas (LNG) :

Liquified Natural Gas (LNG) is simply Natural Gas that has been reduced to liquid state by cooling it to - 161°C. At this extremely low temperature the weight of LNG is slightly less than half of that of water.

LNG is colourless, odourless, and nontoxic. When exposed to atmospheric temperature and pressure it meters, down the space requirement of an orifice of 18 square meters.

This makes Natural Gas convenient and safe to handle transport and store in large amounts. The development of liquifaction technology, coupled with need to transport gas overlong distance led to growth of LNG trade.

There are six good reasons for using Natural Gas as a primary fuel for power generation.

- Lower capital cost.
- Highest conversion efficiency and use of waste heat to generated by the gas turbine in the same turbine process.
- Unit cost of electricity is lower for CCGT facility various coal or nuclear plants.
- Shorter construction time.
- Environmental benefits
- Further because Natural Gas can be easily and safety transported by ship in the form of LNG and then by pipeline to other areas after revaporization/ regasification. The benefits of clean reliable Natural Gas may be enjoyed by other users once the appropriate infrastructure to regasify the LNG is put in plan.

Shippng of LNG

The majority of LNG ship in service today have liquified capacities of about 125000 cubic meters or roughly 75 million cubic meters of Natural Gas. Ships of this capacity has generally have the following dimensions.

Overall length 270 meters, beam or width 45 meters and drafts or depth 11 meters.

The LNG tankers may travel serveral thousand kilometers, at service speed of about 18 or 19 knobs to reach their destination. During that time, a small part of LNG will boil off or vapourise and is used as clean fuel to power the ship's engines. Typical losses of LNG during a ship's voyage are about 0.18% per day.

There are number of LNG cargo containment systems currently available. The Kvarener - Moss self supporting spherical tank is the most popular and most commonly used.

The world LNG fleet will exceed 100 vessles with combined capacity of 11 million cubic meters. The total capacity comprises of 94 ships with another 12 ships on order or under construction. The cost per Btu generly transported will depend upon distance involved, ship size, boil off usage ship speed, the initial capital investment and the rate of return required.

The design of LNG tanker is rugged and strong such that provides much more protection of the cargo containment system, for example LNG tankers must meet rigid industry codes and are constructued with double hulls, which increases the structural integrity of the hull system and provides protection for cargo tanks in the event of an accident. LNG ship cargo tank are separated from the hull if there is substantial damage to the hull, thus LNG is clean, convinient, safe and efficient fuel that is attractive for use in electric power generation and other high value markets world wide.

In India with growing deficit in the demand and availability of crude oil in the country, there is tremendous pressure on the balance of the payment leading to the heavy drainage of precious foreign exchange, which has cascading impact on macro economics. There is urgent need to increase the availability of petrofuels (hydrocarbon viz. crude oil, Natural Gas, associated gas, coal bedmethone gas) through aggressive exploration and exploitation in the country.

It is very essential to improve the reserves from producing fields and through equity oil abroad by joint ventures by national and private companies. Reserve replacement is hovering less than one since last few years. It is evident that unless replacement reserves are found and put in to production the country will have to bear the burden of costly imports.

Crude oil production is going down day by day and Natural Gas production is not sufficient to meet the demand and hence it is very essential to tap the gas resources in the existing sedimentary petro liferrons basins. The flaring of the gas is to be reduced drastically to make its use for power generation as a source of energy.

Hence proper initiatives would be.

* Accelerated exploration in mature basins.
* Combining new/improved technologies to improve the production and known reserves in existing fields.
* medium, low marginal fields require joint efforts to develop these fields with the participation of private/national companies (such as GSPC Ltd.) Gujarat in E&P activities.
* Increasing our returning capacities does to produce associated petroproducts for energy development.
* Development of new practices, technologies in exploitation, processing, transportation and marketing the products of oil & gas and better use of them by industry and at domestic levels.
* The growth in gas sales has gone up to 8 times in last ten years from 3.62 billions cubic meters in 88-89 to approximately 28.7 million cubic meters in 99-2000. Indigenous gas production is 21.63 billion cu.m. will not be able to meet the demand.
* Gujarat has extensive coastal line and about 4 ports with excellent terminal and port development facilities which can faciliate the ships to anchor here.

* LNG is a liquified Natural Gas refrigerated to -165°C to which it can be compressed to 600 times which is advantageneous in shipping.

* Revaporizing it will bring to it again to its Natural Gas form at the terminal and transmitted and distributed to needy industries/domestic requirement in the state.

* Gujarat government has taken right step for developing this venture of importing LNG and distributing them in the revaporized Natural Gas form to industry in places like Surat, Baroda, Ahmedabad, Ankleshwar and other industrial developing towns.

  For this it requires Gujarat Gas Act, Standard Legislation, International/ National Safety, Environment and Occupational Health rules and practices for the development of Network System distribution of Natural Gas/ Revaporized LNG for Gujarat State Petronet Ltd. of Gujarat a subsidiary of GSPC Ltd. Gandhinagar.

* Jointventure in importing LNG at the ports and forming a sound to distribution network based upon sound international/national legislation and standard SHE practices will surely add to the industrial growth and life cycle growth of people of Gujarat. GAS GATHERING AND TRANSPORT THROUGH DISTRIBUTION NET WORK AND TRANSMISSION LINES is a important step in the growth of power generation fuel (i.e. Natural Gas/ Revaporized Natural Gas) for the industry as well as life cycle of the people of Gujarat in domestic applications.

Gas Gathering System has grown tremendously in last 20 years due to coming of new techniques in monitoring, safety, transportation technologies. Automation and application of SCADA system has added to the efficiency of the distribution and transmission system. Gas transmission system often form a connected net, flow through which is almost always transient.

The basic model considers transmission system to a pipe line network with two basic elements nodes and Node Connecting Elements (NCE's) Nodes are the point where pipe leg ends or where two or more (NCE's) join, compressor stations, valves, pressure and flow regulators and underground gas storage etc., High pressure pipe leg, low pressure pipe leg, pressure regulators and storage

play a important role in distribution pipe lines. It is a complex net work and hence Safety, Environment & Health play a important role for operators, distributors, industrial and domestic users.

It is a humble effort to bring out a suitable guidance mannual of on Safety, Health and Environment based upon suitable sound technologies (practical) and automation in practices of distribution pipeline system taking into account of main gas gathering and storage system after processing.

3.3 INTERNATIONAL SCENARIO :

Gas demand should drive international Natural Gas prices to $ 3/MCF through the remainder 2000. Winter demand in United States and Europe will rise 10% while supply drops 3%. This will lead to Canadian increase by 7% from last winter. That is in US alone demand will increase to 78 Bcf/d a production decline to 50.5 Bcf/d, imports at 9.1 Bcf/d and storage levels filled to 3.1 Tcf.

Conservative analysis supports the assumption that demand will rise by 14% and gas production will drop by 6% and Canadian imports will rise modestly. With the increase in international gas prices forecast supports the prediction companies with significant gas reserves and production should be good investment.

Canadian gas prices have more than doubled in 1999. High prices and expanded capacity naturally lead to more drilling and Zift Energy Group on Natural Gas stratagies conference in Calgary, Albertos, Northern Borders 700 MMcf/day expansion and Chicago extension in Dec. 1998 and Trans Canada pipelines expansion for 400 MMcf/d were the first capacity expansion out of Canada in 5 years.

Ziff also says that nuclear capacity in US is rising again in 2000 after years of decline and coal the biggest generator of electricity still is in abundant supply at low cost.

Gas, however should capture most of the new independent power plants. To meet the potential demand the industry will need sound gas strategy.

- Access the resources and rights of the way
- Continued technological advancements
- Financial requirements for developing new supplies and infrastructure
- Skilled workers
- Expansion of drilling fleet
- Adequate lead times for development and
- Continuing assessment of changing customer needs

WORLD UNDISCOVERED OIL AND GAS (Nov. 2000)

	Oil billion bbl	% of world	Gas (TCF)	% of world
Former Soviet Union	116	17.9	1,511	34.5
Middle East, North Africa	230	35.5	1370	29.3
Asia Pacific	30	4.6	379	8.1
Europe	22	3.4	312	6.7
North America	70	10.9	154	3.3
Sub-Sharan Africa/Antarctica	72	11.0	235	5.0
South Asia	4	0.6	120	2.6
TOTAL	**649**		**4669**	

(Surce Hart's E & P Nov. 2000) P – 17

WORLD PETROLEUM BASIN RANKING (By total known petroleum)

Sr. No.	Rank Provine Name (1)	KNOWN Oil (2)	Gas (3)	NGL (4)	Total (5)	MEAN UNDISCOVERED Oil (6)	Gas (7)	NGL (8)	Total (9)
1.	West Siberian Basin	139.9	1270	3.1	354.7	55.0	642.9	20.5	182.8
2.	Mesopotanion Foredeep (Basin)	292.4	298.3	1.8	344.0	61.1	83.7	3.1	78.2
3.	Greater Ghawar up lift	141.7	248.5	8.6	191.7	13.8	227.0	12.2	63.8
4.	Zagros Fold Belt	121.6	399.4	1.3	189.5	45.5	212.0	9.5	90.3
5.	Rub Al Khali Basin	89.8	182.2	26.0	122.8	36.6	425.7	30.3	137.9
6.	Quatar Arch	1.2	465.6	13.8	92.5	5.0	17.4	1.0	8.9

7.	Volga Ural Region	63.9	99.2	1.1	81.6	2.5	3.8	0.2	3.4
8.	North Sea Caraben	43.9	159.8	6.0	76.5	1.3	37.7	1.8	21.2
9.	Western Gulf	26.9	251.6	7.5	76.2	2.3	68.4	1.8	15.5
10.	Premian Basin	32.7	94.0	6.7	55.0	2.9	16.4	0.6	6.2
11.	Maracabo Basin	49.1	26.7	<0.1	53.6	8.2	17.6	1.0	12.1
12.	Niger Delta	34.5	93.8	2.8	53.0	40.5	1.3	6.0	68.6
13.	East Venezula Basin	302	128.1	0.7	52.3	11.9	93.5	4.5	31.9
14.	North Caspian Basin	10.8	156.9	8.9	45.8	23.3	119.0	5.4	48.6
15.	Sirte Basin	37.1	37.8	0.1	43.5	6.8	15.0	0.6	10.0
16.	Vilahermosa Up lift	35.0	41.3	0.1	42.0	7.4	15.6	0.9	10.9
17.	Amu Darya Basin	0.8	230.3	1.2	40.3	0.3	163.6	40.0	31.5
18.	Gulf Cenozoic OCS	11.9	140.3	0.1	36.8	N/A	N/A	N/A	N/A
19.	East-Texas/Basin/ Lousiana/Missisipi Salt Basin	16.3	77.6	2.9	32.3	2.7	29.6	1.5	9.1
20.	Alberta Basin	15.3	78.7	2.7	31.1	0.8	11.9	0.3	3.1
21.	Buhaiwan Basin	24.6	15.7	<0.1	27.2	4.4	8.5	0.4	6.2
22.	North West German Basin	2.3	141.7	<0.1	25.9	<0.1	10.8	<0.1	1.9
23.	Gran Eng/Ahnet Basin	0.5	114.0	5.0	24.5	0.6	8.7	0.4	2.4
24.	South Caspian Basin	17.4	359.9	0.5	23.9	15.7	173.3	8.1	52.7
25.	Northern Alaska	14.4	33.0	1.1	21.0	7.4	63.5	1.2	19.2
26.	Anadarko Basin	2.2	93.1	2.8	20.6	0.4	14.2	0.2	3.0
27.	Traias/Ghadames Basin	15.2	25.0	1.0	20.4	6.5	17.5	1.2	10.6
28.	Tima-Pechora Basin	13.1	36.6	0.7	19.9	5.7	52.1	2.2	16.6
29.	Widyan Basin-Interior Platform	17.4	7.4	<0.1	18.7	21.2	94.7	6.8	43.8
30.	San Loangu in Basin	13.8	12.5	0.7	16.6	1.2	2.6	0.1	1.7
31.	Sangiao Basin	15.6	1.7	0.0	15.9	1.0	5.7	0.2	2.2
32.	West Central Coastal	13.7	12.2	<0.1	15.8	29.7	88.0	4.2	48.7
33.	Greater Sarawak Basin	0.8	82.3	0.4	14.9	0.6	19.2	0.5	4.3
34.	Middle Caspian Basin	9.6	27.1	<0.1	14.2	4.9	39.7	1.7	13.2
35.	Central Sumatra Basin	13.2	3.9	<0.1	13.9	0.9	4.1	<0.1	1.7
36.	Baram Delta/Brueri Sabah Basin	6.9	36.2	0.2	13.1	3.4	23.2	1.2	8.4
37.	Bombay	8.4	24.2	0.3	12.7	2.1	12.9	0.4	4.7
38.	Anglo Dutch Basin	0.6	71.4	0.1	12.6	<0.1	15.0	<0.1	2.6

39.	Zi Basin	3.7	45.1	0.9	12.1	2.9	28.1	0.9	8.6
40.	Malay Basin	3.6	48.1	0.3	12.0	1.2	27.5	<0.1	6.3
41.	Palo-Duro Basin	1.8	48.4	2.1	11.9	<0.1	<0.1	0.0	<0.1
42.	South Barents Basin	0.0	70.0	0.1	11.8	<0.1	160.8	3.4	30.4
43.	Red Sea Basin	9.9	9.5	0.3	11.7	5.2	60.0	3.3	18.5
44.	Kutei Basin	2.9	45.5	1.3	11.7	5.1	64.8	2.1	18.0
45.	Driper-Donets Basin	1.6	59.1	0.1	11.7	1.1	24.0	0.9	59.7
46.	North West Shelf	1.1	56.2	1.0	11.5	2.4	64.7	3.7	16.8
47.	Campos Basin	10.1	6.2	<0.1	11.1	16.3	19.7	0.5	20.1
48.	Los-Angeles Basin	8.6	7.0	0.4	10.1	1.0	1.6	<0.1	1.3
49.	San Juan Basin	0.3	38.2	1.4	8.0	0.2	1.0	<0.1	0.4
50.	Tampico – Misantia Basin	6.9	6.6	0.0	8.0	0.9	2.0	0.1	1.4

* Gas values are in TCF; Liquid in billion bbl; Totals are in billion boe*

3.4 SALIENT FEATURES :

- Exploration and production emphasises Natural Gas among North Americas most Active operators.
- Natural Gas, low cost production, benificial effects of those practices and sustainable production.
- Natural Gas demand 31.3 TCF in 2015 up from 22 TCF this year.
- US production declining besides more rigs in operation
- The same situation applies to Western Canada
- Conoco tops E&P survey in upstream operations
- Prudential Securities of New York based grades top oil companies according to their skills in beating nine bench marks they are Conoco, BP Amoco, Royal Dutch/Shell, Total Fina (before eif merger) Chevron, Exxon Mobil, Texaco, Amereda Hess, EIF Aquitaine, Arco, Marathon Oil, Philips Petroleum and Unocal Corp.
- Anardanco pick-up some good Canadian properties
- Exxun mobil, BP, Philips Petroleum Co. are moving closer to build a pipe line that would bring Alaska's 935 + TCF 07 North slope gas through Canada to United States.
- Pancanadian buys US assets.

- Venezuela to boost gas activity. Proven Gas reserves 146 TCF another 32 TCF of probable and still another 32 TCF of possible reserves.
- Bombay High readies for US $ 1.5 billion boost in Arabian Sea to increase crude/gas production. Seismic and geologic studies in progress.
- Pakistan plans for E&P boost. Gas meets 37% of Pakistan energy needs with oil accounting for 44%, hydro/nuclear 13% and coal 5% of its demand. 12 million tonnes of petroleum products are imported. While 6 million tonnes of petroleum products.
- UN considers foreign E&P role in Iraq.
- An unexpected improvement in the frusty relations between Bahrain and Qatar could open an area potentially rich in untapped hydrocarbon to exploration and development.
- Sakkhalin's island (South East Asia) Although Russian legislation on production sharing agreements is far from smooth running and hastle free, but the operators feel that success can be achieved despite an environment that harsh weather, time consuming and frustrating legal process as well as competitive markets.
- BHP Petroleum (BHPP) and its joint venture partner Canadian Occidental Petroleum Ltd. have started production in Western Australia. Buffalo field in the Timar Sea.
- Texaco confirmed that Nigerian field contained recoverable reserves of more than 1 billion of barrels of oil making to be biggest in deep water find offshore west Africa.

3.5 HEAD WAY IN NATURAL GAS/REVAPOURISED NATURAL GAS USE

The discovery of Natural Gas in promising quantities, widely scattered from Tripura to South basin and Rajasthan, to the Krishna Godavari and Cauvery basins has been raising hopes replacement of other petroleum products such as fuel oil and Naptha by the fertilizer by the industry in particular and augmenting the availability of liquified petroleum gas.

Nondiscovery promising of additional oil & gas fields in Indian sedimentary petroliferrous basins, declining production of major oil & gas fields like Bombay High, Western, Eastern, Eastern region, increasing reserves production ratio is

adding negative side of the self sufficiency efforts of the geo-scientists, petroleum engineers, drilling and production personnel engaged in the upstream of the petroleum industry. This is affecting the industrial growth.

Rise in international prices of oil & gas to $ 30 per barrel has further added to expenditure of foreign exchange to the greatest extent. This has put additional exchequer of 1 lakh crores on the financial budget. This has affected the industrial growth to its maximum extent.

Hence Natural Gas/revaporized Natural Gas plays an important role as subsitute to the fuel for power generation for electricity instead of coal, nuclear fuels.

The poor head way made in Assam, Tripura, Andhrapradesh, Tamilnadu, in the utilisation of Natural Gas is due to the delay in creating required pipeline infrastructure. However, efforts are now being made to promote new gas based projects in the regions and also to establish medium sized projects for using Natural Gas supplies in a particular area for over coming transport problems.

Natural Gas production by ONGC from its Western offshore fields # 1 at about 43 million cubic meters a day that is transported to Hazira where it is fed in to the Hariza - Bijapur - Jagdishpur pipeline, after meeting local requirements. Efforts are being made to increase the capacity are nearing completions, laying of LPG pipeline from Saliaya to Ajmer by Reliance & Gas Authority of India are in progress. This will increase the gas supply to Gujarat, Rajasthan, Uttarpradesh and Punjab. Second trunk line to Hazira is near completion.

The government has given approval for the ONGC's proposal for the development of S_1 sand in Western offshore and further exploration in deeper sands of Bombay high offshore and its satelite areas. The gas recovery factor is about 60%.

There are simultaneous efforts emerging for unconventional hydrocarbon resources like coal- bed Methane and gas hydrate. GSPC Ltd., Gujarata State Government agency in E&P and Reliance industries Pvt. Ltd. has shown interest in E&P efforts and in venturing unconventional hydrocarbon resources. But this will take

some time to reap the fruits.

At present as a urgency of the defficient producing developing countries to import the Natural Gas is the form of LNG by shipping to ports and to use in the form revaporized Natural Gas from terminal points to distribution centres by transmission lines/network for domestic as well industrial growth. Gujarat has having ideal portal areas have taken interest on such type of business i.e. distribution of Natural Gas to the industries and domestic applications by 2005.

The GAIL's proposed for an LPG plant at USAR for producing 1.39 lakh tonnes per year at cost of Rs. 350 - 400 crores with participation with British Gas for implementing Bombay city Gas Distribution project.

Establishment Southern Gas grid, reduction of flaring of gas is financed by World Bank, and increasing the capacity of HBJ pipelines from Hazira with the loan from Asian Development Bank at a cost of about $ 350 million.
A gasgrid for Assam is proposed to supply gas to the Assam Gas Cracker and the Numaligarh refinery.

3.6 PLANNING AND DEVELOPMENT OF PROJECT

The growing industrialization, population and increasing global economic independence have forced the global as well national players to work in harmony. Global partnership commits all countries to get engaged in a continuous and constructive dialogue inspired by the need to achieve a more efficient and equitable world economy keeping in view the increasing independence of the community of nations for "Sustainable development". The government of different countries recognize there is a new global effort to relate the elements of the international climate for achieving Environment and development goals by

a) Promoting Sustainable Development through trade liberalization.
b) Making trade and Environment mutually supportive
c) Providing adequate financial resources to Developing countries.
d) Encouraging macro economic policies conducive to Environment and development.

At the national level it is to be noted that the industrial growth in India with particular reference to Gujarat, Maharashtra, Tamilnadu, Karnataka, UP and Punjab has increased demand of fuel source for power generation. The change in life style of the people has increased the demand of Natural Gas/LPG in domestic use. The Natural Gas / revaporized Natural Gas being a clean fuel has many advantages in respect of environment protection and monetary savings by reducing the load on road traffic by introducing pipe line distribution system.

Increase in oil & gas international prices has increased the spending on foreign exchange to very great extent which the India cannot afford for a long continuous time.

- Hence it is necessary to think like projects like distribution of Natural Gas through pipe line system that is national gas grid and distribution net work system in various states for the growth of industry and in application in domestic uses.
- With the coming up for various refineries and increase in capacity of existing refineries will make available associated gas as product which can be made available for industrial and domestic application. Hence coming up of projects with the joint ventures will be a healthy sign for growth and prosperity particularly for industrially advanced states in India.

PRE-PROJECT PLANNING

Project Planning for parties interested for joint ventures participation for supply of gas to domestic and commercial sectors through transmission and distribution network system.

Major steps for technical feasibility shall be

i) Collaborate with established Natural Gas development company dealing with treatment, transmission distribution and marketing of Natural Gas.

ii) Availability of Natural Gas from a established source with prior approval from ministry of Petroleum and National gas keeping in view the future growth and requirement for domestic and industrial purpose.

iii) Identification of joint venturing company and its complete support and technicaily, financially by making a written approved accord by the

completent authority.

iv) The supply of Natural Gas to the domestic and commercial consumers whether it will result in saving of current LPG consumption. Thus saving of amount of foreign exchange, or expenditure on required Natural Gas at the current price (source whether indigenous or imported) the amount of savings per annum.

v) The offer of participation in JVC be submitted on the proforma approved for it.

vi) JVC will be managed by independent Board of Directors i.e. GAIL, JAV partner three Directors each one of the Directors will be nominated as chairman for period of atleast 2 years by rotation by GAIL and JVC partner.

vii) Managing Director will be the Chief Executive officer of the company assisted by the Director commercial and Director operations. Besides this nominees of JVC partner, the JVC board will have 2-3 directors nominated by State Government / Financial Instruction and from public.

viii) The offer should include a note in corporating the views of the bidder company on sharing of these board positions as well as the methodology for organisational and operational functioning of the company and specially the inputs/supports proposed to be provided by JV partner and those expected from GAIL for the functioning of the company.

ix) Offers should be complete in all respects along with supporting documents. Incomplete offers should be discouraged or rejected.

iv) Preparation of Techno Economic Feasibility report for distribution of Natural Gas to domestic, commercial and industrial consumers taking in to consideration the following points.

i) Gas price at city Distribution point Rupees per 1000 m^3

ii) Demand mix in the concerned project

iii) Natural Gas which is a perfect substitute for LPG as it has lower investment.

a) Land

b) Transportation

c) Operational safety consideration

Comparative advantages :

	LPG	Natural Gas	
1.	Land	Extraction plant, Bottling plants storage (Bulk/ Bottles)	City Gate Station
2.	Transportation Bulk Bottles	Rail/Road Tankers Trucks	NIL
3.	Utilities	Diesel, Power	NIL
4.	Traffic Disruption	Continuous	Only during construction
5.	Safety	Not central	Centrally

* i) GSPL Ltd. is a nodal agency for gas and water in the state.

ii) For State level laying of pipe Gujarat Pollution Control Board is to be approached for necessary permissions and approvals.

iii) For dealing with 'Gas' (Natural Gas) Chief controller of explosives, Nagpur is to be approached for approvals.

Increase in the prices of LPG during recent years, supply of gas to the domestic consumers in large City distribution project will become more viable.

Kerosene and LPG are the main domestic fuel in the country. While kerosene is primarily used for illumination and lighting in rural areas, LPG is the main fuel in the urban areas especially metropolitan towns, the demand of LPG has been rising rapidly in relation to availability.

The imports are restricted on account of limited port handling facility. The population rise, disappearance of forests and increased urbanisation the demand for Natural Gas, LPG and kerosene would increase sharply and would need to be made up by increasing refining capacity of the existing refineries and refineries coming up in private sector such as Reliance Refinery at Jamnager and new refinery to be set up by ESSAR. Hence the burden of additional demand will fall upon imports.

Providing in articulated gas distribution system in the metropolitan areas or developed states is therefore a means of attenuating the LPG deficit. LPG is the only product which is sold in returnable containers and involves substantial recurring bottling and distribution costs.

Where as Natural Gas which is perfect substitute of LPG in the domestic and commercial industrial sector in terms lower investment.

ECONOMIC GRADATION OF NATURAL GAS USE :

Planning commission has worked out the input value of Natural Gas in 1992 and since the prices of petroleum products (i.e. crude oil, Natural Gas, LPG etc.) has increased tremendously in last one year. Considering this factor the distribution system of Natural Gas will be more viable and attractive and shall be foreign exchange saver also.

Factor to be considered

SECTOR	input valve Rs./MSCM	Current escalation
City Distribution (Indl, LPG)	8372.00 (1992)	+
City Distribution (Dom, LPG)	6808.00 (1992)	+
City Distribution (INDL, FO)	6082.00 (1992)	+
Fertiliser (Naptha)	6034.00 (1992)	+
Sponge Iron	5523.00 (1992)	+
Fertilizer (Urea Import)	4278.00 (1992)	+
Based Load Power (1400 km)	4137.00 (1992)	+

Hence next step would be to study.

Type of consumer	No. of consumers (1000)	Daily requirement 1000 m^3
Domestic	x	p
Commercial	y	q
Total	x + y	p + q

Availability of GAS

The appropriate authority such as GAIL must request the Ministry of Petroleum and Natural Gas to consider the required amount of allocation of MMSCMD for the proposed gas distribution project.

Saving in Capital Investment : LPG/Vs Natural Gas

Area for supply of gas will depend upon the availability of gas which may be a limited quantity and establishing a terminal and laying distribution pipe line net work in the area proposed for supply.

If already any terminal and city distribution exists in that case expenditure would be restricted to laying additional new pipe lines in the distribution system.

Implementation Schedule :

If basic grid is available then number of additional domestic/commercial connection can be given in first year itself and thereafter once necessary training and agency providing domestic connections are established, the rate of connections may likely to increase by second year and subsequently years. The year wise build up of consumers and demand of gas can be prepared.

Project cost and Financial Analysis

i) Basic grid requirement if any

ii) Existing pipe line if any for industrial supply and domestic supply if any otherwise.

iii) New pipeline laying formalities, cost, approvals from Ministry of Environment, Safety and Occupational health from the concerned government agencies as required by the legislation.

iv) The cost of required diameter pipe line along with cost of distribution/ service line and internal fittings for supply of gas to domestic and industrial consumers and its estimate at Rs._____ Crores.

v) Proposal would be to meet some part from the consumer contribution if any Rs._____ per domestic consumer say.

vi) Leaving balance Rs. _____ crores is to be provided for implementing the project.

vii) The sale price of gas to the consumers have been assumed as equivalent LPG price.

viii) Working out IRR.

ix) Post tax return may work out to be 22% or more.

ANNEXURES :

Annexure - I

COMMERCIAL POTENTIAL
ALONG PROPOSED PIPE LINE ROUTES
ESTIMATED GAS EQUIVALENT LOAD

	Annual million SCM	Daily million SCM	Peak hour SCM
1. Hotels/Guest houses/Hostels			
2. Restaurants/Bankers			
3. Hospitals/Nursing Homes			
4. Educational Establishments			
5. Offices			
6. Railways/Bus stands			
TOTAL			

ANNEXURE - II

DOMESTIC POTENTIAL

ALONG PROPOSED LINE ROUTES

In the proposed area	No. of Households Thousands	Estimated Gas Equivalent Load Annual million (SCM)	Daily million (SCM)	Peak hours SCM
Zone A	9.7	3.7	0.010	1800
Zone B	73.1	27.6	0.076	13,800
Zone C	70.3	26.4	0.072	12,000
Zone D	79.9	29.8	0.082	14,900
Zone E	97.9	35.3	0.097	17,000
TOTAL	**330.9**	**122.8**	**0.337**	—

ANNEXURE - III

POTENTIAL DEMAND

Section	Nodes	Supply area	Potential Domestic Customers	Domestic Demand SCMD	Commercial Demand SCMD	Total Demand SCMD
Eastern	23		42308	43966	8328	52294
Western	24		27988	28312	2001	30313
Southern	6		23608	24327	5788	30155
Northern	18		11963	12489	8131	20620
Grand Total						

ANNEXURE - IV

YEAR	0	1	2	3	4	5	6	7
Number of Customers								
Domestic market								
(000's)	0	14	42	88	134	181	231	231
Commercial market								
(000's)	0.00	0.02	0.07	0.15	0.24	0.29	0.33	0.33
Gas Consumption								
M.SCM	0.00	5.1	15.4	32.4	49.5	66.5	85.3	85.3
Domestic	0.00	4.4	13.1	26.3	45.9	45.9	45.9	45.9
Commercial								
TOTAL (M,SCM)	**0.00**	**9.5**	**28.5**	**58.7**	**95.4**	**112.4**	**131.1**	**131.1**

ANNEXURE - V

Domestic Gas PRICE Rs. / SCM

Commercial gas price Rs. / SCM

Gas purchase price Rs. / SCM

INCL Carr, & Levies at source

Assumed Gas price Rs. / SCM

Return on Equity %

Import Duty %

Interest on working capital %

IRR ON TOTAL CAP. PRE TAX IRR - POST TAX

3.7 SAFETY AND HEALTH/ENVIRONMENT POLICY :

* Safety is integral part of the GSPL'S day to day activities. It is a necessary employment skill that is required to protect out employees, clients, sub contractors, property, equipment and the public.
* The economic benefits of working on the principles of safety, health and environmental protection (policy) for out weigh the costs of noncompliance.

GSPL will ensure that recognized health and safety standards and legal requirements are meet through, the provision of adequate facilities, equipment, procedures, training and management systems.

All GSPL employees and subcontractors on GSPL worksites are responsible for obeying all safety rules and recommended work procedures as included in the provided mannual or as laid out by the client or the appropriate government agency. Everyone has the right to refuse to do work when unsafe conditions exist.

* GSPL commits that, after proper discussion and in doctrination of employees and contractors in the company practices and procedures, any individuals that cannot follow the rules and regulations will be terminated.

Environment Policy

At such time as corporate profitability allows it. GSPL from time to time under take benevolent environmental action in co-operation with local communities.

GSPL will comply by all applicable environmental laws and regulation GSPL will attempt wherever feasible to minimize resource wastage and the use of recycled products where these do not unduty compromise human safety or efficient operation of business. GSPL will encourage its employees to be aware of environment issues and their environmental responsibilities.

GSPL will encourage innovation among its employees to help ensure environmental compliance and minimization of environmental impacts/resource wastage.

This policy will be posted in all our offices and will be reviewed with all employees.

Managing Director

Dated

RESPONSIBILITIES

Responsibilities can be defined as an individual's obligation to carry out assigned duties. For our safety program to achieve its desired results, everyone in the organization must know their responsibilities. While the SHE policy statement contains a general reference to responsibilities, management has setout specific responsibilities for themselves and for everyone in the organization.

Assignment of responsibility and duties are to be carried out by various level of personnel of the management for the SHE control may be described as below.

MANAGER

1. The manager shall be reponsible for the safe and proper working of the installation/worksite by exercising supervision and control.

2. The manager shall see that sufficient supply of proper material and appliances for the propose of carrying out the provisions of act, the regulation and order made there under for ensuring safety of the installation/ worksite and persons employed there is always provided at the place. If he is not the owner or agent, he shall report in writting to the owner or agent when anything which he is not competent to order is required for the aforesaid purpose. A copy of everysuch report shall be recorded in the boundpaged book kept for the purpose.

3. The manager shall assign to every competent person and official his specific duties and on his appointment make over to him a copy of the regulations, rules and by-laws and any orders made there under which affect him and he shall take all steps to ensure that every such person understands, carries out and enforces the provisions contained therein in a proper manner.

4. The manager shall examine all reports, registers and other records to made or kept in pursuance of the Act. The regulations and orders made thereunder and shall counter- sign same and date his signature. He may, however, by an order in writing delegate this duty to installation manager or other official.

5. The manager shall pay attention to and cause to be carefully investigated any specific representation or complaint that may be made to him in writting by a work person of the installation/worksite as to any matter affecting the safety or health of persons in or about the installation/worksite.

6. When an accident resulting in any serious bodily injury to any person or in loss of life occures, the manager shall inspect the site of accident immediately and shall also either himself or through safety officer have an enquiry made in to causes of and circumstances leading to accident. The results of every such enquiry and a plan and the section of the site of the accident showing details shall be submitted to the Regional inspector/the authority concerned within seven days of the date of occurrence.

7. Manager shall perform such other duties as have been specified in this behalf under this Act, the regulations and order made thereunder.

8. The manager may suspend or take such disciplinary action as he thinks fit against the work persons for contravention of any provision of the Act, the regulations and orders made thereunder.

9. The manager shall maintain in bound paged book kept for the purpose a diary and shall record therein the findings of each of his inspection and also the action taken by him to rectify the defects mentioned, if any.

INSTALLATION / WORKSITE MANAGER

1. He shall have responsible charge and control of such installations and shall carryout such duties as may be assigned to him by the manager.

2. He shall see that a notice of his appointment is posted at a place in the installation in such a position that it can be easily and conviniently read.

3. He shall see that in the installation/worksite assigned to him, all work is carried out in accordance with the provisions of the act and regulations and orders made thereunder.

4. He shall visit and examine the installations/worksite under his charge on every working day to ensure that safety in every respect is ensured.

5. He shall maintain detailed record of each of his inspection and also action taken by him to rectify the defects noticed, if any.

6. He shall see, when any associated equipment, production equipment or pipeline is shifted or nearly installed, that it is given a trial run before it is put to use and shall be present during every such trial run.

7. He shall see that all persons employed at the installation/worksite are thoroughly instructed and familiar with the provisions of standing orders made under these regulations relating to prevention of accident, fire and explosion.

8. He shall see that the Actions of the Act and the regulations or orders made thereunder relating to installation/worksite maintenance, operation or examination of machinery and equipment are properly carried out by himself or competent persons or work persons as the case may be, appointed for the purpose.

9. When during the construction of an installation or any operation thereat, there is an emergency or apprehended emergency, endangering life or the safety of any person or the stability and safety of installation, he shall himself take or cause to be taken such measures as are necessary or expedient to avoid the emergency.

10. No requirement in these regulations shall be taken as prohibiting or restricting the taking of such measures.

SAFETY OFFICER

The safety officer shall carry out the following duties :

1. He shall inspect as often may be necessary, the installations with a view to identify dangers which may cause bodily injury or impair health of any person.

2. He shall advise the manager on measures necessary to prevent dangerous situations.

3. He shall enquire into circumstances and causes of all accidents whether involving persons or not and advise the manager on measures necessary to prevent recurrence of such accidents.

4. He shall collect, compile and analyze information in respect of accidents and dangerous ocurrences with a view to promote safe practies and improvement in working environment.

5. He shall organize, regular safety education programmes and safety companigns to promote safety awareness among persons employed in the installation/worksite.

6. He shall see that all new workers and workers transferred to new jobs receive adequate safety, training, instructions and guidance.

7. He shall maintain a detailed record of work performed by him everyday.

8. If any duties other than those specified above are assigned to safety officer by the manger a written notice thereof shall be sent to Regional Inspector within three days of such assignment.

FIRE OFFICER

1. He shall ensure the observance of the provisions of the Act, regulations and orders made thereunder concerning the fire detection and fire fighting systems and shall advise the manger on measures necessary to ensure adequate protection against fire.
2. He shall ensure proper layout, installation and maintenance of fire fighting equipment.
3. He shall see that contingency plans for likely fire situations are prepared.
4. (a) He shall organize regular training of prersons incharge of fire-fighting duties with particular reference to contingency or emergency plan for fire, correct assessment and handling of fire problem.

   (b) He shall see that persons incharge of fire fighting duties undertake stimulate fire drills atleast once in every month to study promptness of response and effective tactics.
5. He shall examine atleast once in every quarter all devices and equipment of fire detection and fire fighting system in the installation/workplace and report any defect in the same to manager.
6. He shall excercise a general supervision and co-ordination during control and extinguishment of any fire.
7. He shall enquire in to causes and circumstances of all fires with a view to prevent recurrence.
8. He shall maintain detailed records of work performed by him everyday.
9. If any duties other than those specified above are assigned to fire officer by the manager, a written notice thereof shall be sent to Regional Inspector within three days of such assignment.

COMPETENT PERSONS

1. Every competent person shall be subject to orders of superior official.
2. He shall not

   (a) depute another person to perform his work without sanction of his superior officials.

(b) absent himself without having previously obtained permission from such official for the period of his absence or without having been relieved by a duely competent persons and,

(c) without permission from such official, perform during his shift, any other duties other than those for which he has been appointed.

3. He shall on the appearance at the place of work any hazardous conditions take prompt corrective measures to eliminate the hazard.

FIRST AID PERSONNEL

For all jobs the manager will appoint adequate person(s) to provide such first aid service as may be required given the nature of the jobsite and government regulations. The person(s) appointed to this position shall possess an appropriate certificate in first aid on accordance wtih the relevant rules and must be available at all times to administer first aid

* Administer first aid as required
* Maintain a first aid log.
* Requisition all first aid supplies and equipment
* Maintain relations with physicians, ambullance services and hospital's
* Co-ordinate the transportation of injured employees to physicians office or hopsital
* Assist safety officer when necessary
* Provide health education, materials or instructions to all on site employees as required.

3.8 PIPELINE INSTALLATIONS

i) *SAFETY PROCEDURES FOR PIPELINE TRANSPORTATION*

* **Right of Way (ROW)**

- No pipe line and installation connected with pipeline should be constructed without accquiring the necessary right way of user on the land, for construction and access for inspection, maintenance,

repairs and patrolling in accordance with petroleum pipelines Act. 1962.

- Due consideration should be given to future industrial and urban development in the area to ensure safe operation of pipe line and public safety.
- Since pipe line construction work involves trenching, sand blasting welding, coating & crapping, lowering and back filling and these operations are undertaken by contractors, every such contract should on corporate the minimum safety procedures and precautions as laid down in the above standards which must be adhered to by contractors personnel and be ensured by inspecting officer that these are followed.

Classification of pipeline locations :

(1) A "class location unit" is an on shore area that extends 200 yds. (200 mts) on either side of the centre line of any one mile (1.6 km) continuous length of pipe line.

(2) (a) Each separate dwelling unit in a multiple dwelling unit buildup is counted as separate building intended for human occupancy.

(b) Except as provided paragraph (c) of this section pipe line locations are classified as follows.

(1) A class one location is;

i) offshore area or

ii) any class location unit that has 10 or fewer buildings intended for human occupancy

or

(2) A class 2 location is any class location unit that has more than 10 but fewer than 46 buildings intended for human occupancy.

(3) A class 3 location is

(i) any class location that 46 or more buildings intended for human occupancy, or

(ii) An area where pipeline lies within 100 yds. (91 meters) of either building or small, well defined outside area (such as play-ground, recreation area, outdoor theater other place of public assembly) that is occupied by 20 or more persons on atleast 5 days a week for 10 weeks in any 12 months period. (The days and weeks may not be consecutuive)

(4) A class 4 location is any location unit where buildings with four or more stories above ground are prevalent.

(c) The length of class locations 2,3 and 4 may be adjusted as follows :

(1) A class 4 location ends 220 yds. (200 meters) from the nearest building with four or more stories above ground.

(2) When cluster of buildings intended for human occupancy requires a class 2 or class 3 location, the class location ends 220 yards (200 meters) from the nearest building in the cluster.

* **CUSTOMER NOTIFICATION :**

(a) This applies to the operator of a service line who does not maintain the customer's burried piping up to entry of the first building downstream, or if the customer's burried piping does not enter a building up to the principal gas ultilization equipment or first fence (or wall) that surrounds the equipment. For the purpose of this section "customer's burried piping" does not include branch lines that serve yard lanterns, pool heaters, or other secondary equipment. Also maintain "means monitor for corrossion according to rules and practices if the customer's burried piping is metalic, survey for leaks if unsafe condition is found.

(b) Each operator shall notify each customer once in writing of the following information.

1) The operator does not maintain the customer's burried piping.
2) If the customers burried piping is not maintained it may be subject to potential hazards of corrossion and leakage
3) Burried gas pipeline should be
   i) Periodically inspected for leaks;
   ii) Periodically inspected for corrossion if the piping is metalic and
   iii) Repaired if any unsafe condition is discovered.
4) When excavating near burried gas piping, the piping should be located an advance, and excavation done by hand.
5) The operator (if applicable) plumbing contractors and heating contractors can assist in locating, inspecting and repairing the customer's piping.

(c) Each operator shall notify the each customer within 90 days after the customer first receive gas at particular location, whichever is later. However, operator of master meters system may continuosly post a general notice in a prominent location frequented by customers.

(d) Each operator must make the following records available for inspection by the Administrator or a State agency.

i) A copy of the notice currently in use and
ii) Evidence that notices have been sent to customers

ii) ***GENERAL GUIDELINES FOR SAFE OPERATION PRACTICES***

1. The pipe line to be used or segment of the pipe line should be checked for designing, installation, construction, initial inspection and initial testing in accordance with the regulation and standard practices.

2. No. segment of pipeline that is replaced or relocated or othervise charged should be put to use by any person unless operator maintains modify as appropriate and follow plans, procedures and programme.

The following requirements :

(i) The design construction, operation and maintenance history of the pipe line may be revived where sufficient historical records are not available, appropriate tests must be performed to determine if the pipe line is in a satisfactory condition for safe operation.

(ii) The pipe line right of way all above ground and approximately selected underground segments must be visually inspected for physical defects and operating conditions which reasonably could be expected to impair the strength or tightness of the pipe line.

(3) All unsafe defects and conditions must be corrected in accordance with this part.

(4) The pipe line must be tested in accordance with the prescribed regulation and method to substitute the maximum available operating pressure.

(5) Each operator must maintain, the record of investigations, tests, repairs, replacements and alternation made under the requirements before conversion to service.

* **Testing :**

- Before the pipeline is put in to operation, it should be subjected to hydraulic test at a pressure one and half times more than the maximum working pressure. The result of every test should be recorded by authorised persons.
- In case of gas pipeline it should be filled slowly with gas to displace air from inside the pipe. The displacement is considered complete if the oxygen content in the line does not exceed 2%.
- If during testing the pipe line breaks in the vicinity of any railway line public road, residential area, immediate steps should be latest to warn persons from approaching the site.
- Adequate steps should be taken to prevent smoking or open flame in the area.
- Incase railways the competent authority should be immediately informed about the occurrence.
- The route of underground section of the pipe line should be indicated by suitable markers at every 500 mts. and also at all turnings and un-cased crossings. Atleast two such marked should be visible from any point along the route.

* **Patrolling and Inspection**

Adequate arrangement should be made for patrolling along the route truck line, distribution line or network line by line walkers at regular intervals with the following objectives.

i) to check any leakage from the pipe line.

ii) to check any construction or operation by a third party in the vicinity of the pipe line which may endanger, its safe operation.

iii) to check presence of gas in waste pits along the gas pipe line.

iv) to check erosion of cover over the pipe line laid in river beds.

* Cathodic Protection

- Pipe to soil potential should be measured on under ground pipe line as per the approved schedule; in case any static current is detected, adequate remedical measures should be taken.
- underground pipe line should be inspected for external corrossion as per the approved schedule. Suitable inspection pits should be made at different points to assess the effectiveness of cathodic protection.

* **Third party interferance**

iii) ***MINIMUM REQUIREMENTS FOR SELECTION AND QUALIFICATION OF PIPE AND COMPONENTS FOR USE IN PIPE LINES :***

Materials for pipe and components must be

(a) Able to maintain the structural integrity of the pipe line under temperature and other environmental conditions that may be anticipated.

(b) Chemically compatible with any gas that they transport and with any other material in the pipe line with which they are in contact and

(c) Qualified in accordance with regulation and specification of the prescribed part of the minimum federal safety standards for transportation of natural gas or other gas by pipeline.

Steel pipe :

(a) New steel pipe is qualified for use under this part if

(1) It was manufactured in accordance with a listed specification.

(2) If meets the requirements or it is manufactured according to paragraph (c) or (d) section.

(3) It is used in accordance with paragraph (c) or (d) of this section.

(b) used steel part is qualified for used under this part if

It was manufactured in accordance with a listed specification and it meets the requirements of paragraph if (c) of Appendix or

(4) It is used in accordance with paragraph (c) of this section

(c) New or used steel pipe may be used at a pressure resulting hoop stress of less than 6000 psi where no close coiling or close bending is to be done.

If visual examination that pipe is in good condition and that it is free of split seams and other defects that would cause leakage. If it is to be welded, steel pipe that has not been manufactured to a listed specification must all pass the weldability tests prescribed.

(d) Steel pipe that has not been previously used may be used as replacement pipe in segment of it has been manufactured with the same specification as the pipe used in constructing that segment of pipeline.

(e) New pipe that has been cold expended must comply with mandatory provisions of API specification 5L.

Plastic pipe :

As plastic of suitable specifications, quality are in use in pipe line networking distribution of natural/petroleum gas and can be in use if.

(1) It is manufactured in accordance with a listed specification; and
(2) It is resistant to chemicals with which contact may be anticipated.

(b) Used plastic pipe is qualified for use under this part if :
  (1) It was manufactured in accordance with a listed specifications
  (2) It is resistant to chemicals with which contact may be anticipated
  (3) It has been used only in natural gas service.
  (4) Its dimensions are still within the tolerances of the specification to which it was manufactured; and it is
  (5) It is free of visible defects :

(c) For the purpose of paragraphs (a) (1) and (b) (1) of this section, where pipe of diameter included on a listed specification is impractical to use, pipe of a diameter between the sizes included in a listed specification may be used if it :

(1) Meets the strength and design criteria required of pipe included in that listed specification and

(2) It is manufactured from plastic compounds which meet the criteria for material required of pipe included in that listed specification.

Marking of Materials

Each valve, fitting, length of pipe and other component must be marked.

(1) As prescribed in the specification or standard to which it was manufactured except that thermo plastic fittings must be marked with in accordance with the ASTM D 2513 or

(2) (a) To indicate size, material, manufacturer, pressure rating, and temperature rating and as appropriate, type, grade and model.

(b) Surface of pipe and components that are subject to stress from internal pressure may not be field die. stamping.

(c) If any item is marked by die stamping, the die must have blunt or rounded edges that will minimize stress concentractions

(d) Paragraph (a) (1) the item is identifiable as to type, manufacturer and model.

(3) Specifications or standards giving pressure, temperature and other appropriate criteria for the use of items are readly available.

Transportation by pipe :

(a) the transportation is performed in accordance with API RP 5L 1.

(b) The pipe is tested in accordance with sub part J to atleast 1.25 times the maximum allowable operating pressure if it is to be installed in class 1 location and to 1.5 times the maximum allowable operating pressure if it is to be installed in a class 2, 3 or 4 location. Not with standing any shorter time period permitted under support J of this part, the test pressure must be maintained for at least 8 hours.

iv) *PIPE LINE COMPONENTS AND ITS DESIGNING :*

Each component of a pipeline must be prescribed quality and standard must be able to withstand operating pressures and other anticipated loadings without impairment of its serviceability with unit stresses equivalent to those allowed for comparable material in the pipe in the same location and kind of service.

The main components are

i) Valves

ii) Flanges and flange accessories

iii) Standard fittings etc.

Metallic components should qualify

i) Through visual inspection of the cleared components that no defect exists which might impair the strength or the tightness of the component.

ii) It must satisfy

(a) pressure testing

(b) materials

(c) Pressure and temperature ratings.

Valves :

a) Except for cast iron and plastic valves, each valve must meet the minimum requirements or equivalent of API 6D. A valve may not be used under operating conditions that exceed the applicable pressure temperature ratings contained in those requirements.

b) Each cast iron and plastic valve must comply with the following :

(1) The valve must have a maximum service pressure rating for temperatures that equal or exceed the minimum service temperature.

(2) The valve must be tested as part of the manufacturing as follows.

i) With valve with fully open position, the shell must be tested with no leakage to a pressure at least 1.5 times the maximum

servicing rating.

ii) After the she 11 test, the seat must be tested to a pressure not less than 1.5 times the maximum service pressure rating. Except for suing check valves test pressure during the seat test must be applied for successively on each side of the closed-valve with opposite side open. No visible leakage is permitted.

iii) After last pressure test is completed, the valve must be operated through its full travel to demonstrate freedom from interference.

(c) Each valve must be able to meet the anticipated operating conditions.

(d) No valve having shell components made of ductile iron may be used at pressures exceeding 80 percent of the pressure ratings for comparable steel valves at their listed temperature. However a valve having shell components made of ductile iron may be used at pressures up to 80 percent of the pressure ratings for comparable steel valves at their listed temperature; if;

(1) The temperature adjusted service pressure does not exceed 1,000 psi (7 MPa) gage and

(2) Welding is not used on any ductile iron component in the fabrication of the valve shells or their assembly

(e) No valve having pressure containing made up of ductile iron may be used in the gas pipe components of compressor stations.

* Transmission line valves :

Safe Practices :

(a) Each transmission line other than offshore segments must have sectionalizing block valves spaced as follows, unless in a particular case the Administrator finds that alternative spacing would provide equivalent level of safety :

(1) Each point on the pipe line on a class 4 location must be within 2 1/2 miles (14 kilometres) of a valve.

(2) Each point of on the pipe line in class C location must be within 4 miles (64 kilometres) of a valve.

(3) Each point on the pipe line in class 2 location must be within 7 1/2 miles (12 kilometres) of a valve

(4) Each point on a pipe line class 1 location must be within 10 miles (16 kilometres) of a valve.

(b) Each sectionalizing block on a valve on a transmission line, other than offshore segments, must comply with the following.

(1) The valve and operating device to open or close the valve must be readily accessible and protected from tampering and damage.

(2) The valve must be supplied to present setting of the valve or movement of the pipe to which it is attached.

(c) Each section of the transmission line, other than offshore segments, between main line valves must have a blow down valve with enough capacity to allow the transmission line to be blow down as rapidly as practicable. Each blow down discharge must be located so as the gas can be blown to the atmosphere without hazard and if the transmission line adjacent to an over head electric line so that gas is directed away from the electrical conductors.

(d) Offshore segments of the transmission lines must be equipped with valves or other components to shutoff the flow of gas to an offshore platform in an emergency.

* Distribution line valves :

Safe practices :

(a) Each high pressure distribution system must have valves spaced so as to reduce the time to shut down a section of main in an emergency. The valve spacing is determined by the operating pressure, the size of the mains, and the local physical conditions

(b) Each regular station controlling the flow or pressure of gas in a distribution system must have a valve installed on the inlet piping at a distance from the regular station sufficient to permit the operation of the valve during an emergency that might preclude access to the station.

(c) Each valve on a main installed for oprating or emergency purposes must comply with the following :

(1) The valves must be placed in a readily accessible location so as to facilitate operation in emergency.

(2) The operating stem or mechanism must be readily accessible.

(3) If the valve is installed in a buried box or enclosure, the box or enclosure must be installed so as to avoid transmitting external loads to the main.

v) *PIPELINE SAFE WORK PRACTICES*

Lowering of Pipe into Ditch

1. The belt, slings and boom lines, while not in use shall be secured to the boom while the tractor is moving.
2. No workers are to be in ditch, on the pipe or between the pipe and the ditch when the pipe is lowered in to the ditch.
3. Catch of tractor should be in place for lowering in operations.
4. Workers shall stand clear of skid piles and crotches.
5. An adequate space should be kept between the keeping crew and lower in crew.

Maintenance and Repair

1. Suspended machines, or heavy parts beneath which workers must work shall be blocked.
2. Gasoline carbon "tet" or solvents having a flash point less than 38 degrees Celsius (100°F) shall not be used for cleaning purposes.

3. Repairs or adjustments shall not be made while equipment is in operation.
4. All guards shall be in place while equipment is in operation.
5. Engines shall not be turned over by means of fan belts or other belts.
6. Docks, platforms, steps etc. shall kept free from oil, grease and loose tools.
7. Engines on equipments shall be stopped before fuelling.
8. Fuel trucks, lube units and service vehicles shall be equipped with approved for extinguishers.

* Where a product falls under "the controlled products act" the conditions of WHMIS would apply.

Pigging and Testing

General : The pigging of oil & gas pipelines is a common procedure involving a introducing a pig or ball of some type to the inlet of the pipe line and forcing the pig to the outlet. The pig is used to clear the line and/or remove all water that was used to pressure test the line. During these operations great care must be taken to ensure the isolating valves are holding proper procedure must be followed.

1. Before removing the pig catcher or test fittings, pressure shall be relieved from each of the line.

Pipe fitting :

Only approved pipe fitting shall be used

Pigs propelled by compressed air :

1. Line six inches or less in diameter may be sealed with cap hold in place by clamps providing that the clamps are adequately designed to prevent blowing off the sealing caps.
2. The receiving end of the pipe shall be equipped with pig catcher or trap so that there is no danger of pig of being blown free of the line at the end of its turn. Such traps or catchers shall be welded to all lines over

152 mm (6 inches) in diameter.

3. All air hoses, fittings, valves etc., shall be adequate for the pressure used and be maintained in good condition.
4. During pig run, all persons in the vicinity shall be kept well clear of the pipe ends.
5. The pressure shall be released through suitable valves before fittings of any kind are loosened or removed from the pipeline.

Safe-Work Practices

* Low Pressure Testing of Pipelines (700 kPa - 100 Psi)

1. Pipe ends shall be sealed with a fitting welding to the pipe for all lines larger than 152 mm (6 inches) in diameter. Welded caps are preferable for all sizes of pipe, but caps helds in place with properly designed on lines 152 mm (6 inches) and smaller in diameter.
2. During the line is under pressure, all persons shall be kept clear of pipe ends.
3. Fittings shall not be loosened or removed from the pipe until all internal pressure is released.

* High Pressure Testing of Pipelines (over 700 KPA - 100 psi)

1. The pipe line shall be sealed only with weld flanged or threaded fittings (rated to a pressure at least to maximum working pressure of the pipeline.
2. Only those concerned persons with the testing of all allowed in the immediate vicinity of pressure pumps and pipe ends or exposed section during the test.
3. Squeeze truck or any pressure couplings should have whip stop devices at both attachments.

Placing of skids

1. Lock skids shall be employed in all instances where a danger of shifting

pipe exists. Defective skids shall be removed from service.

2. As pipe diameter increases, the number of skid pilles or crotches or increase.

Preparation of right of way

Falling and Buckling

1. The employer shall make available to work as appropriate means of summoning and rendering assistance in case of emergency.
2. Fallers and bucklers shall ensure that there are no obstructions to the falling bucking operations and a safe escape from the hazardous area has been cleared before a tree is bucked.
3. Power saws must be allowed to cool before refuelling. Smoking is prohibited during refuelling operations.
4. Leg protective pads and mesh face shields shall be used by fallers and buckers.
5. Crews burning bush on right of way must use extreme caution to prevent possibility of spaces igniting a forest fire.
6. Fall area should be designated to only authorized traffic.
7. Chain breaks should be in place on all saw power equipment.
8. Gasoline should be prohibited from use for starting fires.

Pipe handling

Stringing Pipe:-

1. Workers shall keep their hands clear of the ends when pipe is butted together.
2. Workers must walk while stringing.
3. Pipe layer should not exceed 6 M.P.H. travel while stringing or moving pipe.
4. Workers should clear area between pipe and truck prior to pipe movement.

Bending

1. Walking on pipe should be prohibited.
2. Over hands should be crotched when on skids.
3. No workers except those actually engaged in bending operation or permitted on or around the bending machine.
4. Climbing on pipe should be prohibited.
5. Second side boom should be used on long bends of large diameter to avoid turning or prevent tripping of bending machine.

Pipe handling

General

1. Taglines should be used in all through lines.
2. Only essential workers should be in the area of operation in all through areas.
3. Workers are not to ride pipe loads at any time.

Unloading Pipe

1. All slings, hooks, cables and taglines shall be inspected at daily intervals by the operator and shall be repaired or replaced when found to be defective.
2. Workers shall be positive that hooks are secured engaged at the ends of the same pipe before it is railed road cars or trucks.

Stockpiling pipe

1. The pipe shall extend three or four feet beyond and cross timbers and workers shall work at the ends of pipe keeping hands clear.
2. When pyramiding pipe, do not stack last pipe on the top as this will cause the pile to spread.

3. Tiers should not exceed

   2 & 3 inches - 5 tiers.

   4, 5 & 6 inches - 4 tiers.

   8 inches and up - 3 tiers.

Pipe laying

Tractor operations

1. No worker shall be allowed to ride any part of a tractor except when an approved seat is provided.
2. When a tractor stops for any reason and the operator dismounts, the unit shall be locked or rendered in capable of being started by an unauthorised person.
3. Pipe shall never be moved, carried or swing above workers.
4. Workers shall stand clear of booms when loads are being lowered or lifted and the tractor operator shall no lift or lower until worker are in the clear.
5. The guiding of lines on to drums by means of hand or foot is prohibited. An iron bar shall be used for this purpose.
6. Wire rope shall be securely fastened to drums. At least five full turms of wire rope shall be kept on winding drums at all times.
7. Wire rope connections shall be of an approved type. Inspection of the lines and connections shall be made daily by the operator and recorded.
8. Side boom pins and sheave block shall be inspected daily by the operator and shall be replaced if found defective.
9. Side boom and blades shall be left in a safe position during non working hours.
10. No operator shall be permitted to leave the controls of machine while a section of pipe is suspended above the ground unless the block is blocked to prevent accidental movement and the controls are locked out.
11. Pipe shall never be picked up or lowered while any worker is between the tractor and pipe.

12. Side booms shall not be driven on the right of way with a load hook dangling in a position hazardous to workers or with the boom more than thirty (30) degrees from the vertical position.

vi) *SAFE WORK PRACTICES FOR ENTRY INTO CONFINED SPACE*

"Confined space" means any vessel, pit, tank, silo, excavation, sewer, sump or situation in which there is limited access or egress.

* The work to be performed must be under the supervision and direction of qualified supervisor who is thoroughly familiar with hazards that may be encountered, fire and accident prevention requirements, first aid and rescue procedures. Responsibility for safety, both at the time of entry and during the entire operations rests with the supervisor.

* All workers connected with or performing the work in the confined space must before entry, be informed of the hazard that may encounter, precautionery measures required and rescue methods needed in an emergency. In addition, those worker who are unfamiliar with confined space work must be thoroughly trained in the use of respiratory protective equipment and other safety and rescue equipment to the job.

* Before worker enters a confined space, it must be isolated by using isolation device such as blanking, blinding, separating and plugging to prevent contaminants from entering. Blanks or blinds must be of same specification as the system or better. Where threaded pipes are used threaded plugs or caps must be of the same material.

* Closing of valve by itself is not considered a suitable method of isolation and must be complemented with other measures.

* Blanks and blinds should be installed as close as possible to confined space and if the confined space contains some toxic gas, self contained breathing apparatus must be worn while the blanks and blinds are being installed.

* When purging is necessary to prevent the development of hazardous atmospheres in the confined space, then water, steam or inert gas may be used.

* The lines should be electrically bonded by a proper connection to the vessel using bonded wire to provide a discharge for static electricity.
* Appropriate tests must be performed to ascertain the level of toxic, explosive atmospheres and oxygen content prior to entry.
* All power driven internal equipment and any power sources must be locked in the off position at the main fuse or braker panel and tagged out, before entry the machine control switch must be operated to ensure that the power source is.

Ventilation

* Proper ventilation is necessary in safe confided space entry operations. Respiratory protection should be used for entry only after all efforts to ventilate the confined space have failed to bring the oxygen level up to acceptable levels or to remove hydrocarbons or toxic materials to safe level of entry.
* Ventilation can be accomplished by using an air or steam powered adductor or by using an electric blower or fan approved for use in hazardous locations.
* Steam may also be used to remove hydrocarbon vapours if adequate steam capacity is available to heat the confined space so that steam is not condensed and loses the capability to expel gas contents. The nozzle of steam hose should be bonded to the tank to equalize electrical potential and prevent arcing. After steam ventilation has been accomplished, the confined space must be ventilated with air to ensure adequate oxygen levels are present for entry.

Testing

* If possible, testing should be conducted out side the confined space.
* Respiratory equipment just be worn inside and outside when testing the atmosphere in confined space. After indication of safe for entry it can be entered without respiratory equipment to perform other necessary inspection/

or maintenance.

* All the precautions out lined in rescue & emergency section must be adhered to when it is necessary to enter confined space.
* Instruments such as JW combustible gas detector or Dredger hand pump unit or other approved equipment can be used to test % LEL and concentration of toxic gases.
* If the acceptable concentration of contaminants rises above acceptable limits or the concentration of oxygen drops while the workers are in confined space, the work should be stopped and the workers removed until the cause is found, eliminated and a safe atmosphere is restored.

Protective equipment

* Boots, gloves, face shields must be made of material resistant to corrosive sub stances.
* Hard hats, safety goggles to protect against common hazards.
* Fire retardant overalls and under garments with a high cotton content so as to minimize the build up of static electricity.
* Every effort should be made to make the confined space for entry without use of respiratory equipment.
* All respirators (breathing apparatus) should inspected before and after each use to ensure they are in satisfactory condition

Item to check includes i) Tightness of connections

ii) condition of the face piece

iii) head bands

iv) regulators

v) connecting tubes

* workers should be Trained in the use of respiratory equipment and then only allowed to enter the confined space.

Rescue & Emergency

One of the possible accidents associated with confined space entery is the "Chain type" tragedy

To avoid this type of accident.

1) The number of worker entering in the confined space should be limited to an absolute minimum.

2) Unless there use is deemed to create a grater hazard, safety harnesses and life lines should be worn by personnel in the confined space. So that rescue operations can be accomplished.

3) The stand by person(s) at the confined space entrance equipped with protective equipment and other applicable emergency equipment, capable of effecting a rescue if required, and able to communicate at all workers with the worker(s) inside.

4) Methods of summoning additional assistance and or/sounding an alarm must also be in place.

5) The stand by person (s) should never leave their post unless they are properly relieved by qualified person (s)

6) The safety stand by person or someone outside who is immediately available, should have current first aid training.

7) Employees should be trained in the resure procedure to be followed in order to minimize confusion in the events of emergency.

8) Dry chemical extinguishers should be immediately available to workers and observers.

To summarize

* Confined space entry should be avoided wherever possible.

* It should be properly planned, to evaluate the hazards involved, and preventive measures are taken to ensure these hazards are adequately dealt.

* Every effort should be made to make the confined space safe for entry

without respiratory equipment.

* Thorough training is essential.

* Proper education about entry, procedures, and correct execution, is must to reduce the chances of accident and subsequently the risk of injury to personnel or damage to equipment.

vii) *EMERGENCY PROCEDURES :*

Emergency procedures should be formulated giving details of the actions to be taken for safe guarding the pipe line as well the interest of the public in the event of following.

* uncontrolled escape of gas from pipe line.

* fire in the pipe line.

* Busting or damage to the pipeline.

The emergency procedures should specify the following.

* Actions required of an GSPL employee discovering a fire, leakage or damage to the pipeline.

* General alaram and communication procedures and action required of persons receiving the alaram and communication.

* Instructions for operating emergency equipment

* Instructions for rendering safe the affected pipe line.

* Duties of key personnel.

* Drawing a contingsuly plan, starting the line of command a vol. the responsibilities of each person involved in case of emergency situations.

* Equipment plan, clearly stipulating the equipment make and by the location correct operation and field of operaiton.

* Action plan correctly and clearly stipulating

  i) Alarm and communication system

  ii) System for notifying the authorities

iii) Guide lines of terminating the action and

iv) Plan for training the personnel and for drills.

Clean up action :

After an emergency, clean up the site, returning it as closely as possible to original state. Clenaup procedures may include.

1) Protection of evidence
2) Proper disposal of hazardous wastes
3) Hiring of specialist clean up services
4) Documentation of cleanup activities
5) Restoration of the work site and surrounding area (including vegetation)

Return to work :

1. Determine the extent of damage
2. Isolate damaged equipment
3. Take necessary steps to prevent further damage and control hazards in damaged areas.
4. Barricade damages areas/sections and erect temporary shelters as necessary.
5. Recall personnel.

Emergency procedures and related telephone numbers are should be located in all field offices and at the head office.

3.9 ENVIRONMENT

GAS PIPE LINES (ONSHORE)

1. Gas line projects include the construction and operation of near shore or over land pipe lines. Pipe lines can range in size up to 2 meters in diameter. They can range in length from several kilometers to hundreds of kilometers. Over land and near shore pipelines are generally burfied.

2. The major facilities associated with gas pipe line include the pipeline itself, access or maintenance roads, the receiving, despatch and control station and the compressor station or pump station. Compression stations are installed at appropriate intervals along gas transmission transfer or processing facilities. Refined gas may be transported by pipe line to an end user, such as industry or domestic users.

POTENTIAL ENVIRONMENTAL IMPACTS :

3. Pipe line installation in upland areas involves surveying, Right of Way (ROW), ditching, pipeline stringling, bending, welding, wrapping and installing cathodic protection for corrosion control, placement in ditch (for buried pipe lines), back filling and clean up. In wetland areas generally same activities are involved but dredging and spoil disposal are necessary for placement of pipe line. In completely water logged soils and open water areas pipe line laying barges are used for dredging pipeline fabrication and placement.

4. Proper pipe line operation emphasizes maintenance and change of the equipment. Periodic ground or aerial inspection along the pipe line route to detect leaks. Pipeline life depends upon rate of corrosions and inside wear of the pipe. Corrossion protection is must in most soils especially in wet or saline areas. Leaks or ruptures of oil and gas pipelines can have significant impacts beyond the immediate vicinity of the pipe line.

5. Positive Impacts :

Gas pipe lines may be viewed as contributing to environmental quality by making cleaner fuels more available (low sulphur gas versus high sulphur coal) for energy production/supply to industrial or domestic purposes.

6. Negative Impacts :

Onland pipe lines

(a) Installation can lead to erosion in the vicinity of the pipeline in hilly areas this can lead to instability in the soils and land slides. Run off and sedimentation can lower water quality in rivers and streams during construction.

(b) Installation of pipelines and maintenance roads can lead to alteration of drainage patterns, including blocking water flow, and raising the water table on up slope side of the pipe line and can lead to killing and reduction of vegetation, such as trees water supply to wetlands can be altered.

(c) Creation of ROWs can lead to the invasion of exotic plants which may wash out complete native vegetation. If un controlled, this can have a significant impact overtime. In addition pipeline installation can result in habitant fragmentation of natural areas (e.g. wild lands resulting in the loss of species and lowering of biodiversity.

(d) In developed areas gas pipelines can result in loss of land use and displacement of habitats due to placement of pipe line and substations. Some of the agricultural activities may also be affected in the short term during construction.

(e) Above ground pipelines can create barriers for humans and migratory wild life. This could be significant depending upon the length and location of pipe line.

(f) Archeological sizes vulnerable to damage or loss during pipelines construction.

(g) Pipe line construction may temporary interrup traffic this could be significant in developed areas, if the pipe line crosses major transportation routes.

(h) Gas pipe line leakage or rupture can cause explosion or fires. In developed areas, such accidents pose significant human health risk.

7. *Indirect Impacts :*

(a) Upland pipe lines can result in indirect secondary development (squatters) within the pipe line ROW. This unplanned development can place strain on the existing infrastructure for an affected area.

(b) Upland pipe lines can allow access to otherwise in accessible natural areas (e.g. wild lands) this can result in degradation and exploitation of these areas.

Special Issues :

8. Natural Resources

Marine and esturine water resources are affected by near shore gas pipelines. Fresh water resources can be affected by onland pipe lines. Flood storage functions of these systems can be altered by changing surface water drainage and by construction of facilities within these water bodies.

9. Depending upon tolerance of the ecological resources in these areas and socio cultural characteristics of population, these activities may have adverse impact.

Pipeline safety :

10. The transportation of natural gas by pipe line, distribution line and network involves some degree of risk to the public in the event of an accident and subsequent release of gas. The greatest hazard is fire or explosion

following a major pipe line rupture.

11. Primary cause of pipeline accident is outside forces, implicated in more than half of all service incidents. Other causes includes corrossion and material and construction defectes.

12. Accidents results from caveless operation of mechanical equipment (bulldozers and backhoes), earth movements due to soil settlements, washouts, landslides, earthquakes, weather effects (winds, storms, thermal strains) and deliberate damage. Some countries have national safety standards for the construction and operation of gas pipe lines.

GAS PIPE LINE

Potential Negative Impacts :	Mitigation measures
Direct	
1. Resuspension of toxic sediments.	1. Select alternate location for laying pipeline.
2. Interferrence with fishing activities from near shore pipelines.	2. Select pipeline route away from known fishing areas.
3. Erosion, run off and sedimentation from construction of pipeline, grading for acess roads and substation facilities.	1. Select ROW to avoid impact to water bodies and hilly areas 2. Install sediment traps or screens to control run off and sedimentation. 3. Use alternative pipe line techniques that minimize impacts. 4. Stabilise soils mechanically or chemically to reduce erosion potencial.
4. Alteration of hydrological	1. Selet ROW to avoid wetlands and flood plans. 2. Minimum use of hill. 3. Design drainage to avoid affecting nearby lands.

5.	Hazards from gas pipe line of rupture.	1. Clearly mark locations of buried pipe lines in high use areas. 2. Develop emergency evacuation plans and procedures. 3. Monitor for leaks 4. Install alarm to notify the public from accidents.
Indirect		
6.	Induced secondary development during construction in the surrounding area.	1. Develop comprehensive plan for location of secondary development. 2. Construct facilities and provide financial support to existing infrastructure.
7.	Increased access to wildlands	1. Develop protection and management plan for these areas. 2. Fences to prohibit acess to sensitive wild lands.

3.10 OCCUPATIONAL HEALTH MONITORING IN GAS INDUSTRY

Introduction

Technological advances while making the gas industry competitive, have also multiplied the hazards in the operating personnel in terms of complex operations, processes and application of hazardous chemicals.

The enlightened management should consider that their duty is to pressure and promote the health of their employees and give them a good deal which in turn fosters better output and happiness in industry.

Greater use of the assets of the work place, stability long term relationships of trust and pear support can be advantageously utilised to make the worksite

as an effective and economical setting for various programmers.

The purpose of occupational health monitoring is to protect and promote the health of all employed persons.

Occupational health is not limited to diagnosis of specific occupational diseases and their treatment, but also to control the health problems of employees which are closely related to work conditions :

Objectives :

(1) A service established in or near to the place of employment for the purposes of
   (a) Protecting employees against the health hazard
   (b) Contributing towards the employees physical and mental adjustment, establishment and maintenance of highest possible degree of physical and mental well being of employees.

(2) i) By virtue of laws and regulations
   ii) By collective agreement
   iii) In any other manner approved by compitant authority
   iv) Administrating emergency treatment
   v) Carrying out regular medical examinations
   vi) To exercise monitoring over hygenic conditions in the plant worksites.
   vii) The function of the occupational health monitoring should be progressively developed.
   viii) The physician incharge of an occupational health centre should give special training in occupational health.
   ix) The first aid personnel should be suitably qualified and should be readily available during workers.

Work environmental monitoring

Occupational hygiene is science and art developed to anticipation, identification, evaluation and control of environmental factors or stresses arising from the work places which may cause sickness, impaired health, significant discomfort or inefficiency among the employees.

Threshold Limit Values (TLVS)

Refer to air borne concentrations of substances/levels of physical agents and represent condition under which it is believed that nearly all the employees may be repeatedly exposed.

PHYSICAL HAZARDS i.e. evaluation of heat stress, exposure to noise. illumination quality, Measurement ionising radiation if any.

CHEMICAL HAZARDS cause personal injury to conduct or entry in to body via. inhalation, ingestion, sieve contact or eye contact health hazard may result from repeated chronic and long term exposure to low concentration of such chemicals monitoring standards for medical fitness.

1. Good mental and physical health and fit constitution.
2. Free from physical defect or abnormality, congenital or acquired likely to interfere with the efficient performance of duties.
3. No evidence of mal-development physical or mental.
4. Joints, locomotor functions are withch normal limits
5. Visual acuity
6. Colour vision
7. Colour blindness
8. Night blindness
9. Ear/Nose/Throat
10. Blood pressure (B.P.)
11. Glands
12. Skin disearses
13. Ventral diseares
14. Fits and other defects if any

Periodic Health examination is the important part of the duty of the group looking after the occupational health biological exposure determinant operations are to be carried out and monitored specially toxics, acetone, arseuic, Berizene, Carbon monoxide, lead and other import hazardous chemicals.

Clinical and screening tests for

i) Respiratory system

ii) Nervous system

iii) Blood & Blood forming system

iv) Liquid

v) Urinary system

vi) Cardiovascular system

vii) Musculo slce letol system land and important of the management is to provide

  i) Building

  ii) Man power such as hygienist, physican

  iii) Communication and relations with reputed hospitals surgeous and organisations for emergency treatments.

CHAPTER-4
ANALYSIS OF NATURAL GAS PIPE LINE DISTRIBUTION NETWORK

- INTRODUCTION
- LEGISLATIVE PROVISIONS
- AMERICAN DOCUMENTS
- GERMAN DOCUMENT
- SITE RELATED ISSUES IN INSTALLATION SAFETY
- LIFE CYCLE CONSIDERATION
- SHE CO-ORDINATION
- HAZARD IDENTIFICATION APPROACH
- LATEST LEGISLATION

4 ANALYSIS OF NATURAL GAS PIPE LINE DISTRIBUTION NETWORK

4.1 INTRODUCTION

Increased availability of Natural Gas, especially in Gujarat, is making it possible to setup installations of gas piping in the state. With these installations coming up, it is essential that the pipework being done conforms to the standards. While relevant and detailed Indian Standards are not yet readily available at Bureau of Indian Standards, British and American Standards are available for safety of gas-pipework practices, Gas Safety (installation and use) Regulations 1984 and British Gas Publication IM/16 Guidance Notes on the Installation of pipework, for example can be considerd as important documents for inspection at vaious installation sites by the contractors. Before any gas fired equipment and systems are brought into production/installation for the first time, it should be properly commissiond. The Institution of Gas Engineers (in U.K.) has brought out Guide to commissioning procedure for gas fired plants and it is essential to make sure that all gas based installations and piping especially at the distribution network carry out the installation & commissioning work as per such international standards.

4.2 LEGISLATIVE PROVISIONS

While details of guidelines on all important legislative provisions will be discussed in detail in the final report, the following list of legislations/standards/ codes of practice are given below as an interim report.

British Documents

4.2.1 British Legislations :

Gas Safety (management) Regulations 1996

Construction (Design and Management) Regulations 1994

Gas Safety (Installation and use) Regulation 1994

Gas Act, 1995.

Health and Safety at work etc. Act 1974

Management of Health & Safety at work Regulations 1992

Reporting of injuries, Deseases and Dangrous Occurances Regulations 1995.

Pipelines safety Regulations 1996.

4.2.2 Approved code of practices

HSE Approved codes of practice

Managing construction for health & safety

Standards of training in safe gas installation

Safety in the installation and use of gas systems and appliances

Avoiding danger from underground services

Avoiding danger from buried services

4.2.3 Institution of Gas Engineers

Distribution Mains

Gas Services

Safety working in the vicinity of gas pipelines, mains and associated installations.

External joint repairs in gas distribution systems Recommandations for dealing with reported gas escapes

Vanting of Natural Gas.

Gas Installation pipework, Boosters & Compressors

Commissioning of gas fired plants on industrial and commercial premises

Electric connection to gas meters.

4.2.4 British Gas Publications

Guidance notes on gas safety in educational establishments.

4.2.5 British Standards

A number of British Standards covering different aspects of Gas Safety piping and installations, maintenance and repair as well as different codes of practice are available for reference and compliance. Depending on the task concerned, these standards can be applied.

4.3 AMERICAN DOCUMENTS :

Code of federal Regulations (29 C F R 1910) US Dept. of Lab OSHA

Transportation of Natural or other Gas by pipeline

Minimum federal Safety Standards 192 CODE/DOC/DT

USASI (United States of Indian Standard Institute) code USAS 31-02- (year) Fuel Gas piping (sponsored by ASME)
USAS1, 12, 12, (year) code for pressure piping
USAS1 B-31.3, 31.8, 31.1
API 5LX Rules for Engineering Design & Construction
ASA B.36.10 and 36.19

4.4 GERMAN DOCUMENT :

DIN 2470 Guidelines for designing gas pipelines.

It can thus be seen that a number of standards are available for the design, installation, commissioning, & maintenance of gas piping (for Natural Gas). Detailed analysis, evaluation and discussion on the actual requirements for site needs will decide the safety standards for the purpose.

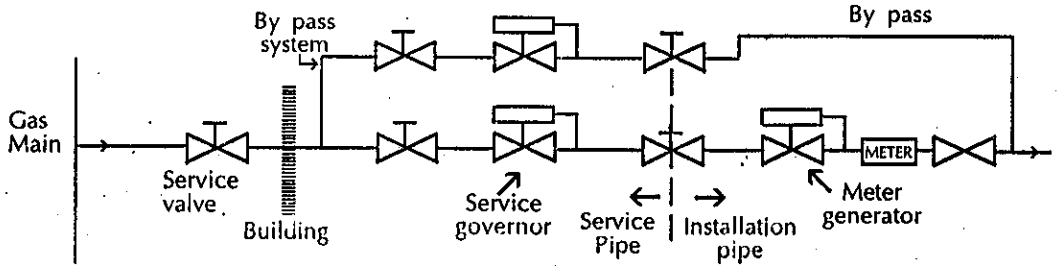
4.5 SITE RELATED ISSUES IN INSTALLATION SAFETY :

The provision of gas supplies falls primarily into two main categories. The gas service pipe (alongwith the primary meter/governor) and the internal pipework (from the outlet side of the primary meter into the building). The former is the responsibility of the supplier or the contractor, whereas the latter is the responsibility of the individual customer. In both cases, hower, the installation must comply with the current regulations codes of practice and the state standards. This section provides general guidance for the installation and operation of gas distribution pipe work with specific emphasis on the safety aspects of the distribution pipeline system. Following examples will illustrate the point.

4.5.1 Line supply :

The following figure shows a schematic layout of the supply system to identify and indicate the different components involved in a meter installation connected installation. Generally it is the supplier's responsibility to instal and maintain the equipment of the installation as such. It is, however, the responsibility of the customer to provide and maintain any housing or security that may be

required to be provided for the installation within his premises.



4.5.2 Service Pipe :

The service pipe, mentioned above, is the pipe between the supplier main line and the meter installation. The route for the serivce pipe normally follows the shortest distance between the main and the meter installation but the route may be altered by some other factors like access/furture plans/ground topography etc .The service pipe however shall not be installed under the foundations of a building or under the base, any load bearing structure or in an unventilated void space. Where the service pipe entering a building passas through any cavity wall, or through a floor of solid construction, than it shall be enclosed in a sleeve and sealed at one end with non-setting mastic material.

4.5.3 Service valves :

A service valve will be fitted in the service pipe in the following cases.

- When the service pipe has an internal diameter for a 63mm pipe & above (specified in British Standard)
- When the maximum operating pressure exceeds 75 mbar
- When the hazardous activity is or is likely to be carried out in the premises supplied.
- When a common service pipe supplies more than one primary meter in the building.

The service valve will be fitted in the service pipe generally outside but very near the property boundary, but sometimes within the area depending on the accessibility. In this case, however, the valve will be provided with a surface box and cover with an identification marker for proper location. This valve is the property of the suppliers and cannot be interfered by the customer.

4.5.4 Meter Installation :

The meter installation is required to be sited within the premises of the building compound as near as practicable to the boundary line. Proper consultation between the supplier and the customer can decide the actual location of the meter since a number of important operational parameters like flow rate, pressure of the gas etc. are involved. The important point to be noted here is that the meter should be fitted at ground level in a well-ventilated area and easily accessible to close the supply in emergency situation. Reading of meter and periodic maintenance are also important while deciding about the meter installation. As per the British Standards, a rotary displacement meter will be used on meter installations where the maximum gas flow rate is more than 170 m^3/h.

Again as per these standards, every meter installation will also include a valve (on the meter inlet side). This valve is known as the meter control valve and is a standard installation in all gas systems. Generally the pressure at the meter inlet does not exceed 22 mbar but the effect of the pressure loss down the pipe work will reduce the available pressure at the appliance.

A gas booster or compressor may be necessary if the burner equipment (to be installed) requires a higher pressure. Under such cases, it will be necessary for the customer to instal an approved non-return valve if air or any other extraneous gas is used at pressure in construction with the natural gas.

Where a service pipe is installed which supplies more than one primary meter (in the same premises) it is essential that a notice (with proper documentation) must be prominantly mounted on or near each primary meter indicating this fact.

A number of cases like those explained above which are primarily connected with system design for safe operations at gas installation at sites in the distribution network can be taken up in the final report. This interim report can however, show clearly the integration of system design for safety as enshrined in the regulations and the codes of practice.

4.6 LIFE CYCLE CONSIDERATION

Life cycle consideration is mostly related to the maintenance activities and the periodic inspection procedures. Though specific considerations for safe systems and procedures have been laid down by the suppliers, site related issues have to be considered in working out preventive and predictive maintenance procedures for safe operations during the entire life cycle of the gas plants. Depending on the experience being gained these systems and procedures require periodic up-dates and at times modifications in the operational phases of maintenance activities in the life-cycle analysis. By applying the principles of terotechnology in the life cycle analysis, one can workout the detailed predictive aspects in the lfie cycle safety consideration.

Draft report will dwell at length these life-cycle aspects of the project.

4.7 H/S/E CO-ORDINATION

With a number of agencies dealing with projects, co-ordination work takes time and a sustined effort in necessary to not just lay down procedures for co-ordination, but also ensure systematic follow-up. In the check list that is being worked out for natural gas distribution system, this element is also playing an important part. It is absolutely necessary that "our own" home work is done throughly before we take up co-ordinating activities on S/H/E aspects of other organizations. While this work carries on, it must be mentioned here that site oriented co-ordination liasion is started at early stages so that closer and more effective help from different co-ordinating agencies/ organizations / units can be ensured.

4.8 HAZARD IDENTIFICATION APPROACHES

Information has to be collected from various organizations and from experienced persons on the failures in pipelines. These failures could be production related, defective material or equipment related, damage related, corrosion related, testing procedure related or site related or any combination of the above. Analysis of these have to be done to work out priorities for safe installations based on probabilities of failures in these specific areas. Safety at design stage itself is

yet another element of consideration. At the installation stage, however, safety during construction work is very important. Differnt elements that can cover construction safety in pipe-line laying have therefore to be considered. As was discussed earlier, operations, maintenance and old- pipe disposal aspects have also an important bearing in the hazard identification approach.

All the above aspects will be analysed in the Draft report.

4.9 LATEST LEGISLATION - Gujarat Gas Act

The latest legislation on gas piping network and related safety health and environmented issues is not yet available though it is understood that the state government has very recently passed this legislation in the state assembly. As soon as details are made available, we shall analyse the same and check this up with other GOI departments and organizations.

CHAPTER-5
NATURAL GAS DISTRIBUTION NET-WORKS OPERATING IN INDIA

- MAHANAGAR GAS LIMITED
- OIL & NATURAL GAS CORPORATION
- QUESTIONARE :
  - NATURAL GAS DISTRIBUTION NET-WORK SYSTEMS
  - INFORMATION REGARDING EXISTING/PROPOSED COMPANIES IN INDIA.

5 NATURAL GAS DISTRIBUTION NET-WORKS OPERATING IN INDIA.

The Indian Text for gas system distribution net-works has little recording or reproduction in the form of a public document. In absence of any such informative documents being present a detailed questionare was prepared and sent to the various agencies for the sole purpose of gathering details of existing system. A copy of same is attached.

The questionare was designed to cover a broad spectrum of features of the system installed. The agencies where the questionare were sent were selected on the basis of the various sites, either operative or new areas being covered. The agencies namely are ONGC, GAIL, OIL, Gujarat Gas, British Gas & Charotar Gas Company to name a few. The information that has been received from various agencies is given in following paragraphs.

5.1 MAHANAGAR GAS LIMITED

On May 8, 1995 Mahanagar Gas Ltd. (MGL) was formed as a joint venture company of Gas Authority of India Ltd. (GAIL). British Gas (BG) and Government of Maharashtra (GOM). GAIL is a national company engaged in distribution of Natural Gas in India and they have all the skills required for cross-country pipeline/steel grid.

On the other hand BG is a leading international gas distribution company headquatered in U.K. and have the requisite technology and skills available for City Gas Distribution Project.

The Ministry of Petroleum and Natural Gas has allocated 1.5 MMSCMD of Natural Gas to Government of Maharashtra for city distribution in Greater Mumbai. The main objective of the project are to subtitute other fuels with Natural Gas in accordance with internationally recognised standards of practices.

The project envisages provision of Piped Natural Gas (PNG) to over 6,00,000 homes, 4500 commercial consumers, 125 industrial consumers and compressed Natural Gas (CNG) to over 50,000 vehicles. MGL is in process of laying a

basic grid of steel pipeline network of about 115 kms. and a distribution of Polyethylene (PE) net work of about 3000 kms over the next years.

Natural Gas from Mumbai High is received by GAIL via Uran and is brought to the city through steel pipeliens. MGL receives the gas at its City Gate station, Wadala. The Gas received at City Gate station is transported through steel pipeline at 19 Bar pressure upto district regulators where pressure is reduced and distributed at 4 bars. Further, the Gas is moved through Polyethylene pipes to the residential societies area and thereafter is carred upto service regulator in the premises of Domestic/Commercial consumers at 75 millibar and reduced to 21 milli bar before connecting to the Gas Appliances.

5.2 OIL & NATURAL GAS CORPORATION

The network distribution system which where being operated by Oil & Natural Gas Corporation (ONGC) have been handed over to GAIL as per the communication from ONGC, Delhi.

GAIL has been contacted in this regard and information from there is awaited.

All other information which ever would be available at any stage would be incorporated, likewise.

APPENDIX :

A detailed questionare (see next page)

Environment & Safety Management Division
SAKET HOUSE, PANCHSHEEL, USMANPURA, AHMEDABAD - 380 013
PHONES : (079) 7551931, 7551817, 7552873 FAX : (079) 7550452
E-MAIL : saketprojects@vsnl.com WEBSITE : http://www.saketprojects.com

NATURAL GAS DISTRIBUTION NET-WORK SYSTEMS

INFORMATION REGARDING EXISTING/PROPOSED

Companies in India

1. Name of the Company :

2. Chairman & Managing Director
   (Address - Regd. Office)
   Contact Person
   Tel. Fax. E-mail :

3. Site - Field Office/Offices
   (Address)
   Contact Person
   Tel. Fax. E-mail :

4. Brief outline of Natural Gas Distribution Net-work System :

   a) Status :

      (i) ☐ Existing, operating :

      (ii) If under planning, ☐
      Present Status, Schedule of Project Completion :

b) Outline :

(i) Brief description - year of starting operations :

(ii) Volume of gas handled :

(iii) No. of consumers :

- Domestic :
- Industrial :
- Others (Hotels, Hospitals, Rest-houses) :

(iv) Profile of gas consumption pattern among various users. PLEASE ENCLOSE A LAYOUT Diagram with details of pipeline length, dia., average pressures maintained. :

c) Complaints about Leakages of gas :

- System for handling complaints :
- Instructions/procedures for monitoring integriety of pipe lines. :
- Safety instructions to consumers of gas. :

(i) Industrial :

(ii) Domestic :

d) Maintenance Procedures, brief outline :

e) Fire Protection System :

f) Standards and codes of practices used in the design of the pipe line systems. :

g) Any plans/project proposals for expansions. For example, distribution of CNG. :

5. Brief outline of accidents involving loss of property or human life, if any, :

6. Your suggestions for establishing design, operating and maintaining a SAFE Natural Gas Distribution Net work System :

CHAPTER-6
GUIDANCE DOCUMENT ON SAFETY, HEALTH AND ENVIRONMENT

6 GUIDANCE DOCUMENT ON SAFETY, HEALTH AND ENVIRONMENT

The main aim of any guidance Document would be to specifically emphasize issues regarding which certain regulations or work practises have already been established.

With a view of the prechecking chapter guidance documents as & when required have been incorporated at the said places to ease the understanding of the subject at the Interim Report Stage.

As the work progresses & new data few various sources flows in a seperate form of a guidance document for the preceeding chapters would be presented at this juncture.

CHAPTER-7
MINIMUM SAFETY STANDARD IN ESTABLISHING NATURAL GAS DISTRIDUTION NETWORK SYSTEMS.

- SAFE OPERATIONAL PROCEDURES FOR OPERATIONS, MAINTENANCE AND EMERGENCES FOR TRANSMISSION AND DISTRIBUTION LINES IN NET WORK SYSTEM
- CHANGE IN CLASS LOCATION
- SUMMARY OF MINIMUM SAFETY PROCEDURES/ELEMENTS FOR THE DISTRIBUTION NETWORK SYSTEM

7 MINIMUM SAFETY STANDARD IN ESTABLISHING NATURAL GAS DISTRIDUTION NETWORK SYSTEMS.

The minimum safety standards for any industry incorporates the quality & procedurs of the company's working within or outside the workspace area. It gives an idea of the standards to be maindained, by anybody & everybody in their day to day routine practices.

With an idea to enlist the safety standards being followed a list of such was prepared by compilation from various sources. The minimum safety standards as given have been assimilated after going through various sources & shall be a guidance for future. However, other agencies who may do the groundwork for preparation of standards & their implementation would have to be engaged. The list may be pruned or new practises included in the Draft or Final stages of the Report.

7.1 SAFE OPERATIONAL PROCEDURES FOR OPERATIONS, MAINTENANCE AND EMERGENCIES FOR TRANSMISSION AND DISTRIBUTION LINES IN NET WORK SYSTEM

General

* No person may operate a segment of pipe line unless it is operated in accordance with the procedurals prescribed.
* Each operator shall keep records necessary to administer the procedures established.
* The admimistrator or state agency that has submitted a current certification under the pipe line safety laws and it is necessary to provide and amend its plans as necessary to provide a reasonable level of safety.
* A mannual of written procedures for conducting maintenance and operational activities and for emergecy response.
* For transmission line the manual must include abnormal operation handling procedures.
* The manual must be updated by the operator every calendar year or at intervals not exceeding 15 months.

* The mannual must be prepared before the pipe line operation system commence.

* The mannual should include procedures for following.

i) Safety during maintenance and operation.

ii) Controlling corrossion.

iii) Making construction records, maps and operating histrory, available to appropriate operating personnel.

iv) Gathering of data needed for reporting incidents in timely and effective manner.

v) Starting up and starting down any part of the pipeline in a manner designed to the assure operation within the MAOP limits perscribed by this part, plus the build up allowed for operation of pressure limiting and control devices.

vi) Maintaining the compressor stations, including provisions for isolating units or section of pipe and for purging before returning to sevice.

vii) Starting, operating and shutting down gas compressor units.

viii) Periodically reviewing the work done by operator personnel to determine the effectiveness of and adequacy of the procedures. used in normal operation and maintenance and modifying the procedure when deficiencies are found.

ix) Taking adequate precautions in excavated trenches to protect personnel from hazards of unsafe accumulations of vapor or gas, emergency rescue equipment including a breathing apparatus and a rescue harness and line.

x) Systematic and routine testing and inspection of pipe type or bottle type holders including.

  i) Provision for detecting external corrossion before the strength of the container has been impaired.

  ii) Periodic sampling and testing of gas in storage to determine the dew point of vapors contained in the stored gas, which, if condensed, might cause internal corrossion or interfere with the safe operation of the storage plant, and

iii) Periodic inspecting and testing of pressure limiting equiment that it is in safe operating condition and has adequate capacity.

(c) Abnormal operation. For transmission lines, the manual required by paragraph (a) must include procedures for the following to provide safety when operating design limits have been exceeded.

(1) Responding to, investigating and correcting the cause of

(i) Unintended closure of valves or shut downs

(ii) Increase or decrease in pressure or flowrate outside normal operating limits.

(iii) Loss of communication

(iv) Operation of any safety device; and

(v) Any other forseeable malfunction of a component, deviation from a normal operation, or personnel error which may result in hazard to person or property.

(2) Checking variations normal operation after abnormal operation has ended at sufficient critical locations in the system to determine continued integrity and safe operation.

(3) Notifying responsible operator personnel when notice of an abnormal operation is received.

(4) Periodically reviewing the response of the operator personnel to determine. The effectiveness of the procedures controlling abnormal operations and taking corrective actions when deficiencies are found.

(5) the requirements of this paragraph (c) do not apply to natural gas distribution operators that are operating transmission lines in connection with their distribution system.

(d) Safety related condition reports.

(e) Surveillance, emergency response and accident investigation

CHANGE IN CLASS LOCATION

Required Study.

Whenever an increase in population density indicates a change in class location for a segment of an existing steel pipe line operating at a hoop stress that is 40 percent more than that of SMYS requires a change of class of location.

The operator shall make a study to determine.

(i) The present class of location for the segment involved.

(ii) Carrying out construction, design and testing studies and comparing with original studies.

(iii) The physical condition of the segment to the extent it can be ascertained from the records, maintenance and operating history.

(iv) The maximum actual operating pressure and corresponding hoop stress, taking pressure gradient in to account.

(v) The actual area affected by the population density increase and other physical barriers or other failure which may limit further expansion.

(6) If the hoop stress corresponding to the established maximum allowable operating pressure of the line is not commensurate with the present class location and the segment line is on satisfactory physical condition then it can be confirmed or revised according to one of the following requirements.

(i) If previously tested in place for a period not less than shours. The maximum allowable operating pressure is 0.8 times the test pressure in class 2 locations. 0.667 times the test pressure in class 3 locations or 0.555 times the last pressure on class 4 locations. The corresponding hoop stress may not exceed 72% of the SMYS of the pipe in class

2 locations 60% of the SMYS in class 3 locations or 50 percent of SMYS in class 4 locations.

(7) The revision of the maximum allowable operating pressure due to above reasons are to be completed within 18 months of the change in class location.

(8) Each operator shall have procedure for surveliance of its facilities to determine and take appropriate action concerning changes in class location, failures, leakage history, corrossion, substantial changes in cathodic protection requirements and other general operating and maintenance conditions.

(9) If it is determined to be in unsatisfactory condition, but no immediate hazard exists, the operator shall program to recondition or phase out the segment involved, if the segment can not be reconditioned or phased out reduce the maximum allowable operating pressure as per the regulations prescribed.

7.2 SUMMARY OF MINIMUM SAFETY PROCEDURES FOR THE DISTRIBUTION NETWORK SYSTEM

Installation of pipe work :

(1) No person shall install any in any position in which it cannot be used with safety having regard to the position of the other pipes, pipe supports, drains, servers cables, conduits and electrical apparatus, and to any part of the structure of any premises in which it is installed which might affect its safe use.

(2) Any person who connects any installation pipe work to a primary meter shall, in any case where equipotential bonding may be necessary inform the responsible person that such bonding should be carried out by a competent person.

(3) The location, installation pipe work should take it consideration in to

account the potential risk e.g. corrossion damage, posed by other building services, equipment and features specified in regulation. Pipe work installation and equipotential bonding should be carried out as per appropriate standards and by competent persons.

(4) In addition to the main bonding supplementary equipotential bonding of pipe work may be necessary in increased electrical shocle risk e.g. bathrooms etc. In such cases a competent electrical engineer should be consulted.

(5) In commercial and large sites where gas and electric meters may be remotely located, the bonding is not always possible in 600 mm. distance. An competent electrical engineer should be consulted for this proper action.

(6) Enclosed pipes

No person shall install any part of any installation of pipe work in a wall or a floor or standing of solid construction unless it is constructed and installed as to be protected against failure, causes by movement of the wall, the floor or the standing as the case may be, it should be designed to stimulate.

i) the effect of solid fuel fire.

ii) designed to operate with a fanned flue system and

iii) installed with in the inner leaf of the cavity wall

(7) Installation of pipe work should not be done under foundation of a building, or in the ground under the base of a wall or footings unless adequate steps are taken to prevent damage to the installation of pipe work or service pipe work.

(8) Gas tightness requirements are set out in the appropriate standard. All joints affected by the portion of the work down should be visually inspected to ensure that they have been correctly made, as part of the gas tightness work.

(9) Joints should be tested before being painted or otherwise protected against corrossion.

(10) Purging should be carried out as per the appropriate standard and should be undertaken after any work which breaches the integrity of installations pipe work.

(11) The open end(s) of any metal pipe from which gas fitting has been disconnected should be sealed with a appropriate metalic fittings.

(12) Gas fittings should be installed in accordance with appropriate standards.

Existing gas fittings :

(13) No person shall make any alternation to any premises in which a gas fittings or gas storage vessel is fitted if that alteration would adversely affect the safety of fittings or a storage vessel.

(14) Modification of any gas fitting should be made by only competent and qualified person, a member of SHE and should be checked by a competent person before gas fitting connection is taken in to use.

Emergency controls

(15) A person who allows gas to flow into any premises for the first time should insure an appropriately sited emergency control is in place.

(16) The emergency control can operate by a key, lever, hand wheel which should be securely attached to the operating spindle of the control.

(17) A permanent notice should indicat how the control operates and when the gas is "off" and "on".

(18) Controls operated by hand wheels need to indicate the opening or closing directions for the control.

(19) Where work its carried out on the gas fittings that evolves breaning into a gasway, it should be done in such a way that any resulting release of gas does not lead to danger.

(20) Where any gas way has been broken into and the gas fittings, concerned is not to be left unattended before the work is completed, the gas way should be sealed with appropriate fittings so as to gas tight.

Maintaning electrical continuity :

(21) A temporary continuity bond to the appropriate standard is required when disconnecting and reconnecting pipe work where the production of a spark could couse a hazard.

Meters :

(22) Before any meter is installed, a check should be made on the means of escape from the premises in the event of fire. Meters and meter components and their installation must satisfy the appropriate standards. New installations (premises with two or more floors above the ground floor)

(23) Meters should not be cited on or under way stair way or any other part of the premises where the stair way or other part of the premises terms the sole means of escape in case of fire.

All other installations (including premises with less than two floors above the ground floor and replacement meters in premises with two or more floors above the ground floor)

(24) Meters need to be installed where reasonably practicable in accordance into safety (23). If it is necessary to install a new or replacement meter on or under a starway or in any part of the premises.

i) the meter should be fire resistant.

ii) the meter should be housed on a fire resistant component with automatic self closing doors

iii) the pipe immediately upstream of the meter or regulator if fitted should be provided with a thermal cut off device which is designed to autimatically cut off the gas supply if the temperature of the device exceeds 95°C.

(25) Before installing a meter, checks should be make on the location and type of any electrical apparatus in the vicinity. Separation distances between gas meter installations and the electrical apparatus are as specified in appropriate standards.

Marking of pipes :

(26) Any person installing, elsewhere than in any premises or part of premises used only as a dwelling or living accomodation, a part of any installation pipe work which is accessible in inspection shall permanently mark that part in such a way that it is readily recognisable as part of a pipe for conveying gas. This applies to more commercial premises such as offices, hotels, commercial buildings etc.

Large consumers

(27) a valve is unstalled in a pipe in a conspicitus and readly accessible positon and

(28) a line diagram in permanent form is attached with the building in a readily accessible position as near as practical to

i) The primary meter or there is no primary meter the emergency control.

ii) The gas storage vessel etc. indicating the position of all installation pipe work of internal diameter of 25mm or more, meters, emergency controls, valves and pressure test points of the gas supply systems in the building.

Gas appliances

(29) No person shall install a gas appliance unless it can be used without constituting a danger to any person.

(30) Gas installers should ensure that any appliance they install or flare to which they connect an appliance is safe for use. Requirements in Appendix-I should be meet as applicable, and reference made to appropriate standards.

(31) Appliances should be installed in accordance with the manufacturer's instructions, including any of flues to which they can be safely connected.

(32) No person shall connect a fluid domestic gas appliance to the gas supply system except by a permanently fixed rigid pipe.

(33) Flexible connections should not be used as this could allow consumers to move the appliance away from the flue.

(34) No person should install a used gas appliance without verifying that it is in safe condition for further use.

(35) After performing work on an installed appliance in installer should carryout the necessary checks and tests to ensure that appliance and any associated flue is safe for use. Requirements of Appendix-I should be meet as applicable, and reference made to appropriate standards.

Flues :

(36) Whenever an appliance is installed to a flue, the installer should ensure that the flue is adequate, suitable and effective for use with the appliance which the necessary tests and examinations should be carried out both before and after the appliance has been fitted. Requirements of Appendix-I should be meet, as applicable and reference made to appropriate standards.

(37) Where a false chimney reast or decorative canopy is fitted, it should be sealed from other rooms in the premises. Reference should be made to appropriate standards.

(38) An interlock should be provided which will cut off the gas supply if the draught falls below a pre set minimum standard for safe operation of the appliance and prevent the gas supply being re-established unless safe to do so. The advice of the appliance/flue system manufacturer should be sought as necessary in respect of interlock deisgn requirements and reference should be made to appropriate standards.

(39) A flue (including any terminal) should be installed in a position which ensures that it will operate effectively and that products of combustion will safely disperse and not present hazard to any person, whether in the premises in which the associated appliance is installed (e.g. by being located a safe distance from vents and openable windows), or in adjoining neighbouring premises. The location needs to take account any possible developments in neighbouring property e.g. building extensions. Any flue

sited so as to discharge at a safe distance from any boundary with adjouning premises. (see regulation & appendix-I); reference should be made to requirements in Building Regulations and appropriate standards, as applicable.

Access

(40) Minimum clearing distance for operation, inspection and maintenance purposes should normally specified in manufacturer's instructions for installation of appliance.

Room sealed appliances

(41) No person shall install a gas appliance in a room used or internal to be used as a bathroom or a shower room, unless it is room sealed appliance.

(42) No person shall install a gas fire, other gas space heater or gas water heater more than 14 kilowats gross heat input in a room or intended to be used as sleeping accomodation, and no person shall install any instantaneous water heater unless (in each case)

(a) It is a room sealed certified appliance

(b) It incorporates a safety control designed to sent down the appliance before there is a build up of a dangerous quantity of the products of combustion in the room concerned.

Suspended appliances

(43) The installation of appliances by suspension from installed pipe work should be avoided, wherever, practicables where approach is to considerd, it should be ensured that the appliance is suitable for suspension in this way and the pipe work is properly supported and capable of safely with standing the weight imposed. Reference should be made to the appliance manufacturers instructions.

Flue dampers

(44) Any person who installs automatic damper to serve a gas appliance shall -

(a) Ensure that the damper is so interlocaed with the gas supply to the burner that burner operation is prevented in the event of failure of the damper to when not in the open position; and

(b) immediately after installation examine the appliance and the danger to verify that they can be used together safely without constituting a danger to any person.

(45) Reference should be made to appropriate standards and appliance manufacturers instruction (see Appendix-II)

(46) The fitting of manually operated damper system to serve a domestic gas appliance is prohibited, because an assured means of purging is not generally possible with such a system.

Testing of appliances

(47) Where a person installs a gas appliance at a time when a gas is being supplied to the premises in which the appliance is installed, he shall immediately thereafter test its connection to the installation pipe work to verify that it is gas tight and examine the appliance and the gas fittings and other works for the supply of gas and any flue or means of ventilation to be used in connection with the appliance for the purpose of ascertaining whether :

(a) the appliance has been installed in accordance with these regulations.

(b) the operating pressure is as recommended by the manufacturer.

(c) the appliance has been installed with regard to any manufacturer's instruction provided with the appliance.

(d) all gas safety controls are in proper working order.

(48) Testing procedures should be in accordance with appropriate standards (Appendix-I and II)

(49) Once the commissioning of appliance is started, it should be either completed in full, leaving the appliance in safe working condition, or the

appliance should be disconnected or the gas supply to appliance is sealed off with appropriate fitting, until tests and examination can be fully completed at a later date.

(50) A person who allows gas to flow in any appliance should ensure that gas fittings are purged and tested for safety or the supply is sealed off with a appropriate standard.

Use of appliances

(51) A responsible person must not use or allow the use of any appliance which it is known or supsected could constitute a danger to any person, and in particular danger of fire/explosion arising from gas leakage or carbonmonoxide poisioning arising from in adequate flueing arrangements or fixed ventilation. An unsafe/dangerous appliance in this context means any appliance where both (a) and, (b) which follow pertain :

(a) there is a design, construction, installation, modification, servicing/ maintenance defficiency or other fault (e.g. maladjustment) in the gas appliance, associated flue/ventilation arrangement or a gas fitting/other works for the supply of gas to the appliance, which has, or likely to result in.

i) incomplete combustion of gas, or

ii) removal of products of combustion not safely carried out or

iii) in sufficient oxygen being available for the occupants of the room/ space in which the appliance is located; or

iv) an accidental gas leakage; or

v) other danger, off

(b) the resulting leakages, inadequate combustion, inadequate removal of the products of combustion, insufficiency of oxygan or other damage has caused or likely to cause death or serious injury.

APPENDIX - I

REQUIREMENTS FOR APPLIANCES AND FLUES

1. This appendix summarises the main points that need to be addressed, as appropriate, in installation and other work, including safety checks, on gas appliances and flues. Additional matters may require attention in particular circumstances; reference should be made to appropriate standards, and Building Regulations where applicable, for further information.

(A) Appliances (regulations 26(1) and (9) and 35/36)

2. Gas installers carrying out installation or safety check work should encure that :

(a) a sufficient permanent supply of air (by natural means) is available to the appliance for safe combustion of gas. Account needs to be taken of the size of the room, whether double-glazing is fitted, the location and size of air-bricks and other permanent air vents, and similar factors which could affect the adequacy of the air supply. It should be checked that vent openings are not obstructed;

(b) the room or space where the appliance is located is adequately ventilated, and that means of ventilation is suitable;

(c) there are adequate and suitable means for removal of products of combustion from the appliance (see flue requirements in (B) below;

(d) the operating pressure and/or heat input of the appliance is correct. The installer should carry out the most appropriate test(s) for the appliance. This information is usually shown in manufacturer installation instructions or on the appliance data badge. In certain cases, eg when appliance burners are modified or replaced, such as for conversion from LPG to natural gas, it may be necessary to check both operating pressure and heat input;

(e) a visual check is made of the 'flame picture' (i.e. appearance) to ensure that it is satisfactory, or a measurement is made of combustion performance where appropriate;

(f) the appliance and associated gas fittings function safely, eg safety devices including flame protection, vitiation devices and fan proving systems operate satisfactorily;

(g) the gas soundness of the appliance is satisfactory;

(h) the appliance is physically stable, securely fitted and properly connected to other fittings.

(B) Flues (regulations 26,27 and 35/36)

DOMESTIC AND OTHER SMALL SCALE FLUES

3. Dutyholders should ensure that:

(a) any flue is inspected and tested sufficiently to determine whether it is suitable and in a proper condition for safe operation of the appliance it is intended to serve. The detailed inspection arrangements necessary to ensure the requirements in (b)-(1) below are met will, to some extent, depend on the particular circumstances/equipment, and must be a matter for judgement by a competent gas installer. However, the following points should be noted:

(i) Wherever necessary, inspection/test should be made with the appliance removed;

(ii) in some cases, dismantling of equipment might be required, e.g. to establish continuity of a flue path in the heat exchanger of a central heating boiler where malfunction is suspected;

(iii) suitable checks for gastightness should be made after any work is done on an appliance, including on installation pipework where this

is disturbed directly or indirectly, for instance when an appliance is removed (eg see regulation 22(1));

(iv) any loftspace through which a flue passed should be examined, where necessary (for instance, during initial installation of an appliance and flue flow test, or subsequent maintenance/safety checks), to ascertain flue integrity through to the outside terminal - see paragraph 213 concerning access for inspection/testing;

(v) where access cannot be gained for inspection, such as where a flue runs partly through property not owned by the dutyholder (eg landlord and access is refused by the occupant, all reasonable steps still need to be taken by the dutyholder to ensure overall flue integrity. This may involve making enquiries with occupants of property (including by 'recorded delivery' correspondence and personal contact as necessary) and requesting to see reports of examinations made by them or on their behalf. Where there are good reasons to suspect fuelling problems, eg because of flue flow/spillage test failure (see (k) and (1) below) or clear medical evidence of carbon monoxide poisoning, it is essential to check the complete length of the flue; any associated appliance must not be used unless or until this is done;

(b) a flue is complete and continuous through its length, i.e. is undamaged and is adequately supported. A flue should not have intermediate openings, apart from;

(i) a draught stabiliser, balancing damper or relief opening which is in the same room, or space, as the appliance being served;

(ii) an opening for inspection or cleaning, which is fitted with a noncombustible gastight cover; or

(iii) an opening integral and essential to the correct operation of the flue, which is purpose-designed and properly located for its application, eg an opening in a vertex flue in an unoccupied loftspace (a guard should be fitted around such an opening, where necessary, to prevent possible ignition of nearby materials);

(c) more than one appliance is not connected to a flue, unless the flue has been specifically designed for this purpose;

(d) the effect of other open-fluid appliances in the same room is properly taken into account. Where more than one such appliance is so installed, it should be ensured that;

(i) the heat output of the appliances is similar and their flues terminate at the same height, preferable close together so that they are subject to the same wind conditions; and

(ii) flues are effective with all appliances in operation (see (k) and (1) below);

(e) the terminal is correctly sited; this should include adequate separation from any site boundary to ensure that the flue will continue to function safely and emissions will not present a hazard to any person either on the site concerned or in adjoining property, including in the event of any future building development on adjoining premises (which might extend close or up to the site boundary);

(f) any chimney has not been closed over/modified so, as to interfere with flue operation. Any flue damper or restructure plates should be removed or permanently fixed open, to avoid obstruction the flue;

(g) any debris, eg in fire/catchment space, is removed before installing/ reinstalling an appliance, that the catchment space is of adequate size and that any openings within this space (other than those for the appliance

connection and flue) are effectively sealed. Flues and chimneys previously used for oil or solid fuel appliances need to be swept before being used with a gas appliance;

(h) where a masonry flue or its lines seems to be in a poor condition, through examination is carried out to determine whether it is safe for continued use. Renovation should be carried out, where necessary, and consideration given to fitting (correctly sized) metal Regulations;

(i) where components, such as external sections of flues (eg terminals) metal flue and inspection openings show signs of damage, eg corrosion, they are replaced as necessary. When replacing an existing liner should normally be replaced unless it is considered suitable for safe operation throughout the lifespan of the new appliance;

(j) when flue liners are fitted or replaced, the flue is tested to ensure it is operating satisfactorily (see (k) and (1), below);

(k) a flue flow test is carried out to check the effectiveness of the flue and ensure that there is no leakage into another part of the premises (including any loft) or, as appropriate, other adjoining premises. (This is particularly important where a number of chimneys combine into a multiple chimney stack.) Smoke coming out of other than the correct terminal, or a down-draught or no-flow condition, indicates an unsatisfactory flue;

(l) after completion of a satisfactory flue flow test, a smoke spillage test is carried out, with the appliance connected and operating to check that the products of combustion are being safety removed. The test should be conducted in accordance with the appliance manufacturer instructions, and take into account any factors which may adcersely affect flue efficiency, eg operation of extractor fans or forced air heating systems in the room housing the appliance or any adjoining room (with interconnecting doors open).

LARGER COMMERCIAL FLUES

4. Larger commercial (and industrial) premises often have purpose designed flue systems. The appliance designer/manufacturer instructions need to be followed when installing, servicing and maintaining such systems. The instructions may well stipulate a particular commissioning procedure to be followed. Reference should also be made to appropriate standards.

Source : *Safety in the installation and use of gas systems and appliances..*
Gas Safety (Installation and Use) Regulations 1998
APPROVED CODE OF PRACTICE AND GUIDANCE
HSE Book, Reprinted with amendments 2000
ISBN 0 7176 1635 5 (Page No. 74 Appendix-1)

APPENDIX - II

APPROPRIATE, STANDARDS. ACOPS, GUIDANCE AND RELEVANT INFORMATION SOURCES

The publications listed below were current when this ACOP/guidance was first published but the list should be taken to refer to any subsequent amendments or latest editions.

Appropriate standards

The following British Standards (listed under subject area) are regarded as 'appropriate standard's for the purpose of this ACOP/guidance - see explanatory note in the introduction to this publication. The list is not comprehensive and is subject to change as standards are revised and new standards introduced.

British Standards are available from:

British Standards Institution Sales and Customer Services,
389 Chiswick High Road, London W4 4AL Tel: 0181 996 7000
Fax: 0181 996 7001

Terminology

BS 1179: Part 6: 1980 Glossary of terms used in the gas industry: Combustion and utilisation including unstallation at consumer's premises

Ventilation

BS 493: 1995 Specification for airbricks and gratings for wall ventilation

BS 5440: Part 2: 2000 Specificaton for installation of ventilation for gas appliances.
BS 5601: Part 1: 1978 Code of Practics for ventilation of caravans

BS 5925: 1991 Code of Practice for ventilation principles and designing for natural ventilation.

BS EN 721: 1999 Leisure accommodation vehicles: safety ventilation requirements

Flues

BS 41: 1973 Specification for cast iron spigot and socket flue or smoke pipes and fittings

BS 567: 1973 Specification for asbestos-cement flue pipes fittings, light quality

BS 715: 1993 Specification for metal flue pipes, fittings, terminals and accessories for gas-fired appliances with a rated input not exceeding 60 kW

BS 835:1973 Specification for asbestos-cement flue pipes and fittings, heavy quality

BS 1181: 1989 Specification for clay flue lining and flue terminals

BS 1289: Part 1:1986 Specification for precast concrete flue blocks and terminals

BS 1289: Part2:1989 Specification for caly flue blocks and terminals

BS 4543: 1990 Specification for factory made insulated chimneys

BS 5440: Part 1: 1990 Specification for installation of flue for gas appliances

BS 5854: 1980 Code of Practice for flues and flue structures in buildings

BS 7435: Part 1 and 2: 1991 Specification for fibra cement flue pipes, fittings and terminals

Installation

BS EN 1775: 1998 Gas supply. Gas pipework in buildings

BS 5482 Specification for domestic butane- and propane-gas burning installations
Part 1: 1994 Installations at permanent dwellings
Part 2: 1977 Installations in caravans and non-permanent dwellings
Part 3: 1999 Installations in boats, yachts and other vessels

BS 5546: 1990 Specification for installation of gas hot water supplies for domestic purposes (1st, 2nd and 3rd family gases)

BS 5864: 1989 Specification for installation in domestic premises of gas-fired, ducted-air heaters of rated input not exceeding 60 KW

BS 5871: Parts 1-3: 1991 Specification for the installation of gas fires, convector heaters, fire/back boilers and decorative fuel effect fires.

BS 6172: 1990 Specification for installation of domestic gas cooking appliances

BS 6230: 1991 Specification for installation of gas-fired forced air convection heaters for commercial and industrial space heating

BS 6400: 1997 Installation of domestic sized gas meters (2nd and 3rd family gases)
BS 6644: 1991 Specification for installation of gas-fired hot water boilers of reted inputs between 60 kW and 2 MW

BS 6798: 1987 Specification for installation of gas-fired hot water boilers of rated inputs exceeding 60 kW

BS 6891: 1998 Installation of low pressure gas pipework of up to 28 mm (R1) in domestic premises (2nd family gases)

BS 7566: 1992 Installation of factory-made chimneys to BS 4543 for domestic premises

BS 7624: 1993 Installation of domestic direct gas-fired tumble driers of up to 3 kW heat input

Valves, meters and regulators (governors)

BS EN 88: 1991 Pressure governors for gas appliances for inlet pressures up to 200 mbar

BS EN 161: 1991 Automatic shut-off valves for gas burners and gas appliances

BS 1552: 1995 Specification for open-bottomed taper plug valves for gas pressures up to 200 mbar

BS 3016: 1989 Specification for pressure regulators and automatic changeover divices for liquefied petroleum gases

BS 3016: 1989 Specification for pressure regulators and automatic changeover devices for liquefied petroleum gases

BS 6448: 1995 Specification for appliance governors of DN graater than 50 and for inlet pressures up to 200 mbar

BS 7461: 1991 Specification for electrically operated automatic gas shut-off valves fitted with throughout adjusters, proof of closure switches, closed position indicator switches or gas flow control

BS 4161 Gas meters

Part 3: 1989 Specification for diaphragm meters (or 212 cubic feet) per hour rating for working pressures up to 50 mbar

Part 5: 1990 Specification for diaphragm meters for working pressures up to 7 bar

Part 6: 1987 Specification for rotary displacement and turbine meter for gas pressures up to 100 mbar

Part 8: 1987 Specification for electronic volume correctors

Tubing

BS 669 Flexible hoses, and fittings and sockets for gas burning appliances

Part 1: 1989 Specification for strip-wound metallic flexible hoses, covers, end fittings and sockets for domestic appliances

Part 2: 1997 Specification for corrugated metallic flexible hoses, covers, end fittings and sockets for domestic appliances

BS 2775: 1987 Specifiaction for rubber stoppers and tubing for general laboratory use

BS 3212: 1991 Specification for flexible rubber tubing, rubber hose, and rubber hose assemblies for use in LPG vapour phase and LPG/air installations

BS 4089: 1989 Specification for hoses and hose assemblies for liquefied petroleum gas

BS 6501: Part 1: 1991 Specification for corrugated hose assemblies

BS EN 1762: 1998 Rubber hoses and hose assemblies for liquefied petroleum gas (liquid or gaseous phase), and natural gas up to 25 bar (2.5 MPa) - specification

Appliances

BS EN 203-1: 1993 Specification for gas heated catering equipment - safety requirements

BS EN 297: 1994 Gas-fired central heating boilers. Type B_{11} and B_{11BS} boilers fitted with atmospheric burners of nominal heat input not exceeding 70kW

BS EN 625: 1996 Gas-fired central heating boilers. Specific requirements for domestic hot water operation of combination boilers of nominal heat input not exeeceding 70 kW

BS EN 676: 1997 Automatic forced draught burners for gaseous fuels

BS 3561: 1962 Specification for non-domestic space heaters burning town gas

BS 5258 Safety of domestic gas appliances

Part 1: 1986 Specification for central heatig boilers and circulators

Part 5: 1989 Specification for gas fires

Part 6: 1988 Specification for refrigerators and food freezers

Part 7: 1977 Storage water heaters

Part 8: 1980 Combined appliances: gas fire/back boiler

Part 9: 1989 Specification for combined appliances: fanned-circulation ducted-air heaters/circulators

Part 10: 1980 Flueless space heaters (excluding catalytic combustion heaters) (3rd family gases)

Part 11: 1980 Flueless catalytic combustion heaters (3rd family gases)

Part 12: 1990 Specification for decorative fuel effect gas appliances (2nd and 3rd family gases)

Part 13: 1986 Specification for convector heaters

Part 15: 1990 Specification for combination boilers

Part 16: 1991 Specification for inset live fuel effect gas fires (2nd and 3rd family gases)

Part 17: 1992 Specification for direct gas-fired tumble dryers (2nd and 3rd family gases)

BS 5386 Specification of gas burning appliances

Part 3: 1980 Domestic cooking appliances burning gas

Part 4: 1991 Built-in domestic cooking appliances

Part 6: 1991 Specification for domestic gas cooking appliances with forced-convection ovens

BS 5809: 1980 Specification for safety and efficiency of the gas heating equipment of commercial dish washers

BS 5885 Automatic gas burners

part 1: 1988 Specification for burners with input rating 60 kW and above

Part 2: 1987 Specification for packaged burners with input rating 7.5 Kw up to but excluding 60 kW.

BS 5978: 1989 Safety and performance of gas-fired hot water boilders (60 kW to 2 MW heat input)

Part 1: 1989 Specification for general requirements

Part 2: 1989 Specification for additional requirements for boilders with atmospheric burners

Part 3: 1989 Specification requirements for boilers with forced or induced draught burners

BS 5986: 1980 Specification for electrical safety and performance of gas-fired space heating appliances with inputs 60 kW to 2 MW

BS 5990: 1990 Specification for direct gas-fired forced convection air heaters with a rated heat input up to 2 MW for industrial and commercial space heating

BS 5991: 1989 Specification for indirect gas-fired forced convection air heaters with a rated input up to 2 MW for industrial and commercial space heating

BS 6350: 1983 Specification for gas heated fish and clip frying ranges

BS 6896: 1991 Specification for installation of gas-fired overhead radiant heaters for industrial and commercial heating (2nd and 3rd family gases)

BS 7186: 1989 Specification for non-domestic gas-fired overhead radiant tube heaters

BS 7261: 1990 safety of small non-domestic flueless space heaters

BS 7462: 1991 Specification for electrical safety of domestic gas appliances

BS EN 50165: 1997 Electrical equipment of non-elecytric appliances for household and similar purposes. Safety requirements

BS EN 1596: 1998 Specification for liquefied petroleum gas appliances: Mobiile and portable non-domestic forced convection direct fired air heaters.

BS EN 778: 1988 Domestic gas fired forced convection air heaters for space heating not exceeding a net heat input of 70 kW, without a fan to assist transportation of combustion air and/or combustion products

BS EN 498: 1998 Specification for dedicated liquefied petroleum gas appliances: Barbecues for outdoor use

BS EN 26: 1998 Specification for gas burning appliances: Gas burning appliances for instantaneous production of hot water for domestic use

BS EN 30-1-1: 1998 Domestic cooking appliances burning gas: Safety General

BS EN 30-2-1: 1998 Domestic cooking appliances burning gas: Rational use of energy. General

General

BS 476: Part 22: 1987 Methods for the determination of the fire resistance of non-loadbearing elements of construction

BS 1710: 1984 Specification for identification of pipelines and services

BS 8313: 1997 Code of Practice for accommodation of building services in ducts

HSE Approved Codes of Practice

Standards of training in safe gas installation. Approved Code of Practice COP20 HSE Books 1987 ISBN 0 7176 0603 1

Managing construction for health and safety. The Construction (Design and Management) Regulations 1994. Approved Code of Practice L54 HSE Books 1995 ISBN 0 7176 0792 5

Design, construction and installation of gas service pipes. Pipelines Safety Regulations 1996. Approved Code of Practice and guidance L81 HSE Books 1996 ISBN 0 7176 1172 8

Management of health and safety at work. Management of Health and Safety at Work Regulations. 1999. Approved Code of Practice L21 HSE Books 1999 ISBN 0 7176 2488 9

Workplace health, safety and welfare. Workplace (Health, Safety and Welfare) Regulations 1992. Approved Code of Practice and guidance L24 HSE Books 1996 (as amended by the Quarries Miscellaneous Health and Safety Provisions Regulations 1995) ISBN 0 7176 0413 6

Safety of pressure systems. Pressure Systems Safety Regulations 2000. Approved Code of Practice and guidance L122 HSE Books 2000 ISBN 0 7176 1767 X

Safety of transportabel gas containers. Pressure Systems and Transportable Gas Containers Regulations 1989. Approved Code of Practice COP 38 HSE Books 1990 ISBN 0 11885515 8

HSE guidance/forms

A Guide to the Gas Safety (Management) Regulations 1996 L80 HSE Books 1996 ISBN 0 7176 1159 0

Safe use of work equipment. Provision and Use of Work Equipment Regulations 1998. Approved Code of Practice and guidance L22 HSE Books 1998 ISBN 0 7176 1626 6

Safety signs and signals. The Health and Safety (Safety Signs and Signals Regulations 1996. Guidance on the Regulations L64 HSE Books 1997 ISBN 0 7176 0870 0

Guide to the Reporting of Injuries. Diseases and Dangerous Occurrences Regulations (RIDDOR) 1995 l73 hse bOOKS 1996 isbn 0 7176 2431 5

Form F2508/2508A: Report of an injury, dangerous occurrence or case of desease under RIDDOR 1995 HSE Books 1996 ISBN 0 7176 1078 0

From 2508G: Report of flammable gas incidents and dangerous fittings under RIDDOR 1995 HSE Books 1996 ISBN 0 7176 1114 0

A guide to the Pipelines Safety Regulations 1996. Guidance on Regulations L82 HSE Books 1996 ISBN 0 7176 1182 5

LP Gas Association Codes of Practice and guidance

Code 1 Bulk LPG storage at fixed installations

Part 1: Design, installation and operation of vessels located above ground

Part 2: Small bulk installations for domestic premises

Part 3: Periodic inspection and testing

Part 4: Buried/mounded LPG vessles

Code 7 Storage of full and empty LPG cylinders and cartriges

Code 17 Purging LPG vessels and systems

Code 21 Guidelines for caravan ventilation and flueing checks

Code 22 LPG piping systems: design and installation

Code 24 The use of LPG cylinders

Part 1: The use of propane cylinders at residential premises

Part 2: The use of butane cylinders at residential premises

Part 3: Use of LPG cylinders in mobile catering vehicles and similar units

Part 4: Use of LPG for catering at outdoor functions

Code 25 LPG central storage and distribution systems for multiple consumers

Guidance Note 2 A guide to servicing cabinet heaters

Available from :

The LP Gas Association, Pavilion 16, Headlands Business Park, Salisbury Road, Ringwood, Hampshite H24 3PB

Institution of Gas Enginers (IGE) technical publications

IGE/UP/1: 1995 Soundness testing and purging of industrial and commercial gas installations

IGE/UP/1A: 1998 Soundness testing and direct purging of small low pressure industrial and commercial gas installations

IGE/UP/2: 1994 Gas installation pipework, boosters and compressors on industrial and commercial premises

IGE/UP/4: 1994 Commissioning of gas fired plant on industrial and commercial premises

IGE/UP/5: 1994 Natural vehicles

Part 1: 1993 Design and installation of filling stations

Part 3: 1997 Filling station operations

IDE/UP/6: 1998 Application of positive displacement compressors to natural gas fuel systems.

IGE/GM/1: 1998 Gas meter installations for pressures not exceeding 100 bar

IGE/GM/2: 1992 Specifications for the repair of diaphragm meters

IGE/GM/5: 1994 Installation and use of electronic gas meter volume conversion systems

IGE/GM/6: 1996 Specificaton for low pressure diaphragm and rotary displacement meter installations with badged meter capacities exceeding 6 m^3/hr (212 ft^3/hr) but not exceeding 1076 m^3/hr (3800 ft^3/hr)

IGE/GM/7: 1996 Electrical connections to gas meters

IGE/GL/8: 1996 Reporting and investigation of gas related incidents (Although primarily concerned with requirements under the Gas Safety (management) Regulations 1996, this document provides information on general practice, relevant to GSIUR)

Please note that some of the above documents include amendments made since the quoted publication date. These publications are available from: the Institution of Gas Engineers, 21Prothand Place, London W1N 3AF

British Gas Publications

Domestic installations

DM7: 1987 A guide to the selection, installation and maintenance of gas heated unvented hot water storage systems

Commercial (and industrial) installations

IM/10: 1989 Technical notes on changeover to gas of central heating and hot water boilers for non-domestic appliances

IM/11: 1989 Flues for commercial and industrial gas fired boilers and air heaters
IM/13: 1980 Specification for pressure switches in industrial and commercial gas fired plant

IM/14: 1989 Standard for non-return valves
IM/19: 1982 Automatic flue dampers for use with gas fired space heating and water heating appliances
IM/20: 1983 Weep by-pass pressure proving systems
IM/22: 1986 Installation guide for high efficiency (condensing) boilers
IM/25: 1989 Guidance notes on gas safety in educational establishments
IM/28:1993 Appliances in commercial garages

These British Gas publications are available from the Institution of Gas Engineers, 21 Portland Place, London WIN 3AF.

Other publications

Code of Practice for the safety of small commercial motor vessles; and Code of Practice for the safety of small commercial sailing vessels HMSO 1993 ISBN 0 11 551185 7

Code of Practice for the safety of small workboats and pilot boats Stationery Office 1998 ISBN 0 11 552006 6

*The Building Regulations 1991. Approved document F: ventilation Department of the Environment and The Welsh Office HMSO 1994 ISBN 0 11 752932 X

*The Building Regulations 1991. Approved document F: heat producing appliances Department of the Environment and The Welsh Office HMSO 1991 ISBN 0 11 752201 5

*The Building Standards (Scotland) Regulations 1990. Technical standards for compliance Scottish Office HMSO 1990 ISBN 0 11 494105 X

*NB Please refer to updated documents/standards, eg concerning any amendments or revision of Building Regulations, as appropriate.

Source of other relevant information

General advice on gas safety issues

Free advice may be obtained by rining the HSE Gas Safety Advice Line on 0800 300 363.

Nationally accredited certification scheme for gas fitting operatives

Information, including on assessment standards, accredited certification bodies, and training providers, is available from CORGI, 1 Elmwood, Chineham Business Park, Crockford Lane, basingstoke, Hants RG24 8WG.

Safety scheme for boats on inland waterways

Details of the British Waterways/Environmental Agency Boat Safety Scheme may be obtained from the Boat Safety Scheme, Willow Grange, Church Road, Watford, Herts WD1 3QA. In the case of inland waterways not covered by this scheme, advice on safety requirements should be sought from the navigation authority concerned.

Source *: Safety in the installation and use of gas systems and appliances.. Gas Safety (Installation and Use) Regulations 1998 APPROVED CODE OF PRACTICE AND GUIDANCE HSE Book, Reprinted with amendments 2000 ISBN 0 7176 1635 5 (Page No. 86 Appendix-4)*

CHAPTER-8
TRAINING IN SAFE GAS DISTRIBUTION NETWORK SYSTEMS

8. TRAINING IN SAFE GAS DISTRIBUTION NETWORK SYSTEMS

Competence in gas installations, with particular reference to the distribution of natural gas network being considered here, requires enough knowledge, skill in practical handling and adequate experience to carry out the job in hand safely. All aspects of installation, operations, maintenance and storage are required to be covered in good working practices. Knowledge has to be kept fully up-dated on a continuous basis with changes in technology and law so as to ensure total safety at gas installations.

Gas installation work should not be undertaken unless people working on the same have undergone a full training programme. While standards of training in safe gas handling & installation have not been evolved in full for the natural gas distribution system, such standards do exist in the U.K. Health and Safety at work etc. Act 1974 and The Gas Safety (installation and use) Regulations 1982 – both U.K. legislations – lays down training and supervision as necessary requirements. The code of practice approved by the Health and Safety Commission in U.K. also lays down training requirements.

Elements of standards of training in safe gas installations cover the following :

- Gas and the technology for its combustion and use.
- Installation of systems
- Installation of appliances
- Servicing, maintenance, repair, disconnection and reconnection
- Recognizing danger
- Law, codes of practice, standards and guidance
- Updating and refresher courses

Final document of this report will cover detailed training schedules in gas installation to ensure full competence of workman. Items that require such training needs include safe installation, purging, commissioning, testing, servicing, maintenance, modification and safety system monitoring. While a number of gas appliances are in operation both in Europe and in the USA, the conditions in our country is different and bulk of the gas installations have only cooking gas coverage. The document that will be finally presented in Draft – Report will therefore reflect the coverage accordingly.

- **ANNEXURES**

1. PROJECT PROPOSAL
2. WORK ORDER OF GSPL

- **APPENDICES :**

1. DEFINITIONS

2. REFERENCES

ANNEXURE-I

PREPARATION

of

GUIDANCE MANUAL

on

HEALTH SAFETY & ENVIRONMENT

for

NET-WORK SYSTEM

DISTRIBUTION

of

NATURAL GAS/REVAPOURISED LNG

Submitted to

GUJARAT STATE PETRONET LTD.,
GANDHINAGAR

August 2000

Prepared by

SAKET PROJECTS LTD.

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National Scenario - an introduction

In India, growth in gas sales has gone up 8 times in last ten years from 3.62 bilion cum in 88-89 to approximately 28.7 billion cu.m. in 99-2000. Indigenous gas production, which is 21.63 billions cu.m. will not be able to meet the demand. Therefore, it is now essential to import Liquified Natural Gas (LNG) to meet the country's growing requirement of Natural Gas.

Scenario in Gujarat

The demand vis-a-vis supply estimates for natural gas in Gujarat shows that natural gas demand for Gujarat State by the year 2011-12 could be 39.47-49.41 MMSCMD as against the total supply which is estimated in the range of 65.3-95.3 MMSCMD. aggravated by the quantum of availability of Natural Gas which would be only 25.3 MMS CMD. Gujarat, having a large coast-line, definitely would be stepping towards port development for LNG imports and subsequently, would require to develop pipeline network for transportation and distribution of natural gas. This needs development of ports in Gujarat to serve as terminal point, laying of gas pipe line for transportation, distribution and marketing of Natural gas/revaporized LNG.

The State of Gujarat has already taken steps to meet the challenge by forming its own state level body i.e. Gujarat State Petroleum Corporation Ltd. (GSPCL). Its role is to explore and exploit smaller oil & gas fields allotted to it in onshore and offshore blocks under the National Exploration Licensing Policy (NELP). Whereas a Seperate body – Gujarat State Petronet Ltd. (GSP) is set up with a specific responsibility to develop a cross-country network of pipe lines for transportation and distribution of natural gas/revapourised LNG in the State.

DISTRIBUTION NET-WORK

Keeping pace with the growing demand for appropriate fuel to meet the energy demand in Gujarat, estimated to grow at the rate of 6 per cent as mentioned earlier, import of LNG appears to be a feasible option. Four LNG import terminals have been given Locational Clearance by Government of Gujarat. A state wide high pressure trunk transmission network and gas grid for the transportation of natural gas/revapourised LNG from the supply point to the demand centres would also need to be set up. In December 1998, Gujarat State Petronet Limited (GSP) was incorporated to implement the GAS GRID Project. The individual gas distribution net-works in the rural or urban centres would be subsequently taken up by separate implementing agencies.

Having got the priorities of establishing a high pressure transmission system based on common carrier principle, plan & develop pipeline corridors for gas transmission system in the state, GSP has shown interest in the study of various issues related to health, safety and environment in respect of the distribution network meant for natural gas/revapourised LNG. It is implied that conceptualizing and establishing the distribution network in the rural and urban areas will be based on established practices of design, operation and maintenance. GSP desired to have an enabling document for their use at the time of appraising any of the proposals submitted by the interested agencies. Therefore, it is our understanding that the FINAL output of this study is to be a guidance document incorporating essential elements of health, safety and environmental issues that may be encountered while establishing, operating and maintaining the distribution pipeline net works. Further, as an outcome of the Study, this document is expected to bring out

questionnaire/check-list that reflect the mechanism by which the regulating authorities would be in a position to assess adequacy of measures that are provided in the design/project report and the manner in which compliance of safety, health and environment provisions are visualized to be achieved.

Scope of Work

In consonance with the objective of the Study indicated earlier, the task for the proposed Study will be conducted as follows :

1. Study and analysis of reports as well as information on the subject available with GSP. Information in respect of market size at different consuming centres could help in defining the magnitude of the problem associated with maintaining safety and environment in the concerned pipeline networks.

2. Based on the literature study, analyze the steps involved in conceptualizing and planning a distribution network system with emphasis on identifying the critical activities that could have impact on health, safety and environmental aspects on the pipeline network.

3. Analyze systems (known to be operational in UK and USA) designed for distribution of natural gas in rural and urban areas. The objective would be to learn from the experience of established systems in industrially advanced countries. The analysis would cover legislative measures, safety, health and environment practices in the total life cycle of pipeline network.

4. Study and analyze the distribution of natural gas through pipeline in Gujarat (for eg. Baroda, Ankleshwar, Surat and other minor locations for domestic as well as industrial applications) and in domestic residential colonies and industry in North–Eastern Region. In this analysis, the emphasis would be to be to learn from the Indian Experience of practices of safety and environmental protection of Natural gas distribution networks that were evolved over a period of time which

were proven to be socially acceptable with minimal risk.

5. Preparation of the guidance document incorporating the inputs available from the above analyses and studies. The proposed contents of the Guidance Document is as follows :

GUIDANCE DOCUMENT

PROPOSED CONTENTS

INTRODUCTION

General considerations – Transmission/Transportation/Distribution of natural gas or revaporized LNG by pipeline-outline of pipeline accidents reported in literature

ACTIVITIES OF PIPELINE TRANSPORTATION PROJECT

On the life cycle approach to pipeline system, list of various activities is as follows :

* Conceptualization and definition of Project
* Design
  - Decide range of throughputs and select an appropriate pipe diameter for that range.
  - Select material of construction of pipe (Steel, Plastics etc.) as per API or any other national or international standard.
  - Firm up preliminary design and route.
  - Detailed design – Identify in detail the possible impacts of the proposal on the environment.
  - Profiles, Hydraulics gradients need for compressor stations.
  - Review applicable legislations and procurement of land or obtain rights of way. Prepare Final Environment Impact Statement/study of the proposal.
* Construction
  - Cleaning and grading – stringing of pipes – bending – ditching or trenching – welding – coating and wrapping – lowering and backfilling – clean-up and re-instatement – cathodic protection – hydrostatic testing of completed pipeline.
* Telemetry and control
* Testing commissioning and operation

* Pipeline intergrity Monitoring and Inspection Practices
* Maintenance – (including pigging etc. wherever applicable)
* Prevention of third-party interfence
* De-Commissioning of the pipeline system

ANALYZE IMPLICATION OF THE LISTED ACTIVITIES

* On Environment and suggest measures to minimize the impact and
* On Safety and Health related issues of these activities.

MINIMUM SAFETY STANDARDS FOR PIPELINE SYSTEMS

* These could include safety standards for materials, pipe design, design of pipeline components, weldings, joining of materials, general construction requirements, customer meters – service regulators – service lines, corrosion control, Testing of pipelines, operations, maintenance etc.

REVIEW SAFETY PRACTICES IN THE GAS PIPELINE TRANSPORTATION SYSTEMS IN INDIA

LIST OF STANDARDS RELAVENT TO THE PIPELINE SYSTEMS

* These could include API, OISD and industry codes of practice. Annexe some standards (full text) for ready reference purpose.

Time Frame

The entire Study will be completed in a 16 weeks as per following time table –

- Interim Progress Report – 8 weeks
- Draft Report – 12 weeks
- Final Report – 16 weeks

Professional Fees

A lumpsum amount of Rs. 5.60 lacs for carrying out the assignment as per the scope of work will be charged as Professional Fees. The professional fees do not include the Service Tax which will be charged extra as for prevailing rate : (current rate : 5%)

The professional fees do not include travelling/ transportation and other out-of-pocket expenses for field visits to North-Eastern Region.

Terms of Payment

The Professional Fees, mentioned on Page 8 of this proposal, will have to be paid as per following schedule.

40% – as an advance on assigning the job

20% – on Submission of Interim Progress Report

20% – on Submission of Draft Report

20% – on Submission of Final Report

ANNEXURE-2

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Regd. Office : Block -15, 3rd Floor, Udyog Bhavan,
Sector-11, Gandhinagar-382 011
Tel. : +91-2712-36372 Fax : +91-2712-38648
E-mail : gujpetronet@gujaratpetro.com
Web site : http://www.gujpetronet.com

Sanjay Gupta, IAS
Director

GSPL/00-/446
November 20, 2000

Shri Kamal Khokhani
Director
Saket Projects Ltd.
Saktet House,
Panchsheel, Usmanpura
Ahmedabad

SUB: Work order for Preparation of Guidance Manual on Health, Safety & Environment for Distribution pipelines.

Dear Sir,

We are pleased to place a work order for Preparation of Guidance Manual on Health, Safety & Environment for Distribution pipelines. The terms and conditions shall be as follows:

Scope of work

1. Study and analysis of reports as well as information on the subject available with GSPL.

2. Based on the literature study, analyze the steps involved in conceptualizing and planning a distribution network system with emphasis on identifying the critical activities that could have impact on health, safety and environmental aspects on the pipeline network.

3. Analyze systems (known to be operational in UK and USA) designed for distribution of natural gas in rural and urban areas. The analysis would cover legislative measures, safety, and health and environment practices in the total life cycle of pipeline network.

4. Study and analyze the distribution of natural gas through pipeline in Gujarat (for e.g. Baroda, Ankleshwar, Surat and other minor locations for domestic as well as industrial applications) and in domestic residential colonies and industry in North-Eastern Region. In this analysis, the emphasis should be to be to cover the Indian Experience of practices of safety and environmental protection of Natural gas distribution networks that were evolved over a period of time, which were proven to be socially acceptable with minimal risk.

5. Preparation of the guidance document incorporating the inputs available from the above analyses and studies.

Time Frame

The entire Study will be completed in a 16 weeks as per following timetable –

- Interim Progress Report - 8 weeks
- Draft Report - 12 weeks
- Final Report - 16 weeks

Professional Fees

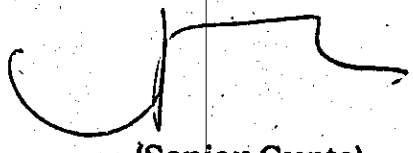
A lumpsum amount of Rs.5.60 lacs (Rupees five lacs sixty thousand only) shall be payable as fees. The professional fees do not include the Service Tax.

Other out-of-pocket expenses for field visits shall be payable at actual.

Kindly acknowledge acceptance of the work order.

Thanking you,

Yours sincerely,



(Sanjay Gupta)

APPENDIX - 1

DEFINITIONS

Gas means natural gas, flammable gas, or gas which is toxic or corrossive.
Distribution line means a pipe lines other than a gathering or transmission line.
Exposed pipe line.: Means pipeline where top of the pipe is protruding above the seabed in water less than 15 ft. (4.6) m deep as measured from the mean low water.
Gathering Line : means a pipe line that transports gas from current production facility to transmission line or main.
Line Section : means a continous run of transmission line between adjacent compressor stations, between compressor station and storage facilities, between compressor station and a block valve or between adjacent block valves.
Low pressure distribution **system** means a distribution system in which the gas pressure in the main is substatntially the same as the pressure provided to the customer.
Main : means a distribution line that serves as a common source of supply for more than one service line.
High pressure distribution system a distribution system in which the gas pressure in the main is higher than the pressure provided to the customer.
Maximum actual operating pressure means the maximum presure that occurs during normal operations over a period of one year.
Maximum Allowable operating pressure (MAOP) means maximum pressure at which pipe line or segment of pipe line may be operated under this part.
Municipality means a city, county or any other political sub-division of the state.
Operator means a person who engages in the transportation of gas.
Person means any individual, firm, joint venture, partenership.
Corporation, association, state, municipality, co-operative association or joint stock association, and including any trustee, reciever assignee, or personal representative there of.
Petroleum gas means propare, propylene, butane (normal butane or isobutanes), and butylene (including isomers) or mixtures composed predominatitly of these gases, havig a vapur pressure not exceeding 208 psi (1434 Kpa) gage at 100°F (38°C).
Pipe means any pipe or tubing used in the transportation of gas, including pipe type holders.

Pipeline means all parts of those physical facilities through which gas moves in transportation including pipel, valves an other appurtenance attached to pipe, compressor units, metering stations, regulator stations, delivery stations, holders, and fabricated assemblies.

Pipe line facility means new and existing pipe line rights of way, and any equipment, facility or building used in the transportation of gas or in the treatment of gas during the course of transportation.

Service line means a distribution line that transports gas from a common source of supply to (a) a customer meter or the connection to a customer's piping, whichever is farther downstream or (b) the connection to a customer's piping if there is no customer meter. A customer meter is the meter that measures the transfer of gas from an operator to a consumer.

SMYS means specified minimum yield strength is :

(a) For steel pipe manufactured in accordance with a listed specification, the yield strength specified as a minimum in that specification or

(b) For steel pipe manufactured in accordance with as unknown or unlisted specification, the yield strength determined in accordance with 192.107 (b)

Transmission line means a pipe line other than a gathering line, that :

(a) Transports gas from a gatherline or storage facility to the distribution center, storage facility or large volume customer that is not down stream from a distribution center

(b) Operates at a hoop pressure of 20% or more of SMYS or

(c) Transports gas within a storage field.

A large volume of customer may receive similar volumes of gas as a distribution center and includes factories, power plants and institutional users of gas.

Transportation of gas means gathering transmission or distribution of gas by pipe line or the storage of gas in or affecting interstate or foreign commerce.

APPENDIX - 2

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