

## Executive Summary

### Introduction:

Oil India Limited (OIL) is a premier Indian National Oil Company under the administrative control of Ministry of Petroleum and Natural Gas, Govt. of India. OIL is engaged in the business of exploration, development, production and transportation of Crude Oil and Natural Gas and production of LPG with its Headquarters at Duliajan, Assam.

In order to meet the growing demand of gas, Oil India Limited proposes to undertake an integrated Gas Field Development Projects which include laying of gas pipelines and several new gas installations such as CGGS, GCS, FGS etc. Before execution of the project as per Ministry of Environment & Forests Notification 2006, Environmental Impact Assessment has to be done. In line with this requirement, OIL hired the services of M/s En-Geo Consultancy & Research Centre, Assam to conduct the Environmental Impact Assessment & Risk Assessment Studies.

### Project Description:

This project is planned for maximization of natural gas production and utilization from Tengakhat - Naharkatiya – Jorajan, Tinsukia Dhola and Dumduma-Pengri area of Oil India Limited. Oil India Limited has been producing natural gas from this area for more than five and half decades. However, these needs to be developed further based on its potential and OIL's future commitments. With this objective this project is undertaken which comprises of the following natural gas production, collection and transportation facilities-

Name of Area	Type of Installation	Installation Name
Gas Field Development in Tengakhat-Naharkatia-Jorajan Area	<b>GCS (Gas Compressor Station)</b>	Tengakhat
		Bhogpara
	<b>FGS (Field Gathering Station)</b>	a) Jorajan:
		b) OCS-4
		c) Kathaloni
		d) Hapjan
		e) Ushapur
	<b>Pipelines</b>	a) W/50 to LPG Offtake : 3 nos. : 600mm X 10Km (2Nos.) 500mm X 10Km (1No.)
		b) W/50 to Location NKF : 2 Nos. : 400mm X 7Km (1No.) : 300mm X 7Km (1No.)
		c) Location NKF to Shalmari Approach via GCS-2, OCS-8 : 300mm X 33Km
		d) OCS-3 to W/50 OT : 400mm X 8Km
		e) Tengakhat OCS to Tengakhat Approach : 2 Lines : 300mm X 0.8Km (1No.) 100mm X 0.8Km (1No.)
		f) Hatiali Scrapper Trap to Wilton : 250mm X 4Km
		g) Hatiali Scrapper Trap to W/263 : 100mm X 1Km
		h) Hatiali Scrapper Trap to Dikom OCS : 150mm X 5.6Km
i) Tengakhat Approach to Kathaloni OCS : 100mm X 4.5Km		
j) Wilton to Tengakhat Approach : 200mm X 0.8Km		
k) Bengenabari to Bhekulajan EPS : 150mm X 3.2Km		

**EIA- EMP Study for Tengakhat-Nahorkatiya-Jorajan, Tinsukia-Dhola & Dumduma-Pengri Integrated Gas Field Development Project**  
**OIL INDIA LTD.**



(ENGECORC)

		l) OCS-2 to GCS-7 : 150mm X 3.2Km m) GCS-7 to OCS-6 : 100mm X 0.8Km n) LPG OT to OCS/GCS-5 : 250mm X 1Km o) W/50 OT to OCS-4 : 150mm X 4Km p) W/319 to GCS-1 : 150mm X 2.5Km q) GCS-1 to OCS-1 : 100mm X 1Km. r) Hapjan OCS to Makum OCS : 150mm X 6.5Km s) Nagajan OCS to Hapjan OCS : 200mm X 13.5Km t) Kathalguri OCS to Nagajan OCS/GCS : 200mm X 7.6Km u) Jorajan Approach to Jorajan OCS/GCS : 150mm X 0.8Km v) Bhogpara EPS to Wilton w) Extension/Augmentation of Existing Gas Flow P/L Network : 50mm to 250mm : Approx. 50Kms.
	<b>CGGS &amp; OTP</b>	CGGS & OTP - Madhuban (W/50)
<b>Gas Field Development in Tinsukia - Dhola Area</b>	<b>GCS (Gas Compressor Station)</b>	Dikom
		Chabua
		Barekuri
		Baghjan
		Makum
<b>FGS (Field Gathering Station)</b>	Dikom	
	Chabua	
	Baghjan	
	South Chandmari	
<b>Pipelines</b>	a) Chabua to W/50 CGGS : 400mm X 20.8Km	
	b) Baghjan to W/50 CGGS : 400mm X 41.5Km	
	c) W/263 to Hatiali EPS : 2 nos. : 100mm X 1.5Km each	
	d) Makum OCS to TF : 100mm X 14Km	
	e) Hatiali EPS to Hatiali Scrapper Trap : 100mm X 3Km	
	f) Extension/Augmentation of Existing Gas Flow Pipeline Network : 50mm to 250mm : Approx. 50Kms	
<b>Gas Field Development in Dumduma-Pengri Area</b>	<b>FGS (Field Gathering Station)</b>	Borhapjan
	<b>Pipelines</b>	a) Kushijan-2 Approach to DDGG : 200mm X 1Km b) Extension/Augmentation of Existing Gas Flow Pipeline Network : 50mm to 250mm : Approx. 30Kms

**Base Line Environmental Study:**

To know the present environmental condition of the study area, field studies have been conducted for 5(five) weeks to determine existing conditions of various environmental attributes by collecting baseline data within a radius of 10 km from each installation and

500m both sides from proposed Gas Transmission pipelines from primary and secondary sources viz. various government and non government organizations.

### **Physiographic and Geographical Feature:**

Dibrugarh district is located in the northeastern corner of the Upper Brahmaputra valley south with an altitude ranging between 99 and 474 meters. A major part of it is an extensive plain formed by the Brahmaputra and its major south bank tributary-the Buri Dihing.

The Tinsukia district is located in the north corner of the Upper Brahmaputra. A variety of elements such as flood plain, beels and swamps, occasional highlands and foothills of the Barail Range constitute the Physiography of the district.

Dumduma is located at 27.57°N 95.57°E .It has an average elevation of 114 m (374 ft). It is situated on the bank of Dumduma River a tributary of Brahmaputra. Dumduma is a circle of Tinsukia. The town itself is surrounded by tea gardens and is known as the Tea City of Assam.

Project area is situated within the seismic zone- V, which means that the area is located in one of the high seismically active zones in India.

The Geology in this part of area is typically sedimentary. It is the northern part of a geologic province which has been termed as Assam Arakan.

The geological formation of the area may be broadly described as unclassified older and newer alluviums (quaternary deposits) comprising high level terraces and recent alluvial deposits of the Brahmaputra Quaternary fluvial sediments over the entire portion of the area.

### **Land Use:**

A total of 13 land use/ land cover classes have been demarcated in the study area, comprising of 3 projects. A thematic map suitable for 1:50000 scale map generation incorporating these classified categories has been prepared.

The area as a whole represents an alluvial terrain drained by numbers of rivers, out of which majority of the rivers flow from North West to south east of the project site. The fertile alluvial soil is extensively used for agriculture, mostly to grow one crop (paddy) during the kharif season.

The agricultural plantation including both kharif and rabi, represents 17.52 % of the total land use area. Crop land covers 13.84% of the the total area Jhum Cultivation which is mainly practiced in Arunachal area represents 0.04 %. Tea Gardens, which is a major contributor to the economy of the area represents 42.06% of total land use. Rivers/ water bodies represent 1.73 % of the land use. Due to large seasonal variation in discharge of these rivers, the area coverage of this category varies in space and time. Wet land (1.08%) & sand bars (2.38%) have developed mainly in the areas adjacent to the rivers within the project area. Forest cover including dense forest, open forest and degraded forest represents 16.24%, 1.92%, and 1.78% respectively .Grassland covers 0.43% of total land use pattern. The urban settlement (settlement/built up areas) is mostly confined to the towns and along the road networks (0.93%). Mining area represents 0.06% of the land use.

### **Air Quality:**

Ambient Air Quality (AAQ) with respect to Suspended and Respirable Particulate Matter (SPM & RPM), Sulphur dioxide (SO<sub>2</sub>), Oxides of Nitrogen (NO<sub>x</sub>), was monitored at twenty one (21) stations and VOC & HC was monitored at twenty eight (28) stations covering the project area. The locations of the monitoring stations were selected based on pre-dominant wind direction and with due consideration to accessibility, sensitivity,

prevailing conditions representativeness of the site in terms of its exposure. The analytical data depicts that at all the sampling locations the Suspended Particulate Matter (SPM), Respirable Particulate Matter (RPM), NO<sub>x</sub> & SO<sub>2</sub> were found well within the prescribed standard limit as per CPCB except at W/50 location where the SPM (804µg/m<sup>3</sup>) value exceeds the standard limit (200 µg/m<sup>3</sup>) which may be due to local concentration of construction activity in the limited area and heavy traffic on the Duliajan-Tinsukia road which is very adjacent to the proposed site.

The VOC & HC was recorded higher in some locations due to release of gas which is an abnormal condition. No permanent source of VOC release was observed within the study area. The leakage of VOC has stopped immediately after the rectification of the leaky source & the value of VOC has come down as shown in the graphs.

The wind rose diagram prepared for Tengakhat, Duliajan, Makum and Barhapan station indicates that the predominant wind direction is north.

### **Noise Level:**

The noise monitoring locations are selected by considering the proximity to habitation, traffic and forest cover etc. Monitoring was carried out at twenty one (21) locations in the study area for five weeks. Noise levels at the residential, commercial, industrial as well as sensitive locations within the study area are well below the prescribed standard by **Ministry of Environment and Forests 14<sup>th</sup> February' 2000** except in N2 (Near Tengakhat OCS) residential area during day time where the noise level was found slightly high which may be due to various household chores and N12 (Sessa Tea Garden, near Dikom OCS) residential area during day and night time the noise was found slightly high, which may be due to the movement of heavy vehicles on the nearby Dikom Sessa road, whose condition is not good.

### **Traffic Monitoring:**

Vehicular traffic counts were performed at Duliajan Tinsukia Road, Duliajan -Digboi Road, Dikom Sessa TG Road, Sarupathar (Near Chabua) Road and Ananada Bagh Camp NH 37 for a period of 24 hours at each location. The traffic starts increasing gradually at Duliajan Tinsukia Road during the morning time & reaches the peak value between 12 PM - 1 PM for all the three types of vehicular traffic. Traffic volume gradually decreases after 2 PM. At Duliajan - Digboi Road, the peak traffic volume for the light vehicle was observed during 11 AM-12 PM, medium vehicle during 6 PM-7 PM & heavy vehicle during 11 AM-12 PM. At Dikom Sessa TG Road the traffic load was found maximum in case of Light vehicle between 5 PM-6 PM followed by Heavy vehicle between 8 AM-9 AM. Only few Medium vehicles were observed on this road. At Sarupathar (Near Chabua) Road the traffic volume of Medium & Light vehicle attain peak value during 10 AM-11 PM whereas the Heavy vehicle was observed maximum during 1 PM-2 PM. At Ananada Bagh camp NH 37 the traffic volume of Medium & Light vehicle attains peak value during 10 AM-11 AM and 11 AM-12 PM respectively whereas the Heavy vehicles were observed maximum during 11 AM-12 PM.

### **Water Environment:**

Surface water (16 samples) assessed in the study area reveals that there was no contamination in the surface water except for Total Coli- form Organisms at all the locations. Hence it is recommended not to drink the surface water directly from the source. Water may be chlorinated before drinking. However the water is fit for any other household use. The value of Chemical Oxygen Demand (COD) is observed in between 3.0 to 24.0 mg/l in various sampling locations of the proposed survey area. In SW4 (Dhekiajan stream) the COD value

was found highest (24.0 mg/l) which may be due to the wastes from poultry farms and the tea garden drains which carried many chemical wastes and discharge into this stream. The COD level was found high in all the water samples which may be due to the non biodegradable substances that are drained in these river systems from the Duliajan town areas.

Ground water (17 samples) assessed in the study area reveals that there was no contamination in the water. However in almost all the ground water samples Magnesium content was found exceeds the prescribed limit (30mg/l), which may be due to magnesium content in the rocks. The iron content in water samples was found beyond due to subsurface iron rich soil.

**Biotic Environment:**

As many as 208 plant species were found in the study area of which 105 species of trees, 3 species of bamboo, 26 species of herbs and shrubs, 6 species of climbers, 4 species of palms, 11 species of aquatic/semi aquatic plants, 14 species of Pteridophytes, 2 species of orchid, 2 species of canes and 35 species of medicinal plants were recorded.

**IVI value of species as recorded at different locations of study area**

Sl No.	Location	Range of IVI	Highest IVI	Lowest IVI
1	Near W/50, Madhuban tea garden	24.1-91.2	<i>Albizia sp.</i>	<i>Syzygium cumini</i>
2	Near Tengakhat OCS	15.8-65.8	<i>Areca catechu</i>	<i>Syzygium cumini</i>
3	2 No. Mohmari	28.15 - 55.17	<i>Livistona jenkinsiana</i>	<i>Spindus mukorossi</i>
4	Near Jorajan OCS	7.5- 35.2	<i>Dipterocarpus macrocarpus</i>	<i>Mesua ferrea</i>
5	Bhogpara	14.3-52.3	<i>Areca catechu</i>	<i>Lagerstromea speciosa</i>
6	Hatiali scrapper	11.01-75.21	<i>Litsea monopetala (Roxb.)Pers</i>	<i>Musa sp.</i>
7	Near Bhekulajan EPS	21.65 - 53.71	<i>Musa sp.</i>	<i>Heteropanax fragrans Seem</i>
8	Nagajan OCS	20.1- 60.3	<i>Areca catechu</i>	<i>Embllica officinalis</i>
9	Denkagaon (Barekuri)	25.8 - 58.6	<i>Croton jauphra L.</i>	<i>Lannea grandis A.rich</i>
10	Baghjan	16.4 – 64.3	<i>Areca catechu</i>	<i>Gmelinia arborea</i>
11	Makum	13.6 – 55.8	<i>Mangifera indica</i>	<i>Embllica officinalis</i>
12	Chabua	22.3 – 58.9	<i>Livistona jenkinsiana</i>	<i>Gmelinia arborea</i>
13	Dikom	8.3 - 55.5	<i>Areca catechu</i>	<i>Bauhinia acuminata</i>
14	Balijan Namghar, Near Kushijan FGS	7.5- 64.3	<i>Terminalia myriocarpa</i>	<i>Holarrhena antidysenterica</i>
15	At Bardubi T.G, Dumduma	14.7- 60.8	<i>Moringa oleifera</i>	<i>Mangifera indica</i>

Surface water bodies have highly diverse planktonic community. Approximately 20 different planktonic species were recorded in the study area. In addition to that 21 species of aquatic weeds, & approximately 31 different species of aquatic fauna, approximately 45 different species of fish species, 10 species of butterflies, 8 species of invertebrates, 51

species of avifauna species, 6 species of amphibians, 6 species of reptiles & 47 species of mammalian were observed in the study area. Information related to terrestrial as well as aquatic fauna were collected through secondary sources like interaction with inhabitant in the study area backed by field observations and from the concerned departments.

**Ecologically sensitive areas within 10km radius from various proposed installations/Pipelines of OIL in the Tengakhat –Naharkotiya-Jorajan Gas Field Development area.**

SI No.	OIL Installations/ Pipelines	Ecologically sensitive area within 10 Km from OIL Installations
1.	FGS Ushapur	Dehing Patkai Wildlife Sanctuary
2.	Jorajan FGS	Dehing Patkai Wildlife Sanctuary
3.	CGGS & OTP Madhuban	Bherjan-Borjan-Padumoni Wildlife Sanctuary
4.	FGS - OCS-4	Bherjan-Borjan-Padumoni Wildlife Sanctuary
5.	Gas Pipelines near existing OCS – 3 & Kathalguri	Bherjan-Borjan-Padumoni Wildlife Sanctuary
6.	Pipelines from Baghjan & Barekuri (proposed under Gas Field Development in Tinsukia-Dhola Area)	Dibru-Saikhowa National Park Bherjan-Borjan-Padumoni Wildlife Sanctuary
7.	Pipeline from Chabua (proposed under Gas Field Development in Tinsukia-Dhola Area)	Bherjan-Borjan-Padumoni Wildlife Sanctuary

**Table: 3.16 Ecologically sensitive area from various installations/pipelines of OIL in the Tinsukia-Dhola Gas Field Development area.**

SI No.	Oil Installations/Pipelines	Ecologically sensitive area within 10 km from OIL Installations
1.	Gas transmission pipeline originating from Baghjan FGS	Dibru Saikhowa National Park Bherjan-Padumoni-Borjan WLS
2.	Gas transmission pipeline originating from Barekuri	Dibru Saikhowa National Park Bherjan-Padumoni-Borjan WLS
3.	Gas transmission pipeline originating from Chabua	Bherjan-Padumoni-Borjan WLS
4.	GCS Baghjan	Dibru Saikhowa National Park
5.	GCS Barekuri	Dibru Saikhowa National Park
6.	FGS Baghjan	Dibru Saikhowa National Park
7.	FGS South Chandmari	Bherjan-Padumoni-Borjan WLS
8.	GCS Makum	Bherjan-Padumoni-Borjan WLS
9.	FGS Hapjan	Bherjan-Padumoni-Borjan WLS

**Dumduma-Pengri Gas Field Development area does not fall within 10 km from any eco-sensitive zone.**

**Rare, Endangered and Vulnerable Species**

No Endangered species are recorded in the study area as per IUCN (International Union for Conservation of Nature). Elephant, Pig-tailed macaque, Assamese macaque, Capped langur, Tiger, Clouded leopard, Stump-tailed macaque, Serow are recorded in the study area treated as Vulnerable species by IUCN (International Union for Conservation of Nature).

However, it is envisaged that with the adoption of proper Environmental Management Plan, construction and operation of OIL's proposed installations and pipelines will not have any adverse impact on the flora and fauna of above mentioned ecologically sensitive areas.

#### **Land Environment:**

To access the soil quality of the proposed project area twenty two (22) nos. of samples were collected from different locations, soil samples should be collected from three different depths viz. 30 cm, 60 cm and 90 cm below the surface and are homogenized in line with IS: 2720.

The water holding capacity of the soil samples are found to be in the range of 20.66 to 74.30 % indicating suitable for vegetation. TKN (Total Kjeldahl Nitrogen) in the soil samples are well within the suitable range i.e. 0.03 to 0.32 % and total phosphorous is found in the range of 0.5 to 2.9 mg/gm. Presence of suitable amount of nitrogen and phosphorus encourages vegetation growth, its production and gives deep greenery colour to the plant leaves. Organic carbon content of the soil samples ranges from 0.20 – 1.10 % indicating a healthy soil condition. Overall observation indicates that the soils are fertile and support the vegetation life in the region. The soil quality does not indicate any industrial contamination.

There are no archeologically important monuments found in the study area.

#### **Socio-Economic Environment:**

Major portion of the proposed project area falls under Dibrugarh and Tinsukia District. Socio-economic profile of Dibrugarh and Tinsukia district in terms of demographic characteristics like population, literacy, social structure, occupational structure and basic infrastructure were collected from census report 2001 and from field survey. The average house hold size of the study area is 5.3. Highest populations were recorded in the Tengakhat area (195,037), Chabua (147,372), Duliajan No. 2 (2,306) and Dikom TE (4,561) of Dibrugarh district. Highest non worker population (115,443) and SC (8,118), ST (14,239) population was recorded in Tengakhat area. Lowest literacy rate (18.5%) was recorded in Ushapur, Naharkatiya area of Dibrugarh district.

In Tinsukia district, highest populations were recorded in Dumduma (TC) [19,806] and Makum (TC) [15,118] and non worker population (13,343) and SC (1117) ST (179) population was recorded in Dumduma (TC) area. Lowest literacy rate (35.6%) was recorded in Dumduma area of Tinsukia district.

#### **Impact Assessment:**

During the construction phase due to movement of earth moving equipment, operation of DG sets, site grading, trench digging etc air quality of the site shall be marginally affected in terms of slight increase in CO, HC, SO<sub>2</sub>, NO<sub>x</sub>. The SPM and RPM levels are expected to increase during pigging and construction of pipeline.

The impact to the surface water bodies could arise from discharge from the site, disposal practice of spent product, cuttings, handling of liquid hydrocarbons etc. Noticeable impacts to water quality in nearby watercourses are more likely to occur as a result of increased suspended particle load. However, if the site preparation activities are conducted in dry season this impact would be negligible or insignificant.

During operation phase, water usage is generally confined to CGGS & OTP, GCSs & FGSs for drinking, service and firewater. The requirement shall be met through installing tube wells / from nearby existing water sources.

The potential sources of air emissions at the project sites will be as follows:

- Dust from earth works (during approach road and site preparation);
- Emissions from DG sets (including noise emission);
- Emissions from vehicles.

During construction of GCS, FGS water requirement will be more and shall be taken from temporary boring or nearby water sources. This impact will be temporary and insignificant. Septic tank and soak pit shall be provided at base camp for sanitary waste discharge.

Construction activities will be carried out mainly during the day time. Localised increase in noise level is expected, however the effect is reversible and for short duration. During operation phase at GCS and FGS there may be marginal increase in noise level. Along the pipeline route there shall be no impact on the ambient noise levels.

As few proposed installations are nearby tea gardens, it is presumed that tea plant will be affected if the concentration of SO<sub>2</sub>, NO<sub>x</sub>, O<sub>3</sub>, PAN etc. crosses the permissible limit during the operation. But considering the present status of ambient air, the impact is not so significant. As the level of SO<sub>x</sub>, NO<sub>x</sub> etc. were observed below the standard limit in the study area.

Major Biological impacts, in general, of any underground pipeline project during construction are:

- Felling of trees in the ROW.
- Movement of labour and machinery such as cranes, welding machineries and transport vehicles, for trench making, welding and laying the pipes in the trench and hydro testing.
- Creation of ROW can lead to the invasion of exotic plants which may out-complete the natural vegetation.

Construction of Pipelines, GCSs, and FGSs will generate some direct and indirect employment opportunities to the local population, mainly for unskilled and semiskilled people. The local infrastructure will also have certain positive impact due to this project.

### **Environment Management Plan and Mitigation Measures:**

The EMP lists out all the measures not only for operational phase of the plant but also for construction phase and planning. Environmental problems that may arise during development phase will be mainly due to site preparation, civil construction and establishment of CGGS, GCS & FGS setup at site as well as construction of pipelines. Site preparation will involve filling, leveling and cleaning of location, during dry weather; it is necessary to reduce pollution due to dust emission by using dust suppression techniques. In order to ensure population safety the pipeline will be buried at appropriate depth as per OISD norms. A Supervisory Control and Data Acquisition (SCADA) system will be used to ensure protection of pipeline integrity. A leak detection system will be installed to quickly detect any leakage in the pipeline. This operation will be monitored and controlled from SCADA master control station. The pipeline shall be constructed as per ASME B 31.8 standard. The corrosion protection coating of the pipeline will be done at the plant itself and then transported to the ROW in order to avoid any potential impact on the environment. Welding shall be carried out as per API 1104. Hydro testing shall be done as per ASME B 31.8. The pipeline will be buried in the trench with an approximate cover of 1 meter from ground level.

The land use pattern particularly of agricultural land will be temporarily affected by the construction. However, the impact of pollution on the environment during construction phase is localized in nature and for a short period. In order to develop mitigation measures, specific activities related to impacts are sorted out during construction phase. The construction process for GCS, FGS and pipeline route will not be carried out during the rainy

season so as to avoid the problem of soil erosion. During the excavation the top 25 cm soil will be excavated and kept separately from the rest of the excavated soil. After laying pipeline, backfilling will be done by first using the soil from lower depth and then the topsoil will be replaced. This will minimize impact on soil productivity. Preferably construction activities shall be done to avoid cultivation period to the extent possible.

The effect of marginal increase in noise levels during the construction stage will be insignificant on nearby villages. However, it will be worthwhile providing noise protection device such as ear muffs and proper silencer systems for power generators and machineries. Horn' should be used or fitted as per M.V. Act.

Excavated soil will be placed along the ROW and will be used in covering the pipeline. After laying pipeline, backfilling will be done by first using soil from lower depth and then the topsoil will be replaced. This will minimize impact on soil productivity.

Construction of installations and laying of pipeline need to be done within a short span of time especially in area close to the wetland and vegetated area. Minimal vegetation clearance at the proposed installation site and ROW is recommended.

Green belt development is to provide a barrier between CGGS, GCS, FGS and surrounding areas. The green belt helps to capture the fugitive emission and attenuate the noise generated in the CGGS, GCS & FGS apart from improving the aesthetics. The internal roads should be planted with grass, shrubs or trees.

The tree species selected for greenbelt include native species like *Anthocephalus codomba* (Kodom), *Azadirachta indica* (Neem), *Ficus racemosa* (Jagya Dimaru), *Bambusa arundinacea* (Kotah Banh) etc. These trees should be planted in several rows as per availability of space. Based on the climate and soil characteristics around the proposed CGGS, GCS & FGS some species are recommended for plantation. The region is rain prone hence some fast growing species are recommended. Afforestation scheme may include the following programmes:

- i) Provide sapling to locals and the land owners; approximately ten times the number of uprooted trees, may be supplied to land owners to substitute the uprooted trees. A suitable incentive may also be offered to promote tree plantation.
- ii) OIL may undertake intensive tree planting programme in government lands along the new ROW of the pipelines.

Collaboration with the local Social Forestry division of the forest department should be done before undertaking plantation programme. A green belt with a combination of trees and shrubs would be developed in and around the permanent installations in the production facilities.

The green belt should be developed, starting from the 'Blue zone' as suggested in the 'consequence analysis of maximum credible loss scenarios' of the Risk Analysis chapter. It is evident from the Consequence analysis of the Risk assessment report for pipeline that different 'Radiation levels' have different 'Maximum impact distance'. Hence it is suggested that the green zone / safe zone should be developed beyond 150m (from the pipeline route) on both sides of the pipeline. However restricted greenery (gardens, small bushes etc.) can be developed at distance of 77-140m (from the pipeline route) on both sides of the pipeline.

Experts with experience in tropical / semi tropical area Green Belt Development will be consulted to design the green belt program with due care to the soil and water quality and the prevailing climatic conditions.

## **Risk Assessment**



- a) Present study for dispersion and consequence demonstrates that impact is limited to the battery limits of the proposed facilities. Such analyses should be carried out periodically especially when the process is modified, new equipments is introduced, and as communities grows.
- b) The study does not involve the risk from natural calamities and the bomb threat hazards. We recommend for geotechnical investigation to discover all natural hazards. These must be addressed in accordance with existing regulations.
- c) Corrosion refers to the degradation and/or breakdown of material due to chemical reaction. Higher rates of corrosion increase containment failure rates. A corrosion monitoring program which can predict corrosion rate, identify local corrosion etc. may be initiated.
- d) Many corrosion problems are related to the welding process. Welding cracking causes a large percentage of equipment and piping failures. The welding procedures should be well defined and included in material specification for fabrication and installation.
- e) Reliable measurement of pressure, temperature, flow and level as well as analysis for specific gases is critical for safe plant operations and it begins with proper installation of process measuring device. Thus, reliability and accuracy of the field instrumentation must be considered and carefully checked during installation.
- f) To reduce the failure rate of the pipeline within the boundary limit:
  - i. The pipeline shall be supported on appropriate supports and should be slightly above on the ground.
  - ii. Wherever required the expansion joints may be provided to take care of pipeline expansion due to thermal stresses.
  - iii. Wherever the pipeline crosses the roads through pipe bridges, adequate measure for impact guarding should be adopted.
  - iv. To reduce the probability of occurrence of an error, every pipeline carrying hazardous chemical shall be coded, marked for its content & direction of flow at conspicuous locations.
  - v. A visual inspection schedule for the pipelines may be prepared by the OIL. It will help us to check the problems like water logging at sub zero levels.
- g) To prevent the occurrence of domino effects, the distances between the two equipments (Vessels & tanks) should conform to recommendations of OISD-118.
- h) Ensure Installation of fire protection system as per OISD and/or TAC guidelines.
- i) It is recommended to prepare and implement procedures for maintenance so as to ensure the mechanical integrity and reliability of the equipment at the proposed facilities. It may involve establishment of a schedule for inspection and testing for the equipment associated at facilities under consideration.
- j) The hydrants/monitors/sprinklers along with the firewater pump and jockey pumps must have the schedule for their testing under normal operation conditions regularly. During fire drill the discharge of sprinkler/hydrant/ monitors at the farthest point from the firewater source should also be checked.
- k) To reduce the frequency of failure for emergency power supply, the DG sets must be tested on load periodically and during the fire drills to ensure that it will not fail while in demand.
- l) Management of change procedures as suggested by the various guidelines for safety management systems shall be followed strictly by every employee of the plant.
- m) Diking provides initial means of safely by containing the spill of hazardous materials. It is an effective means of reducing post release hazard. It is therefore recommended that the plant should take every care to keep dike facilities i.e. surface of dike, collection pit, drainage system, etc. always in good condition.

- n) Arrangements for hazards and risk management through awareness and training should also be communicated to workers (both companies and contractors) and officers.
- o) OIL should have PPE & other safety equipments required to deal with emergency situations. It is recommended that the person from response team who is going to use these equipments shall be given proper training and talked about their benefits and limitations. During the emergency rehearsals the functioning of the PPEs must be checked and recorded.

### **Emergency Planning –Onsite**

Oil has comprehensive on site and offsite emergency management plans. These plans should be extended to cover all the facilities under the proposed project. The plan should not only address to the major hazard in the works but it should also take care of whole range of activities of handling hazardous materials.

### **Emergency Planning-Offsite**

Continual up gradation of database as desired by the district administration for off-site emergency management planning should be ensured.

During the study, it was found that the societal risk for FGS Baghjan is in the tolerable regime. For risk mitigation, OIL management should ensure that the operations of hazardous processes are being carried out as per the planned safe operating procedures. The system for emergency preparedness and response should be developed and monitored regularly through regular mock drills. Schedules for preventive maintenance, testing and calibrations, etc. should also be on the top priority.

The development of key commercial places e.g. Schools, Hospitals Cinema halls, etc. should be permitted only outside the vulnerable zones. Hence the liaisoning and coordination should be made with district administration for sealing such types of developments in future. It is further recommended that plant management should formulate the risk reduction program as suggested here in this study and also an action plan for effective implementation of the developed risk reduction programme.

### **Proposed measure for Gas Pipeline Risk Reduction:**

- 1) Regular patrolling of the pipelines should be carried out especially when transfer operation is in progress. This will help in identifying any activity that have the potential to cause pipeline damage or to identify small leaks whose effects are too small to be detected by instruments.
- 2) Pipeline failures due to third party activity can be reduced by ensuring that the members of the public, surrounding population, and the district administration are aware of the pipeline.
- 3) The entire stretch of the underground pipeline is proposed to be cathodic protected. Regular readings of pipe to soil potentials should be taken to ensure that rapid corrosion is not taking place locally.
- 4) The unloading operation should be continuously manned and monitored.
- 5) At locations where the pipelines / pipe racks are close to traffic movement, adequate crash guards may be provided.
- 6) All unloading arms may be inspected by non-destructive testing methods annually. The pipelines should be subjected to hydro test.

### **General Health & Safety:**



- 1) Employees are required to use personal protective equipments.
- 2) Do not permit employees to work near electric wires unless the wires are fully insulated.
- 3) Remove from job any workers who is under the influence of alcohol or drugs or who is too sick (in a doctors opinion) to work.
- 4) Have workers wear eye protection while cutting out rivets, chipping or doing similar work. Keep adjacent area clear of personnel, or screen such operation.
- 5) General Protective Equipment.

Head Protection	Protective Headwear: Helmets with full brim, not less than 1 1/4 inches wide, Protective welding headwear.
Eye Protection	Welding Helmets, Goggles, Spectacles
Face Protection	Variety of Face shields protect the face and neck from flying particles sprays of hazardous liquids and hot solutions.
Hearing Protection	Use of PVC earplugs, foam earplugs, ear muffs, enclosure.
Respiratory Protection	Air –supplying respirators (provide clean breathing air), air purifying respirators [remove (filter) contaminants from the air], gas mask, half-mask, full-face piece.
Hand and Arm Protection	Use of gloves, hand leathers, arm protectors, impervious clothing
Foot Protection	Use of metatarsal footwear, conductive footwear, electric hazard footwear, static dissipative footwear, sole puncture resistant footwear, foundry footwear, cleaning rubber boots etc.
Body Protection	Use of leather clothing is one of the most common forms of body protection against heat and splashes of hot metal.

**Project Benefits:**

The proposed project will have many beneficial impacts.

- The proposed activities would generate indirect employment in the region during site preparation, supply of raw material, auxiliary and ancillary works;
- The commissioning of project would lead to improvement in transport facilities as loose or soft surface rural roads will be upgraded to facilitate movement of the supply vehicles.
- The proposed project after completion will lead to maximization of Natural gas production and utilization from Tengakhat-Nahorkatya-Jorajan, Tinsukia-Dhola & Dumduma-Pengri area of Oil India Limited and will result in all round prosperity of the region.