CHAPTER-7 : Additional Studies

7.1 Risk Assessment

M/s Sun Petrochemicals Private Limited (Sun Petro) Company is engaged in the business of Exploration and Production of Crude Oil and Natural Gas. The company holds mining lease for Modhera field in Gujarat for exploration and production under Production Sharing Contracts (PSC) signed with the Government of India.

PSC for Modhera field was transferred to Sun Petro on 10th Jun, 2016 by Ministry of Petroleum and Natural Gas (MoPNG), Government of India. Mining Lease for Modhera Field was transferred to SunPetro from Interlink Petroleum Limited (IPL) on 19th Aug, 2016 by State Government. Currently 2 wells are already present in the Mining Lease area of Modhera Field – M#1 & M#2; Modhera # 1 well in the field is currently producing the crude oil and is in testing phase.

The Modhera field, discovered in year 1982 by Oil & Natural Gas Corporation Ltd (ONGC), is situated about 30 km southwest of Mehsana city in Gujarat. The location of the field is on the western rising flank of Ahmedabad-Mehsana tectonic block of Cambay Basin. Modhera structure is an anticline having N-S axis. The reservoir sand is thinning towards east of the structure. Hydrocarbon entrapment in this field is mainly attributed to this structural feature. This field was awarded to Interlink Petroleum Limited (IPL) under production sharing contract (PSC) by Government of India for expeditious exploitation of hydrocarbon.

The Modhera Field is located in Mehsana district of Gujarat; 30 km southwest of Mehsana city in Gujarat The block is spread over an area of 12.7 sq. km. Nearest village Matresan is located on outer periphery of the block with most part of the village outside the block. SunPetro is planning for exploratory & development drilling of new wells in the field near the existing two wells. With the additional wells at Modhera Field, present crude oil and gas production is expected to increase which would contribute in the development of the country and also the local area.

S. No.	Parameter	Description
1.	Area	Modhera Field has a total Mining Lease of 12.7 Sq. KM
2.	Location	Modhera Field is located in the Mehsana District of Gujarat,
3.	Existing Capacity	Modhera Field has 2 wells currently. After new wells total capacity of 200 bbls/day is envisaged.
4.	Need of the Project	The Proposed new wells in the Modhera Field would increase the Crude Oil & Gas production of the region and create new opportunity for the locals.
5.	Power Supply & Source	DG sets of about 1250 KVA x 2 nos. will be used for drilling whereas electricity from State electricity board will be used for Group Well Head Installation.
6.	Site Connectivity	Modhera Field is well connected by Roads; Nearest railway station is Becharaji Station and is approx. 20 kms away. Nearest airport is in Ahmedabad city and is approx. 120 kms away.
7.	Existing Infrastructure	SunPetro currently has no permanent facility in place in the field.
8.	Alternative Site	No alternate site is considered as all operations are to be carried out in the Modhera Field area only. However, we have some flexibility to shift wells locations to few meters
9.	Raw material required	Drilling related material like HSD, Steel (in the form of casings) tubing and Chemicals like Baryte, Oil well cement and Bentonite would be required
10.	Land Form, Land use and land ownership	The land associated with producing wells is being acquired on Lease rental basis from the farmers. The land for the new wells may be acquired on lease basis.

S. No.	Parameter	Description
11.	Cost of the Project	INR 32 million per well
12.	Conclusion	SunPetro proposes to carry out drilling of new wells in future. Besides drilling of wells, Construction of Group Well Head Installation and facilities near to the new wells may also be planned, The monetization of Modhera Field would not only result in improved energy scenario for the country but will also generate opportunities for the local people and would help in the economic up-liftment of the region. The company will adopt all the measures through its Environment Management Plan and Disaster Management Plans to prevent harm and damage to environment (if any) due to production/drilling activities in the Modhera Field.

All the existing facilities of pumping station like fire fighting, electrical system, Pump house, Pipeline etc. would comply with national, international standards and M.B. Lal committee recommendations.

The facilities required for operation of the project, viz., pumping units with associated facilities have been planned to be steel structure. Other facilities like RCC civil structure have been planned to accommodate control panels, HT/LT panels, Batteries etc. All the safety factors like wind load, seismic load, soil bearing capacity etc have been taken into account while designing the civil structures.

This document is prepared by Mantec Consultants Pvt. Ltd. for Risk Assessment (RA) study for "Exploration And Development Of Drilling Wells In The Existing PML Area (PML 12.7 Sq.Km) Of Modhera Field, Mehsana, Gujarat" and to identify the key hazards and risks. By conducting this type of RA it should be emphasized that the focus is on the major, worst-case, hazards and impacts from surrounding area of these units, essentially in order to priorities the off-site risks and potential impacts to the public.

Project Description

The project envisages monetization of Modhera Oil & Gas field .The proposed wells in Modhera Field will be connected for production to Group Well Head Installation Facility (GWHI) very near to the wells. From GWHI, the Crude Oil will be transferred to the nearest ONGC processing facility (Sobhasan GGS – II) for treatment of the crude to be sold to Indian Oil Corporation limited (IOCL) or to small private buyers as per the PSC terms. SunPetro will sell the gas (if found economical after testing) in the local market. The various activities of the project are:

- Drilling of new wells in future.
- Construction of Group Well Head Installation

Flow diagram showcasing the steps involved from drilling of wells to putting the wells on production is as below:

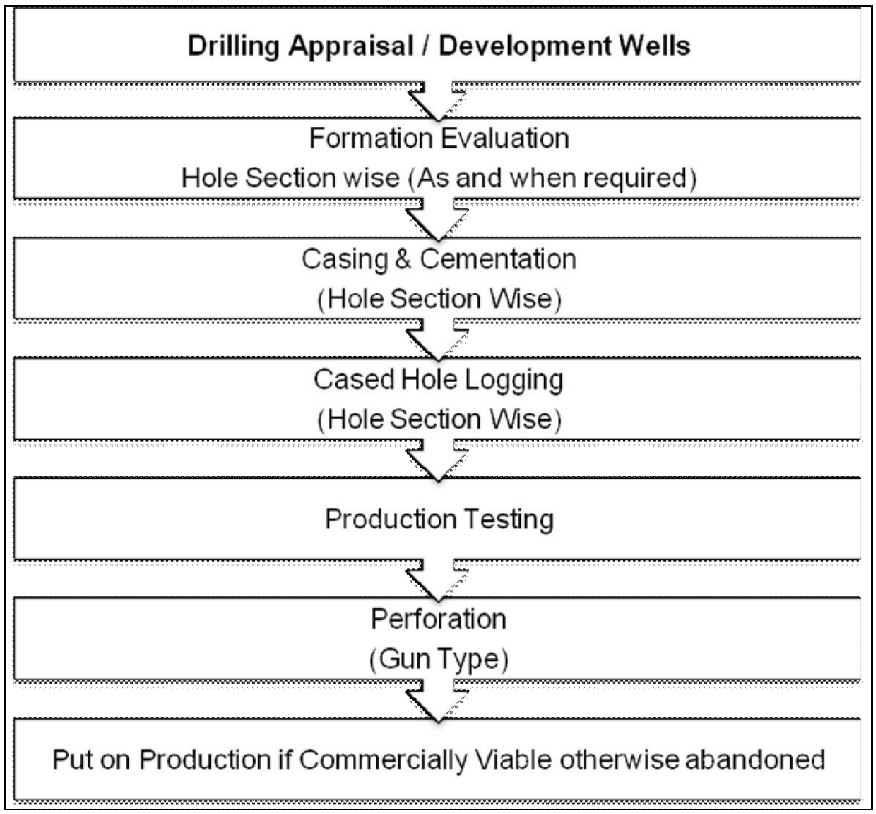


Figure 7.1: Drilling Process Description

7.1.1 Consequence Analysis

Consequence analysis involves the application of the mathematical, analytical and computer models (PHAST software) for calculation of the effects and damages subsequent to a hydrocarbon/toxic release accident.

Process **H**azard **A**nalysis **S**oftware **T**ool (**PHAST**) Software is used to predict the physical behavior of hazardous incidents. The model uses below mentioned techniques to assess the consequences of identified scenarios:

- Modeling of discharge rates when holes develop in process equipment/pipe work.
- Modeling of the size & shape of the flammable gas clouds from releases in the atmosphere.
- Modeling of the flame and radiation field of the releases that are ignited and burn as pool fire, jet fire, Overpressure (Blast Force) and flash fire.
- Modeling of the explosion fields of releases, which are ignited away from the point of release.

7.1.2 Blowouts during Drilling / Testing Operations

Blowout is one of the major risks in exploration of Oil at any drilling location. Holland (1996, 1997) gives a breakdown of blowouts according to the individual operations in which they occurred. Scand power (1995) summarised this data into the following major categories of operations:

- Drilling, i.e. the period when the bit is on the bottom
- Tripping, including time when the drill string is running into the hole (RIH), pulling out of the hole (POOH) and held out of the hole
- Running casing, including time when casing is being run, waiting for cement to harden, and pressure-testing the casing
- Other, including installing the BOP (nipple-up/nipple-down), milling, wire line lagging, waiting on weather etc.

These categories were further sub-divided into two phases:

- Prior to installing BOP, i.e. drilling the top hole
- After the BOP is installed

7.1.3 Causes of Drilling Blowouts

Well control can be lost as a result of:

- Formation fluid entry into the well bore;
- Loss of containment due to mal-operation (e.g. during wire lining); and
- Wellhead damage (e.g. by fires, storms, dropped objects, etc).

7.1.4 Causes of Production Blowouts

Blowouts during production are commonly caused by well interventions such as workovers, wire lining, snubbing and coiled tubing operations, although some production blowouts are initiated by the well equipment in normal operation.

Blowouts due to External Causes

Possible external causes of blowouts include:

- Escalation from process fire
- Structural collapse
- Military or pirate attacks

These should not be included in the analysis of blowouts if they are separately modelled under the other hazard categories. However, for simple studies that do not model such escalations in full, it is appropriate to include them as blowouts.

7.1.5 Risk Criteria

Individual risks are the key measure of risk acceptability for this type of study, where it is proposed that:

Risks to the public can be considered to be broadly acceptable (or negligible) if below 10^{-6} per year (one in 1 million people per year). Although risks of up to 10^{-4} per year (1 in 10,000 people per year) may be considered acceptable *if* shown to be **A**s **L**ow **A**s **R**easonably **P**racticable (**ALARP**), since in India no any standard has been set, it is recommended that 10^{-5} per year (1 in 100,000 people per year) is adopted for this study as the maximum tolerable criterion.

Risks to workers can be considered to be broadly acceptable (or negligible) if below 10^{-5} per year and where risks of below 10^{-3} per year (1 in 1000 per year) may be considered acceptable if in **ALARP**.

7.1.5.1 Location specific individual risk (LSIR)

The Location specific individual risk (LSIR) is risk to a person who is standing at that point 365 days a year and 24 hours a day.

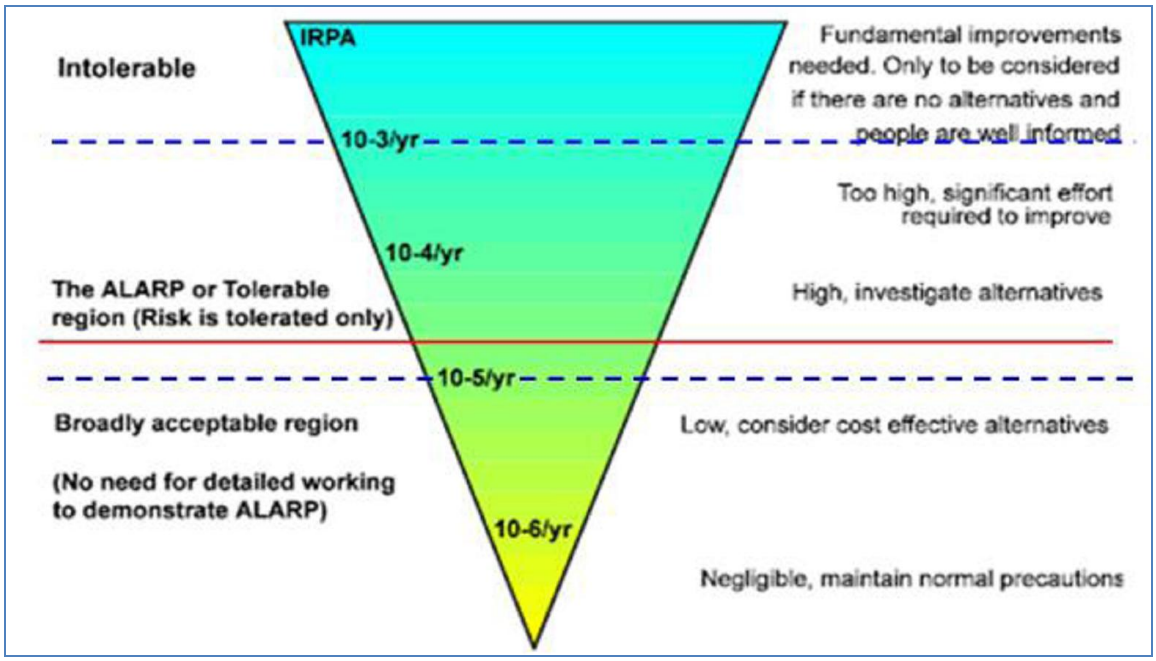
7.1.5.2 Individual risk to worker (ISIR)

The personnel in respective terminals are expected to work 8 hour shift as well as general shift. The actual risk to a person i.e. "Individual Specific Individual Risk (ISIR)" would be far less after accounting for the time fraction a person is expected to spend at a location.

$ISIR_{Area} = LSIR \times (8/24)_{(8\ hours\ shift)} \times$ (Time spent by and individual/8 hours)

ALARP summary & comparison of Individual risk with acceptability criteria

The objective of this RA study is to assess the risk levels of the project with reference to the defined risk acceptability criteria and recommend measures to reduce the risk level to **A**s **L**ow **A**s **R**easonably **P**racticable (**ALARP**).



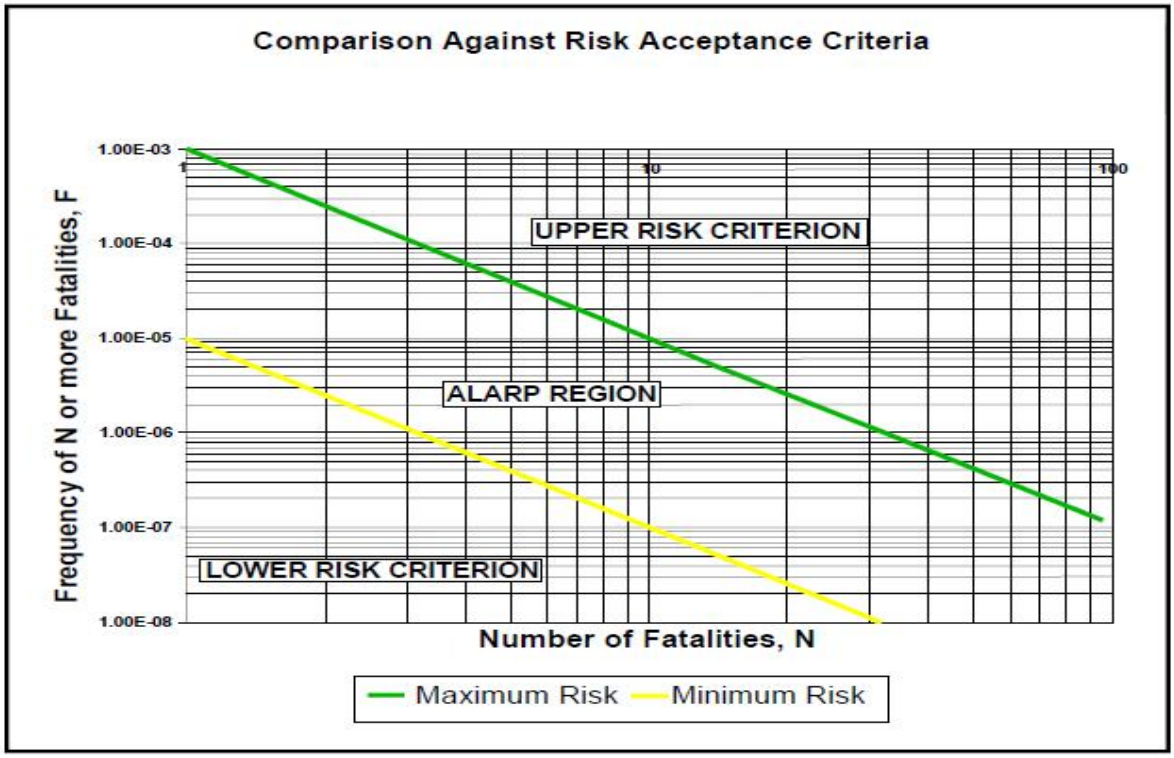
7.1.5.3 Societal Risk

It is the risk experience in a given time period by the whole group of personnel exposed, reflecting the severity of the hazard and the number of people in proximity to it. It is defined as the relationship between the frequency and the number of people suffering a given level of harm (normally taken to refer to risk of death) from the realization of the specified hazards. It is expressed in the form of F-N curve.

Societal risk acceptability criteria

A formal risk criterion is used at all for societal risk; the criterion most commonly used is the F-N curve. Like other forms of risk criterion, the F-N curve may be cast in the form of a single criterion curve or of two criterion curves dividing the space in to three regions – where

the risk is unacceptable, where it is negligible and where it requires further assessment. The latter approach corresponds to application to societal risk of the ALARP principle. Risk criteria for the Netherlands have been considered for the present study. F-N curve of the station is represented in **Figure** below-



Societal risk criteria are also proposed, although these should be used as guidance only. A criterion of 10^{-4} per year is recommended for determining design accidental loads for on-site buildings, i.e. buildings should be designed against the fire and explosion loads that occur with a frequency of 1 in 10,000 people per years.

7.1.5.4 Top risk contributors (Group Risk)

The present major contributing scenarios to societal risk from station/terminal are within the ALARP region.

7.1.6 Conclusions and Recommendations

Although the results of this Risk analysis show that the risks to the public are within the **ALARP** region, they will be sensitive to the specific design and/or modeling assumptions used.

The major conclusions and recommendations based on the risk analysis of the identified representative failure scenarios are summarized below:

- The drilling points & borehole are to be covered as per the prevailing practive of safety management system of Oil Industries.
- It is necessary to provide extensive fire detection system as per OISD guidelines. Operators should be well trained about the fire and gas detection system.
- It is recommended to have necessary provision for emergency stop of critical equipments from control room (during commissioning) in the event of major leak/flash fire.
- The vehicles entering the station should be fitted with spark arrestors.
- Routine checks are to be done to ensure and prevent the presence of ignition sources in the immediate vicinity of the flammable material (near boundaries).
- Clearly defined escape routes shall be developed for each individual plots and section of the drilling area taking into account the impairment of escape by hazardous releases and sign boards be erected in places to guide personnel in case of an emergency.
- Windsocks shall be considered at the site to ensure visibility from all directions. This *will assist people to escape in upwind or cross wind direction from flammable releases.*
- In order to further, reduce the probability of failure of catastrophic rupture and equipments, critical equipments shall be identified and inspection methodologies to be finalized for continuous monitoring during operation and shutdown maintenance.
- The active protection devices like firewater hydrant, water monitor and other protective devices shall be tested at regular intervals.
- There should be an SOP established for clarity of actions to be taken in case (during drilling and production) of fire/leak emergency.

7.1.7 General Recommendations

1. Ensure that combustible flammable material is not placed near the Critical instrument at the site. These could include oil filled cloth, wooden supports, oil buckets etc. these must be put away and the areas kept permanently clean and free from any combustibles.

Secondary fires probability would be greatly reduced because of these simple but effective measures.

2. Hydrocarbon detectors should be provided at every drilling point.
3. Proper lighting arrangements and CCTV should be provided at drilling points for new facilities inside the drilling site.

7.2 Corporate Social Responsibility (CSR)

Corporate Social Responsibility (CSR) is a Strategic Business Management concept through which a company integrates social & environmental concerns in their business operations and can achieve a balance of economic, environmental & social imperatives. Furthermore, at the same time attends to the expectations of shareholders & stakeholders. Through it the company can make valuable contribution to poverty reduction. The CSR refers to responsibility of a company to ensure positive impact on environment, consumers, employees, communities, stakeholders and all other members of public sphere. In India, it is comparatively a new but rising concept and the companies are going through the learning curve. The CSR activities are increasingly being taken up by the project proponents not only as fulfilling of mandatory provisions but also for formation and enhancement of brand image. Besides all, CSR is seen more as a responsibility towards society rather than a business philosophy. It is the need of the time for expansion of occupational welfare. Keeping in mind these codes of belief, we have identified some activities which may propose to undertake for the benefits of the people living in the study area. This will not only improve the socio-economic status of the people but also enhance the reputation of the project proponent among the community. The following activities are proposed to be taken up for the benefits of the local community:

1) Providing employment opportunities.
2) Vocational training for skill development to the local youth.
3) Educational scholarships and study materials to the meritorious students belonging to BPL.
4) Providing drinking water facilities to nearby schools.
5) Providing medical assistance/medicines to the local people.