Rapid Risk Assessment Report for Pipeline from Jetty to BPCL Coastal Installation at Haldia.

M/s Bharat Petroleum Corporation Limited

at
Patikhali, Haldia
Purba Midnapur district
West Bengal.

Submitted by

Bharat Petroleum

Prepared by

ABC Techno Labs®
India Private Limited
(Accredited by NABL, NABET, MOEF)
(An ISO : 9001, ISO : 14001 & OHSAS : 18001 Certified Company)

PROJECT DETAILS

Name of Publication	***Rapid Risk Assessment Report for the Proposed pipeline from Jetty3 to BPCL Coastal Installation at Purba Medinipur in Haldia of West Bengal.***

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CONTENTS

CHAPTER 1

INTRODUCTION

CHAPTER 1: INTRODUCTION

1.1 PREAMBLE

Bharat Petroleum Corporation Limited (BPCL), the project proponent, is the highest ranked Indian public sector company in the prestigious Fortune 'Global 500' listing, having 242nd position in 2014. BPCL is engaged in refining and marketing of petroleum products. The company is India's one of the largest commercial enterprises.

BPCL and its subsidiaries account for a 25% share in the petroleum products market, 31% share in refining capacity and 27% downstream sector pipelines capacity in India. The BPCL Group of companies owns and operates 4 of India's 22 refineries with a combined refining capacity of over 34 Million metric tonnes per year. BPCL has recorded outstanding results in all the facets of business for the year 2013-2014. Both in Refining and Marketing excellent results have been delivered which have contributed to the Company achieving the highest ever net Profit till date of Rs. 4060.88 Crores surpassing the previous year's record of Rs. 2642.90 Crores.

The location of proposed Pipeline on google satellite image and surrounding area is shown in Figure 1.1.

M/s ABC Techno Labs India Private Limited (ABC Techno Labs) has been engaged by M/s BPCL to carry out Rapid Risk Assessment (RRA) for the proposed project. This report contains the Rapid Risk assessment (RRA) for the BPCL pipelines project in Haldia.

Google Image of the proposed pipeline from Jetty to M/s BPCL at Haldia,Purba Medinipur, West Bengal

Figure 1.1: Location of Proposed Pipeline

1.2 SCOPE FOR RRA AS SPECIFIED BY BPCL

M/s BPCL has defined the following scope of work for carrying out rapid risk assessment (RRA) for proposed Pipeline.

Hazard analysis (HAZAN) and Risk Assessment:

i. Identification of major fire, explosion and other hazards.

ii. Assessment of consequences of worst-case and most credible accident scenarios on human life, property and environment in terms of radiation, BLEVE, blast waves, dispersion and study the impacts from cascade effects.

iii. Plotting of damage contours.

iv. Evaluation of the damage/ vulnerable zones/risk qualitative within and outside the proposed pipeline.

v. Suggestions and measures to eliminate control or minimize the occurrence of fire and explosion and other hazardous situations.

1.3 OBJECTIVES OF RRA

Rapid Risk Assessment will be carried out Petroleum product (MS/HSD) transfer facilities to assess the consequence of the complete range of potential hazards associated with the proposed facility. Broadly, Rapid Risk Assessment will cover the following aspects comprehensively:

- Identification of hazards associated with pipeline operations
- Generation of release scenarios for escape of combustible substances along the pipeline route
- Estimation of damage distances for the accidental release based on different scenarios

- Estimation of probability of occurrence of hazardous event through event tree analysis
- The risk to personnel is to be expressed in terms of Individual Risk (IR) represented by Risk Transects and group risk/societal risk represented by F-N curves.
- Finally, RRA shall demonstrate that the risk tolerability criteria have been met.
- The extent of study is to perform a RRA for calculating numerical individual, environmental, employee, and public risk level values for comparison with regulatory risk criteria and also to assess the potential risks associated with the operation of the proposed project. Therefore, RRA shall consider the risk to personnel from all major risk contributors.
- Suggestions of risk mitigation measures.

1.4 APPROACH & METHODOLOGY FOR RISK ASSESSMENT

The approach and methodology by ABC Techno Labs followed for the RRA study are described hereunder:

❑ System Description

The first step of the RRA is the definition of the project limits, where the potential hazards are associated with the transfer Pipeline. Information about pipeline design and operating conditions will be described under system description required for the risk analysis. It includes site location, environs, weather data, layout drawing, operating and maintenance procedures, and thermo physical property data, etc.

❑ Identification of Hazards Analysis

Various possible hazards will be identified during transfer of Petroleum products (MS/ HSD). The release sources and potential accidents scenarios associated with

each hazards will be listed. For each selected release sources, several scenarios may be possible depending upon the failure mode causing loss of containment. The criteria used for selection of scenarios for the consequence analysis will be the Maximum Credible Accidental (MCA) scenarios.

- **Effects & Consequence Estimation**

Effects & consequence distance estimation will be performed to determine the potential for damage or injury from the selected scenarios. The incident outcomes will be analyzed using release rates, heat radiation and explosion models from fire and explosion. Damage distance computation will be based on jet fire, flash fire, and late ignition, as applicable.

- **Failure Frequency Analysis**

Failure frequency analysis will be done for valve, flange and piping, etc. Standard international database will be referred for estimation of probabilities.

Failure rate data is essentially derived from internationally well known generic databases. The generic failure data base selected for calculating the failure frequencies and the values in the database are used to reflect the mechanical and process design of the pipeline and process facilities

- **Risk Summation**

Risk quantification and summation will be based on probabilities from standard international database. The risk to personnel will be expressed in terms of Individual Risk (IR) represented by Iso Risk Contours and Group Risk/Societal risk represented by F-N Curves based on risk tolerability criteria.

- **Risk Mitigation Measures**

Based on consequence analysis and risk summation findings, risk mitigation measures will be suggested in view of applicable standards, guidelines and best practices to reduce risk and enhance safety.

1.5 FORMAT OF RRA REPORT

Rapid risk analysis report has been organized in the following chapters. A brief description of each Chapter is presented below:

Chapter 1: Introduction

Chapter 2: Project Description

Chapter 3: Hazard Analysis

Chapter 4: Effect and Consequence Analysis

Chapter 5: Frequency Analysis

Chapter 6: DMP

Chapter 7: Conclusion and Recommendation

CHAPTER 2

PROJECT DESCRIPTION

CHAPTER 2: PROJECT DESCRIPTION

2.1 INTRODUCTION

Bharat Petroleum Corporation Limited (BPCL) has planned to lay 24" dia pipeline, approx. 9 km. long from takeoff to terminal point of BPCL - Patikhali, Haldia

BPCL in their long-term strategic goal of playing as a key partner in refining, transportation and distribution of Petroleum products have come up with a plan for production enhancement, transportation and distribution of Petroleum products from Haldia Jetty-3 to BPCL's Installation at Haldia in West Bengal through close loop pipe line system for connecting to existing installation plants. For this BPCL intend to lay 24" dia pipeline, approx. 9 km. long from takeoff to terminal point of BPCL - Patikhali, Haldia.

- **Location**

Haldia Jetty-3 to BPCL's Installation. The project is located between 22°0'57.00"N latitude & 88°4'9.59"E longitude and 22°3'22.11"N latitude & 88°8'14.88"E longitude.

- **Land requirement**

Laying of Underground pipeline is proposed on undeveloped land acquired by Haldia Dock Complex. Land is a lease area from KOPT.

- **Water requirement & source**

One time 2500 KL water is required for Hydro testing of pipeline. The water shall be sourced from HDC/HAD.

- **Air pollution control**

Fugitive dust shall be the main air pollutant, from the small diesel engines used for the construction works & movement of vehicles for which dust suppression system will be installed at relevant points.

- **Solid Waste Management**

Reusable solid wastes will be sold periodically and non-reusable wastes will be used for land filling purposes in the dock premises or will be disposed off site in consultation with the concerned Civic body.

Hazardous wastes will be stored separately in a secured enclosure and would be transported to the Treatment, Storage & Disposal facility (TSDF) at Haldia. Oily waste & metal scrap water will be handed over to registered re-refiners /recyclers having approval of MoEF&CC. During operational phase no such solid waste will be generated.

- **Manpower**

50 persons/day (engaged during construction temporarily.)

2.2 PIPELINE ROUTE CONSIDERED

The length of the proposed pipeline project is 9.00 km. Originating from the HOJ3 the route follows the existing BPCL corridor destine to POL Terminal safely off the right side of the approach road from HOJ3 while proceeding towards Jawahar Tower junction on the north and deflects in easterly north direction along central workshop and Garage road up to 1.3 km and orients southerly east side follows the Haldia township-and port road continues up to chainage 1484m and crosses Turning water basin about 700m width water depth maximum 11m then deflects eastern direction up to 2739 m chainage arrives at the spot of road on bund of Hooghly river on the

right bank .This portion of the route dodged passed the main built up system of HDC. After this the route follows the western side of the bund road keeping itself free from various pipelines already installed. There is space constraints and low lying area in patches observed along this route. Some pipelines are buried, a few are exposed and others are on trestle structures as suits. Several water ways flowing towards river causing construction of bridge slab structures etc. The route has maintained independent positions up to BPCL terminal at Patikhali.

2.3 PROJECT DETAILS

Originating from the HOJ3 the route follows the existing BPCL corridor destine to POL Terminal safely off the right side of the approach road from HOJ3 while proceeding towards Jawahar Tower junction on the north and deflects in easterly north direction along central workshop and Garage road up to 1.3 km and orients southerly east side follows the Haldia township-and port road continues up to chainage 1484 m and crosses Turning water basin about 700 m width water depth maximum 11m then deflects eastern direction up to 2739 m chainage arrives at the spot of road on bund of Hooghly river on the right bank .This portion of the route dodged passed the main built up system of HDC .After this the route follows the western side of the bund road keeping itself free from various pipelines already installed. There is space constraints and low lying area in patches observed along this route. Some pipelines are buried, a few are exposed and others are on trestle structures as suits. Several water ways flowing towards river causing construction of bridge slab structures etc. The route has maintained independent positions up to BPCL terminal at Patikhali. Existing pipelines crosses the bund road, canal and water body over steel structures constructed for this purpose.

2.3.1 Dispatch Terminal at Haldia

This jetty (HOJ-3) is set up in the year of 2000 on the right bank of Hooghly River just downstream off other two jetties (HOJ-2 & HOJ-3). The Draft here is maximum 8 m and minimum of 7m amongst all three oil jetties. The occupancy of this jetty is about 45%.

The limitation of draft and silting problem in Hooghly River bed, bigger ships cannot berth in HOJ-2. Moreover the HOJ-2 berth occupancy is 85% causing detention/delay thus stagnation. Haldia is a rescue location for Eastern Region with TW loading facility and BPCL need the port and jetty facilities to sustain their business interest.

Considering the above BPCL planned to lay MS/HSD pipelines of approx. 9 km length from HOJ-3 to their installation at Patikhali.

In this connection BPCL, A Government of India enterprises propose to construct pipeline for transporting the imported petroleum products to their existing terminal at Patikhali, Haldia, in the district of Purba Midnapur in the state of West Bengal.

2.3.2 Pipeline

- BPCL has two dedicated pipeline from HOJ-1 to Installation. These are 24" Dia black oil and 16" Dia MS BS III (We also have 16" pipe earlier laid as Naphtha later on converted to MS BS IV).
- BPCL has planned to lay MS/HSD pipelines of appox 9 km length from HOJ-3 to their installation at Patikhali at Haldia, West Bengal. The transportation capacity will be 1.3 MMTPA.
- The direction of flow of the proposed route from Haldia Oil Jetty 3 to BPCL installation at Patikhali with the objective that the new pipeline to be laid entirely

in the acquired area owned by Port authority of Haldia. Schematic diagram of pipeline is shown in Annexure.

2.3.3 Receipt Terminal at Patikhali

Receipt terminating location is inside BPCL installation at Patikhali.

2.3.4 Pipeline Design

Following design parameters have been considered for the study: -

- Total length of Pipeline: 9 km
- Product handled: petroleum products (BSIII MS, HSD),
- Fluid Temperature: 15-30°C
- Flow Rate: 2200 KL/Hr,
- Operating pressure 10kg/Cm2
- Design pressure 49 kg/cm2
- 3LPE pipeline coating
- Design Life - 25 Years
- Guiding Standard - OISD 141
- Design Standard-ASME B31.4
- Pipeline Material of Construction: Carbon Steel Pipeline,
- Corrosion Allowance: 0.5mm,
- Diameter of Pipeline to be considered: 24”,
- NB External Coating: 3layer PE,
- PipelineLaying: Buried

Raw Material required along with estimated quantity, likely sources, marketing area of final product, mode of transport of raw material and finished product.

- Raw Material: MS, HSD. Total 1.3 MMTPA will be handaled.
- Mode of transport of raw materials: MS, HSD through pipelien.

- Finished product mode of transport, marketing area: POL (MS/HSD) to be transported to Patikhali, Haldia, in the district of Purba Midnapur in the state of West Bengal.

Resource Optimization Envisaged

Availability of water, its source, Energy/ Power requirement and source

- One time 2500 KL water is required for Hydro testing of pipeline. The water shall be sourced from HDC/HAD.
- During the construction Phase, the diesel (HSD) requirement estimated at 90 KL over the period of 8 months.

Quantity of waste to be generated (liquid and solid) & Scheme for their disposal

- No effluent and waste water will be generated.
- No Hazardous wastes since transportation of finish petroleum product (MS, HSD) will be done through close loop pipe line system
- No Municipal waste (domestic and or commercial wastes) will be generated.

2.4 METEOROLOGICAL DATA

The climate of the district is tropical with hot and dry summer and pleasant winter. The summer season extends from March to the middle of June followed by the rainy season from June to September.

2.4.1 METEOROLOGICAL CONDITIONS IN PROJECT AREA

The meteorological and climatological data collected from India Meteorological Department (IMD) from Secondary Sources: PURBA MIDNAPUR DISTRICT has been considered for the study.

PURBA MIDNAPUR DISTRICT	
Average Maximum Temperature	**Average Minimum Temperature**
Summer34°C (max) to 19°C (min)	Winter22.7°C (max) to 9°C (min)

The stability class at a particular location is generally dependent upon: Time (Day or Night), Cloud Cover, Season and Wind Speed

The following stability class and with wind speed combinations have been considered for the calculation purpose:

Stability Class D and Wind Speed 5 m/s during day and night time (D – 5 m/s) and

Stability Class F and Wind Speed 1.5 m/s during night time (F – 1.5 m/s).

CHAPTER 3

HAZARD ANALYSIS

CHAPTER 3: HAZARD ANALYSIS

3.1 INTRODUCTION

The Rapid Risk Analysis (RRA) is carried out using the renowned DNV software Phast version 6.7.

The following input data are required for the risk calculation:

- Process data for release scenarios (material, inventory, pressure, temperature, type of release, leak size, location, etc.)
- Estimated frequency of each failure case
- Distribution of wind speed and direction (wind rose data).
- Distribution of personnel/ population in the plant/ adjoining area during the day and night time.
- Ignition sources

Failure frequencies are estimated using generic failure databases published by organizations such as UK Onshore Operator's Association (UKOPA).

UK Onshore Operator's Association (UKOPA) 1962-2012. It presents collaborative pipeline and product loss incident data from onshore Major Accident Hazard Pipelines (MAHPs) operated by National Grid, Scotia Gas Network, Wales & West Utilities, Shell UK, BP, Huntsman and E-ON UK, covering operating experience up to the end of 2012. The overall failure frequency over the period 1962 to 2012 is 0.227 incidents per 1000 Km/year. (Ref. UKOPA Report No UKOPA/13/0047 issued December 2013).

The failure frequency over the last 20 years is 0.080 incidents per 1000 km. year. For the last 5 years the failure frequency is 0.122 incidents per 1000 km. year, whilst in the previous report this figure was 0.108 incidents per 1000 km. year (covering the 5 year period up to the end of 2011).

3.2 SELECTION OF FAILURE FREQUENCY DATABASE

UKOPA database is selected for this QRA study. It has by far the greatest detail, and enables great flexibility of analysis because of failure distribution with reference to causes. It gives the details in a format readily used in QRA.

The database is designed to reflect the ways in which the UKOPA operators design, build, operate, inspect and maintain their pipeline systems. Although the pipeline and failure data are extensive, there are pipeline groups (e.g. large diameter, recently constructed pipelines) on which no failures have occurred; however, it is unreasonable to assume that the failure frequency for these pipelines is zero. Similarly, further pipeline groups exist for which the historical failure data are not statistically significant.

UKOPA database contains extensive data on pipeline failures and on part-wall damage, allowing prediction of failure frequencies for pipelines for which inadequate failure data exist.

For these reasons, it was chosen as the main source of failure information for this study

3.3 FAILURE DATA ANALYSIS

The total length of Major Accident Hazard Pipelines, above ground, below ground and elevated, in operation at the end of 2012 for all participating companies (National Grid, Scotia Gas Network, Northern Gas Network, Wales and West Utilities, BP, Shell UK, Huntsman and E-ON UK) is 22,113 km. The total exposure in the period 1952 to the end of 2012 is about 8, 32,775 km.yr.

3.4 TRANSPORTED PRODUCTS

The lengths of pipeline in operation at the end of 2012, by transported product, are shown in Table below.

Table 3.1: Transported Products in Pipelines (km)

Natural Gas (Dry)	20,344	Propylene	38.0
Ethylene	1,140	Condensate	24.0
Natural Gas	251	Propane	20.0
Crude Oil (Spiked)	224	Butane	20.0
Hydrogen	14	TOTAL	22,113

3.5 IGNITION

There were 9 out of 189 (~5%) product loss incidents that resulted in ignition. Table below provides more detail:

Table 3.2: Incidents that resulted in Ignition

Affected	Cause Of Fault	Hole Diameter Class
Pipe	Seam Weld Defect Ground Movement	0-6 mm Full Bore and Above (18" Diameter Pipe)
Pipe	Girth Weld Defect	6-20 mm
Pipe	Unknown	6-20 mm
Pipe	Pipe Defect	0 – 6 mm
Pipe	Unknown	40 – 110 mm
Pipe	Lightning Strike	0-6 mm
Bend	Internal Corrosion	0-6 mm
Bend	Pipe Defect	6-20 mm

The overall ignition probability in the present analysis has therefore been taken as 0.05.

The overall incident frequency by hole size over the period 1962 - 2012 is shown in Table below

Table 3.3: Failure Frequency distribution by hole size

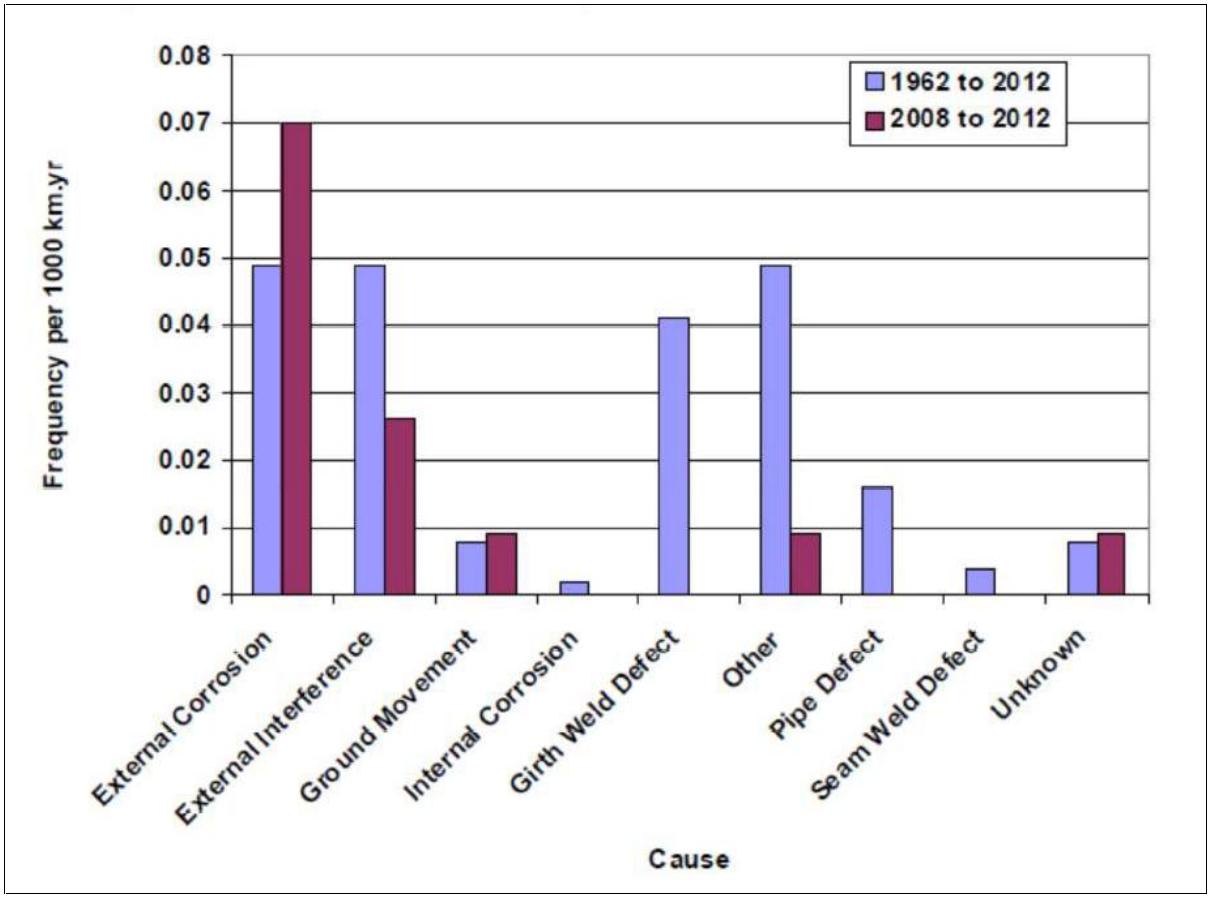
Hole Size Class	Number of Incidents	Frequency [Incidents per 1000 km.yr]
Full Bore* and Above	7	0.008
110mm – Full Bore*	3	0.004
40mm – 110mm	7	0.008
20mm – 40mm	23	0.028
6mm – 20mm	31	0.037
0 – 6mm	116	0.139
Unknown	2	0.002
Total	189	0.227

3.6 INCIDENT FREQUENCY BY CAUSE

Table 3.4: Products loss Incidents by Cause

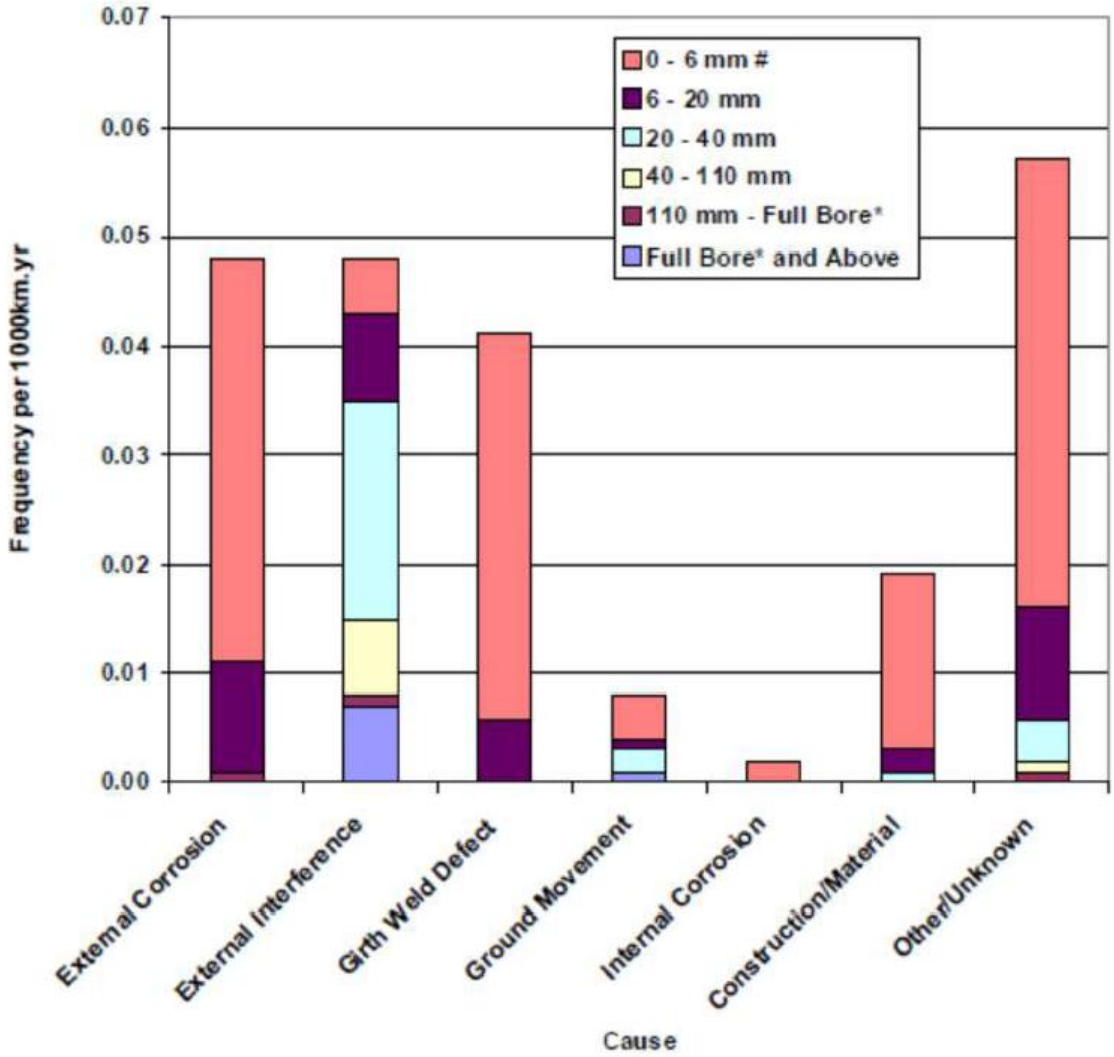
Product Loss Cause	No. of Incidents
Girth Weld Defect	34
External Interference	41
Internal Corrosion	2
External Corrosion	41
Unknown	7
Other	41
Pipe Defect	13
Ground Movement	7
Seam Weld Defect	3
Total	189

Figure 3.1: Products Loss Incidents by Cause - Historical



An overview of the product loss incident frequency by cause and size of leak in the period 1962 to 2012 is shown in Figure below. Figure below shows the product loss incident frequencies associated with external interference by diameter class and by hole size

Figure 3.2: Products Loss Incidents by Cause & Leak Size



Full Bore = diameter of pipeline

Equivalent hole diameter is the circular hole diameter in mm with an area equivalent to the observed (usually non-circular) hole size

3.7 EXTERNAL INTERFERENCE

External Interference by Diameter Class

Figure 3.3: Products Loss Incidents by External Interference – Diameter Class

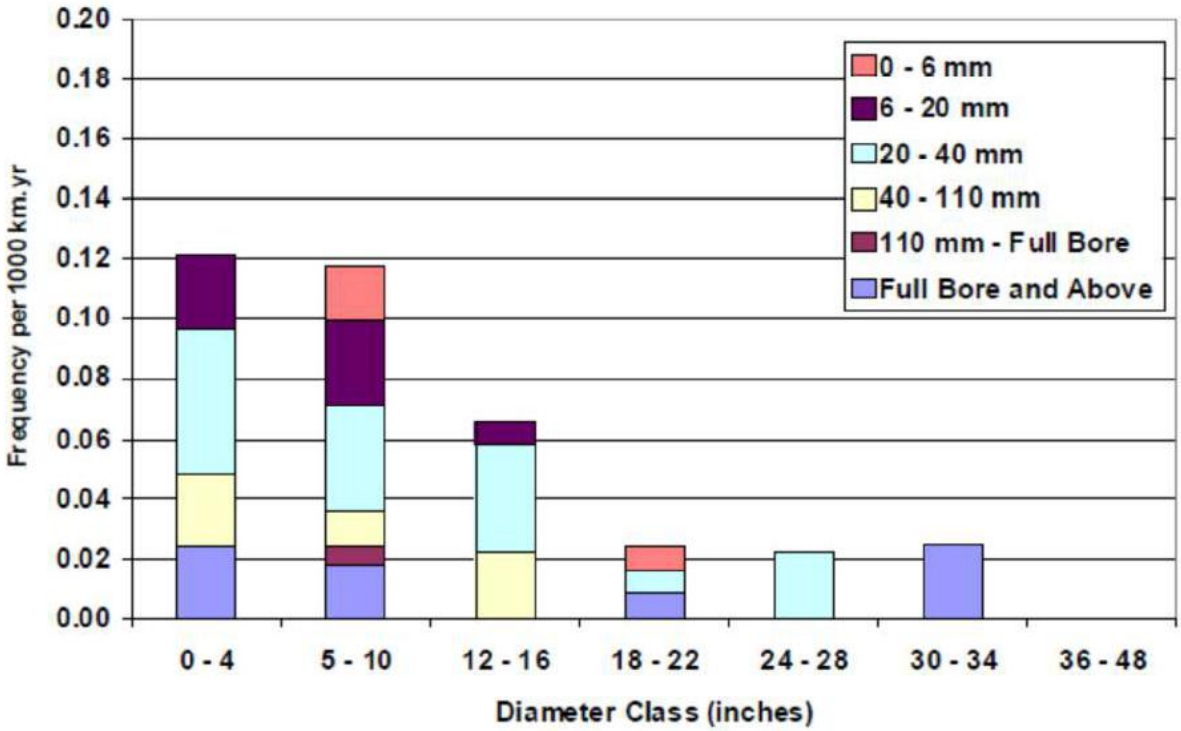


Table 3.5: Exposure by Diameter Class

Diameter	Exposure	Incidents	Frequency/1000km.yr
0-4	41098	5	0.122
5-10	170268	20	0.117
12-16	138055	9	0.065
18-22	121019	3	0.025
24-28	134607	3	0.022
30-34	39945	1	0.025
36-48	186783	0	0.000
Total	832775	41	0.049

3.8 External Interference by Measured Wall Thickness Class

The relationship between product loss incidents caused by third party interference and wall thickness is shown in Figure below.

Figure 3.4: Products Loss Incidents by External Interference - Wall Thickness Class

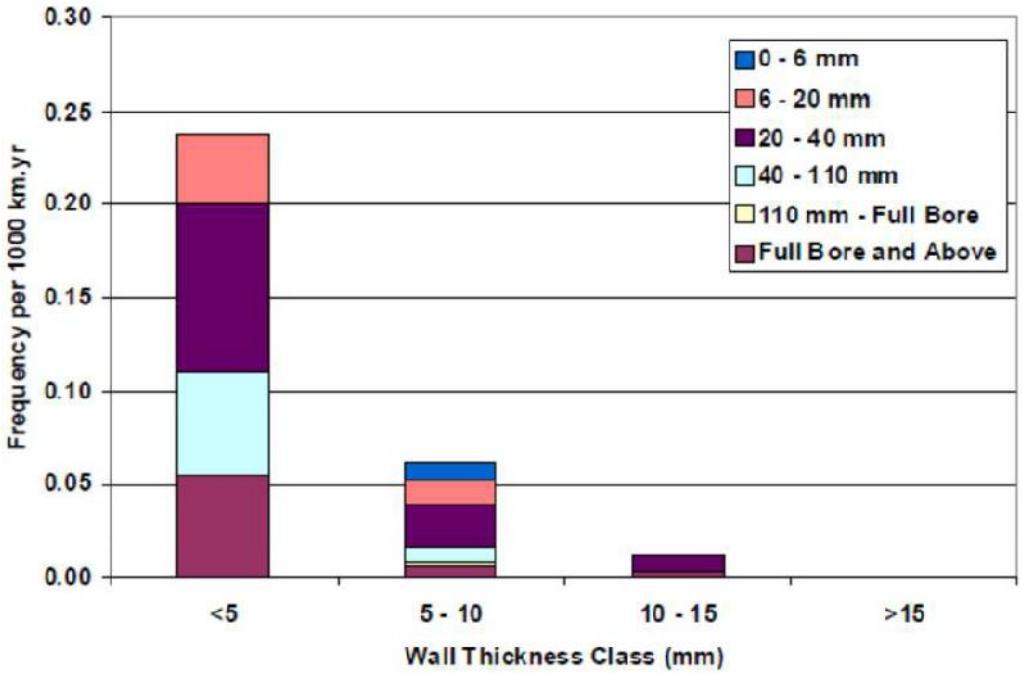


Table 3.6: Exposure by Wall Thickness Class

Wall Thickness	Exposure km.yr	Incidents	Frequency/1000 km.yr
<5	54775	13	0.237
5-10	392241	24	0.061
10-15	318941	4	0.013
>15	66818	0	0.000
Total	832775	41	0.049

3.9 External Interference by Area Classification

Figure 3.5: Products Loss Incidents by External Interference – Area Classification

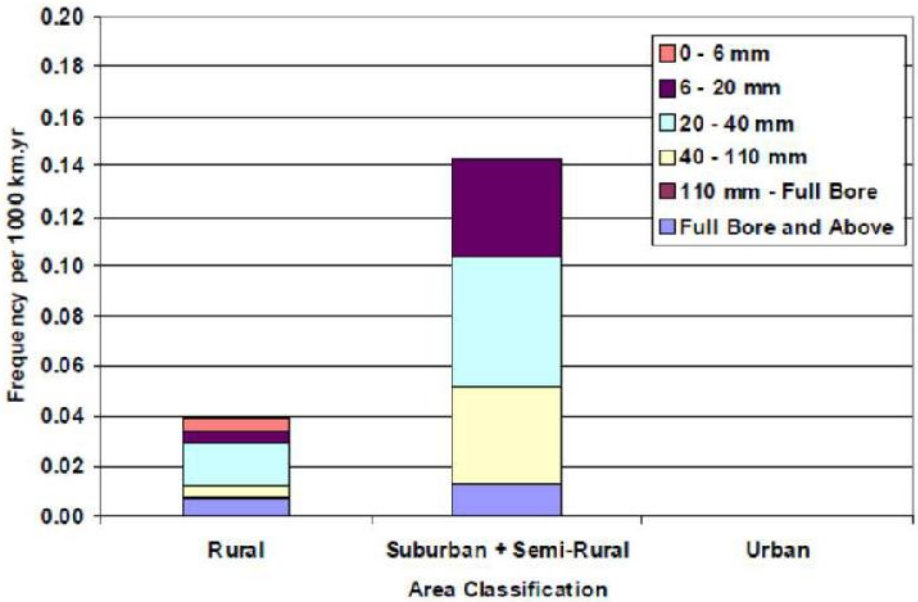


Table 3.7: Exposure by Area Classification in km. yr.

Area Classification	Exposure km.yr	Incidents	Frequency/1000 km.yr
Rural	754858	30	0.040
Suburban	76847	11	0.143
Urban	1069	0	0.000
Total	832775	41	0.049

3.10 External Corrosion by Wall Thickness Class

Figure 3.6: Products Loss Incidents by External Corrosion - Wall Thickness Class

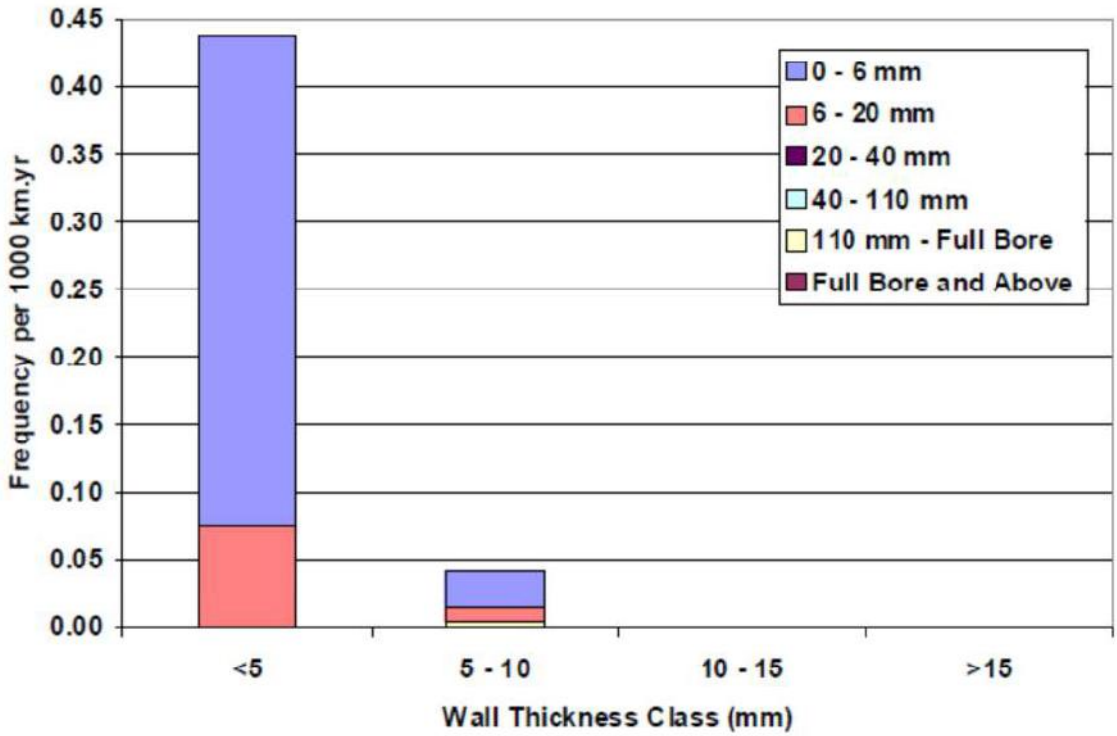


Table 3.8: Exposure by Wall Thickness Class

Wall Thickness mm	Exposure km. yr	Incidents	Frequency/ 1000 km. yr
<5	54775	24	0.438
5-10	392241	16	0.041
10-15	318941	0	0.000
>15	66818	0	0.000
Total	811923	40	0.048

3.11 External Corrosion by External Coating Type

Figure 3.7: Products Loss Incidents by External Corrosion – Coating Type

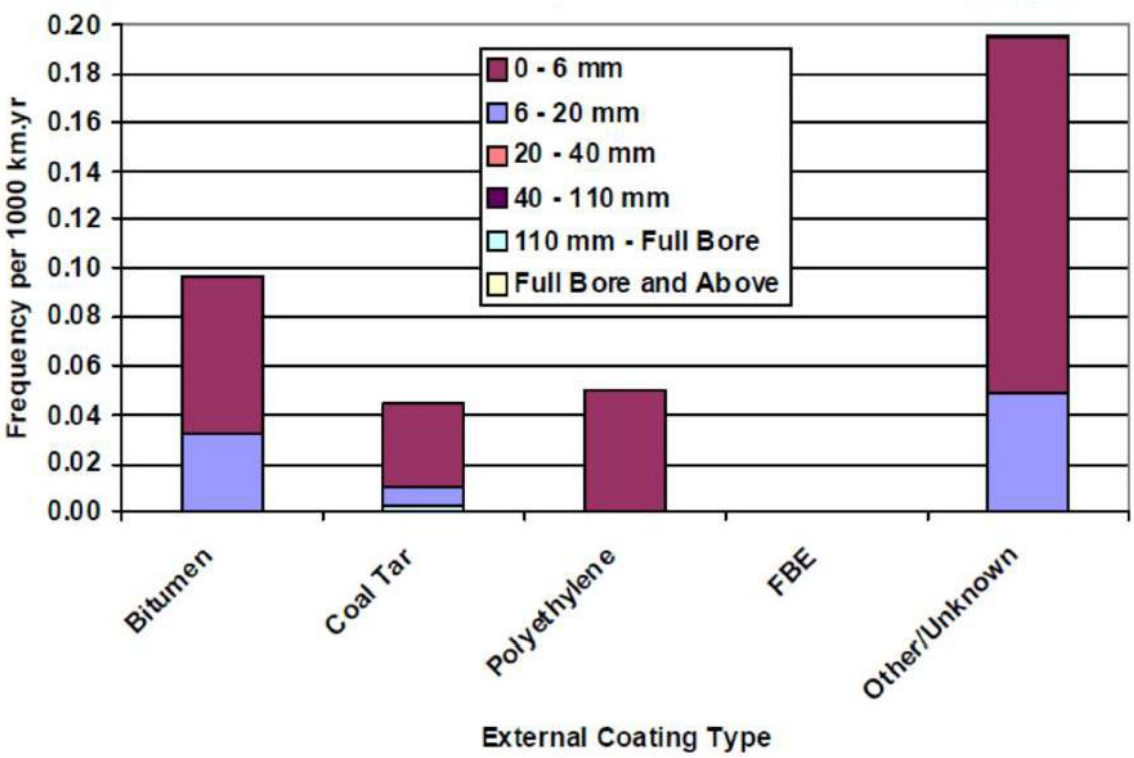


Table 3.9: Exposure by External Coating Type

External Coating	Exposure km.yr	Incidents	Frequency / 1000 km.yr
Bitumen	30798	3	0.097
Coal Tar	597009	26	0.044
Polyethylene	79704	4	0.050
FBE	84111	0	0.000
Other/Unknown	41153	8	0.194
Total	832775	41	0.049

3.12 External Corrosion by Type of Backfill

Figure 3.8: Products Loss Incidents by External Corrosion – Backfill Type

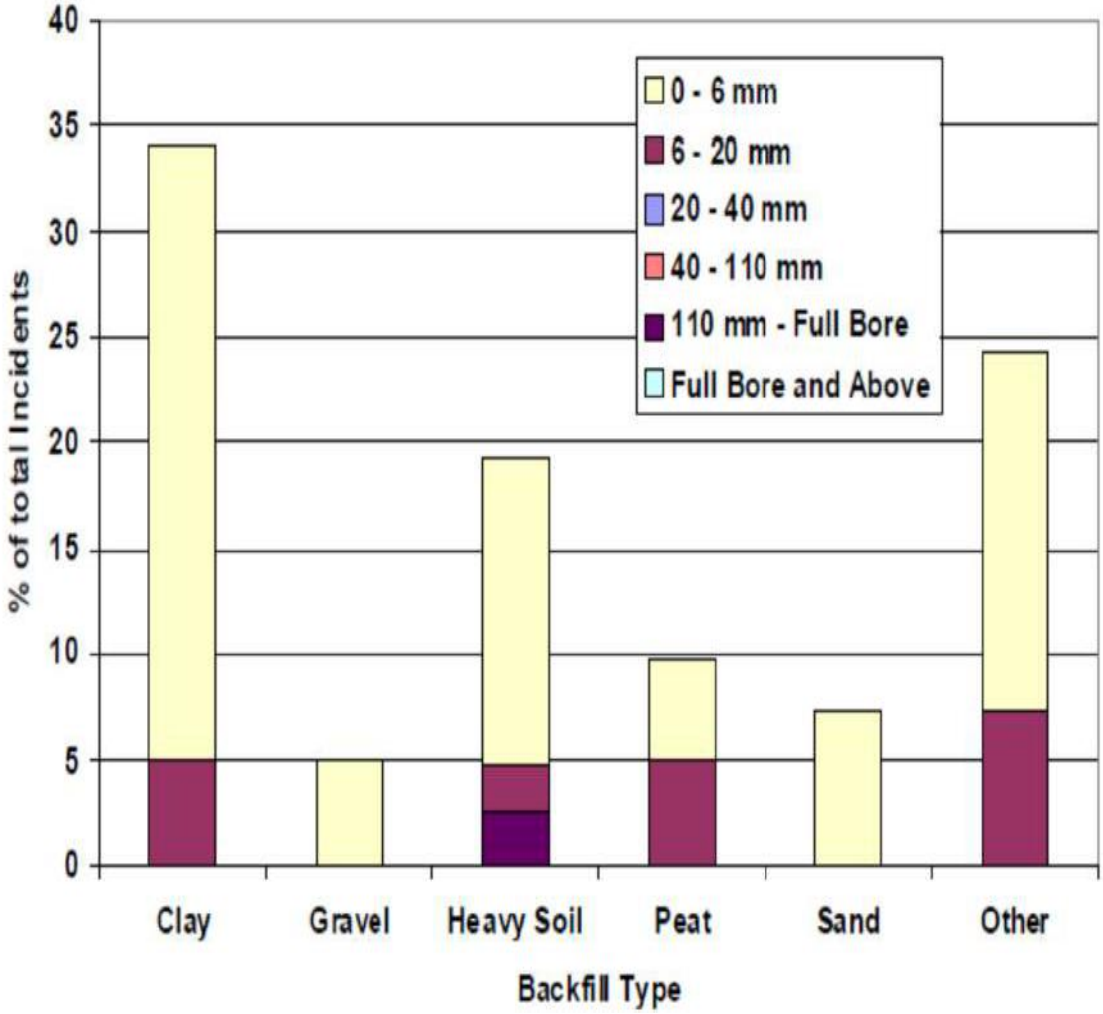


Table 3.10: Hazards for POL Pipeline Transfer

Sl.No	Hazardous Event	Potential Consequences	Safeguards
1.	Hole/Leak in Transfer pipeline from Jetty to BPCL POL storage.	♦ Release of MS/HSD ♦ Fire and Explosion	
2.	Rupture in Transfer pipeline from Jetty to BPCL POL storage.	♦ Release of MS/HSD ♦ Fire and Explosion	♦ SOPs to be followed. ♦ Ensure corrosion protection ♦ Ensure mechanical integrity time to time
3.	Natural Disaster such as high winds, earthquake, etc	♦ Damage to piping ♦ Fire and explosion	♦ Follow relevant design standards to withstand natural disasters

CHAPTER 4

CONSEQUENCE ANALYSIS

CHAPTER 4: CONSEQUENCE ANALYSIS

4.1 CONSEQUENCE ANALYSIS

The consequence analysis for the selected accident scenarios for MS Leak has been carried out to estimate the effect distance or vulnerability zone. Once the effect distances are computed for various failure cases, risk can be quantified and appropriate measures can be taken for risk mitigation to eliminate damage to life and property and enhance the safety.

4.2 MODEL USED FOR CONSEQUENCE ANALYSIS

The risk assessment study involves a large number of computations for which established computing aids are essential.

PHAST (Version 6.7) software of DNV has been used to perform the consequence calculations. PHAST is consequence analysis software for calculation of physical effects (fire, explosion, atmospheric dispersion) of the escape of hazardous materials.

4.3 CONSEQUENCE ANALYSIS

The consequence analysis has been carried out for various Leak scenarios. Out comes of consequence analysis have been described in subsequent section.

4.3.1 LEAK OF TRANSFER PIPELINE (10 MM LEAK)

In the event of catastrophic leak of MS, Jet Fire may be occurred on immediate ignition. The leak scenarios are considered for the transfer lines with hole diameter of 10 mm and 25 mm (20 % of pipe diameter). Assuming the two isolation valves on both sides of the pipeline have been closed by control room operator/PLC within 2 minutes of the pipeline leak/rupture. As a result of leak, the case of jet fire may happen if ignition is present immediately. Various outcomes in the event of pipeline leak will be as given below under different stability classes:

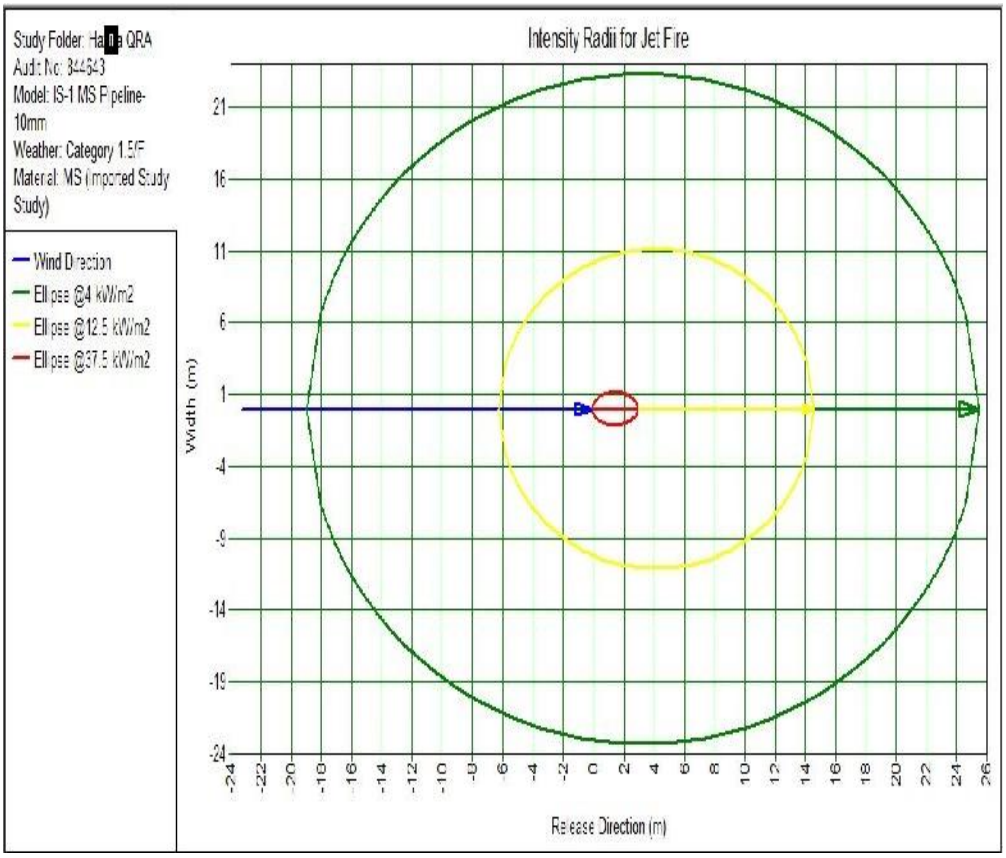
4.3.2 Jet Fire Hazard

Thermal Radiation: Jet Fire Ellipse

Radiation Effects	D, 5 m/s	F, 1.5m/s
4 (kW/m²)	24.77	25.5
12.5 (kW/m²)	15.97	14.56
37.5 (kW/m²)	10.16	2.91

Note: All values are in m

The intensity radii for Jet fire due to leak of MS pipeline are as given in **Figure**



- **UFL & LFL Concentrations Distance (m)**

Concentration	D, 5 m/s	F, 1.5m/s
UFL	0.211	0.1076
LFL	3.50	3.08

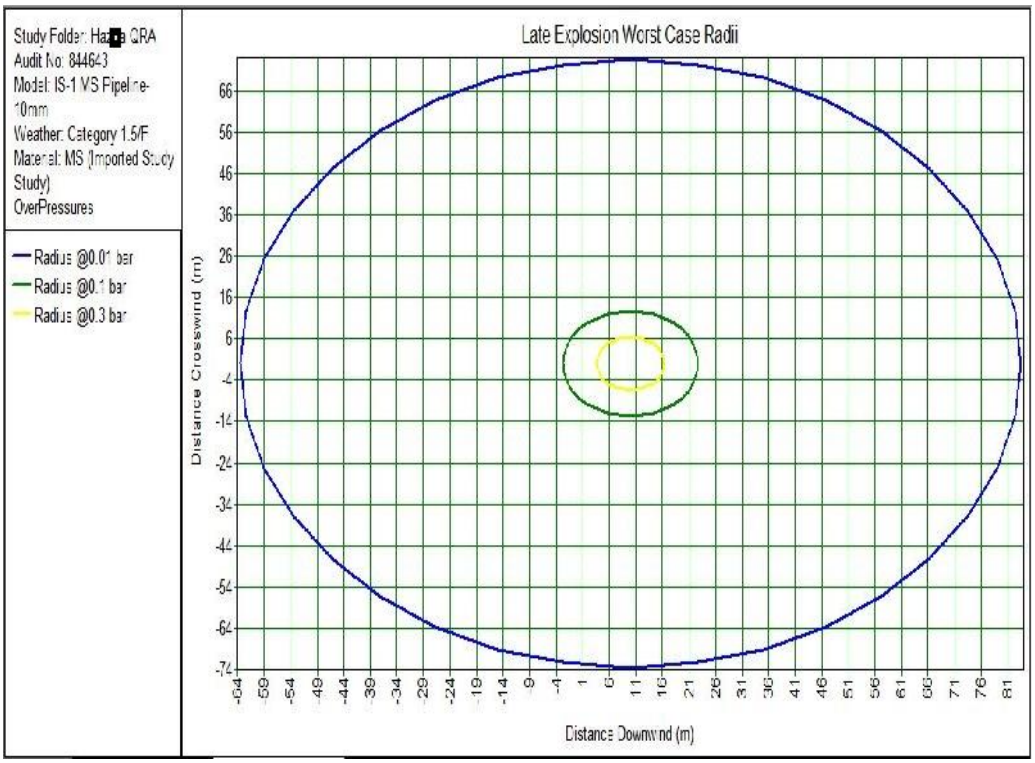
Note: All values are in m

- **UFL & LFL Concentrations Height (m)**

Concentration	D, 5 m/s	F, 1.5m/s
UFL	2.77	4.60
LFL	5.69	11.32

Note: All values are in m

Late explosion worst case radii



Overpressure	Maximum Distance (m)
0.01 bar	83.44
0.1 bar	22.74
0.3bar	16.39

4.3.3 Flash Fire Envelope

- **UFL & LFL Concentrations Distance (m)**

Concentration	D, 5 m/s	F, 1.5m/s
4262.13 ppm	6.72	12.44
8524.26 ppm	5.69	11.31

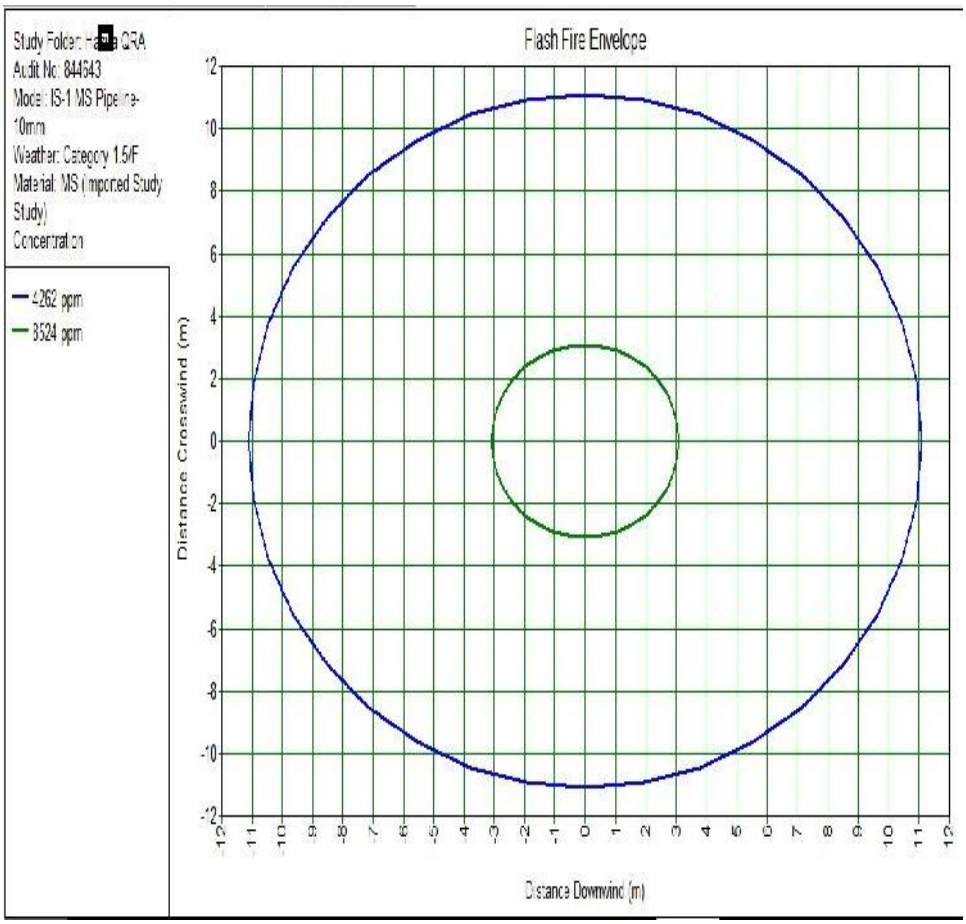
Note: All values are in m

- **UFL & LFL Concentrations Height (m)**

Concentration	D, 5 m/s	F, 1.5m/s
4262.13 ppm	8.14	11.11
8524.26 ppm	3.50	3.08

Note: All values are in m

Flash fire envelope due leak of MS pipeline is shown in **Figure.**



II. Jet Fire due to Large Leak (25 mm)

UFL & LFL Concentrations Distance (m)

Concentration	D, 5 m/s	F, 1.5m/s
UFL	0.63	0.41
LFL	10.39	14.68

Note: All values are in m

UFL & LFL Concentrations Height (m)

Concentration	D, 5 m/s	F, 1.5m/s
UFL	6.30	10.37
LFL	12.78	15.08

Note: All values are in m

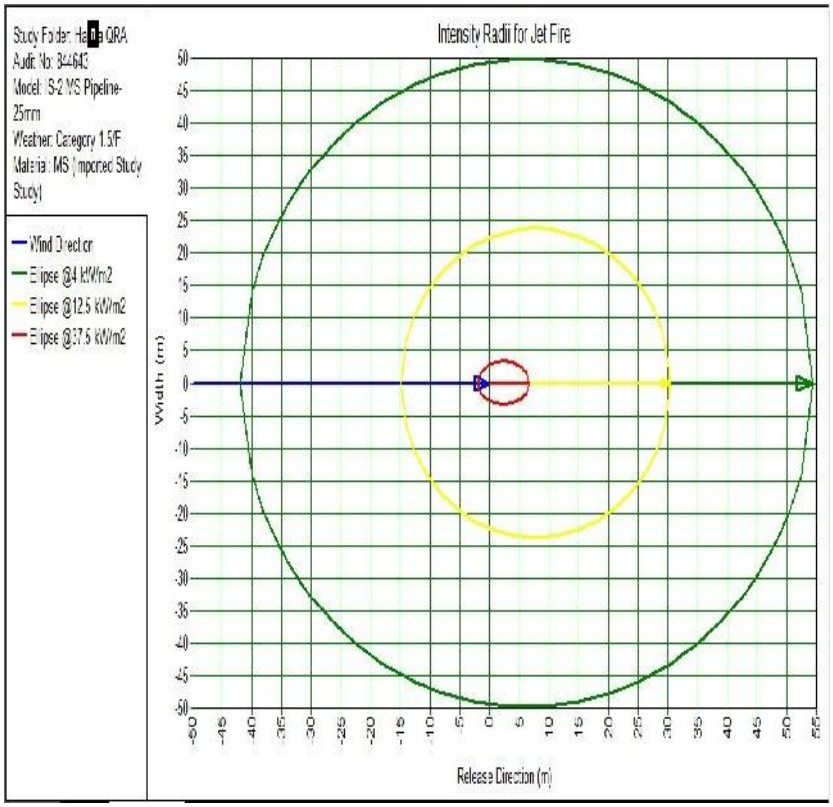
Thermal Radiation: Jet Fire Ellipse

Radiation Effects	D, 5 m/s	F, 1.5m/s
4 (kW/m^2)	50.97	54.40
12.5 (kW/m^2)	31.60	30.40
37.5 (kW/m^2)	20.40	6.65

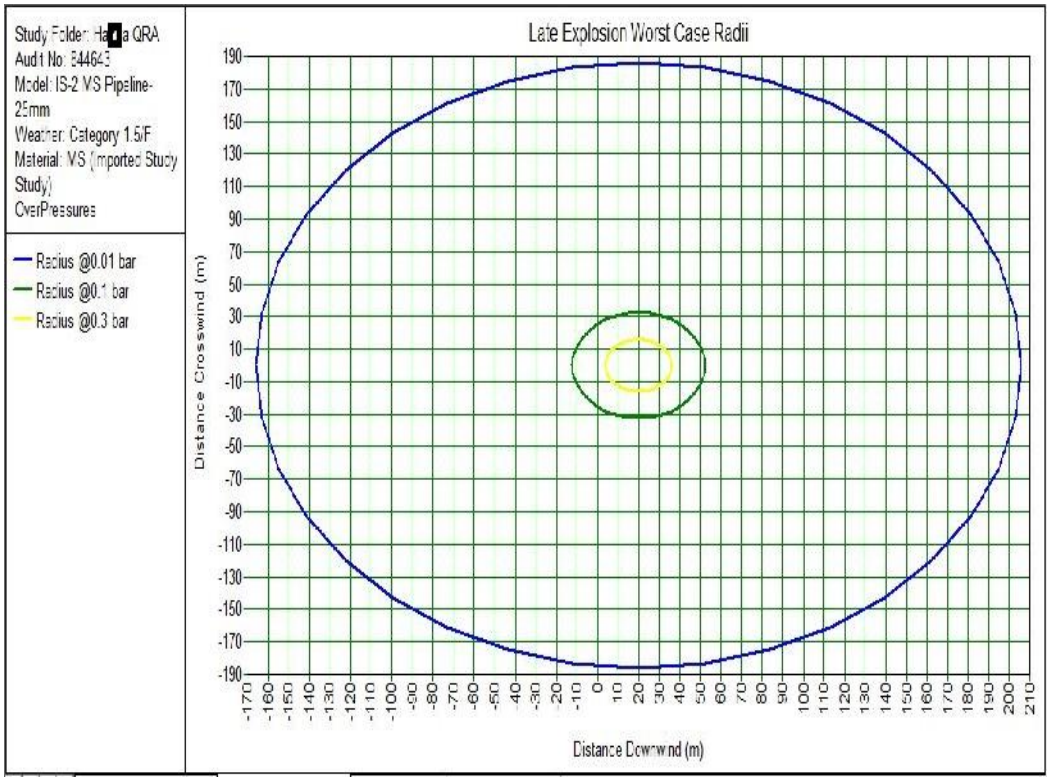
Note: All values are in m

The intensity radii for Jet fire due to large leak of MS pipeline are as given in

Figure



Late explosion worst case radii



Overpressure	Maximum Distance (m)	
	D, 5 m/s	F, 1.5m/s
0.01 bar	151.66	205.97
0.1 bar	42.83	52.25
0.3bar	31.40	36.11

Flash Fire Envelope

- **UFL & LFL Concentrations Distance (m)**

Concentration	D, 5 m/s	F, 1.5m/s
4262.13 ppm	26.88	26.66
8524.26 ppm	10.39	21.17

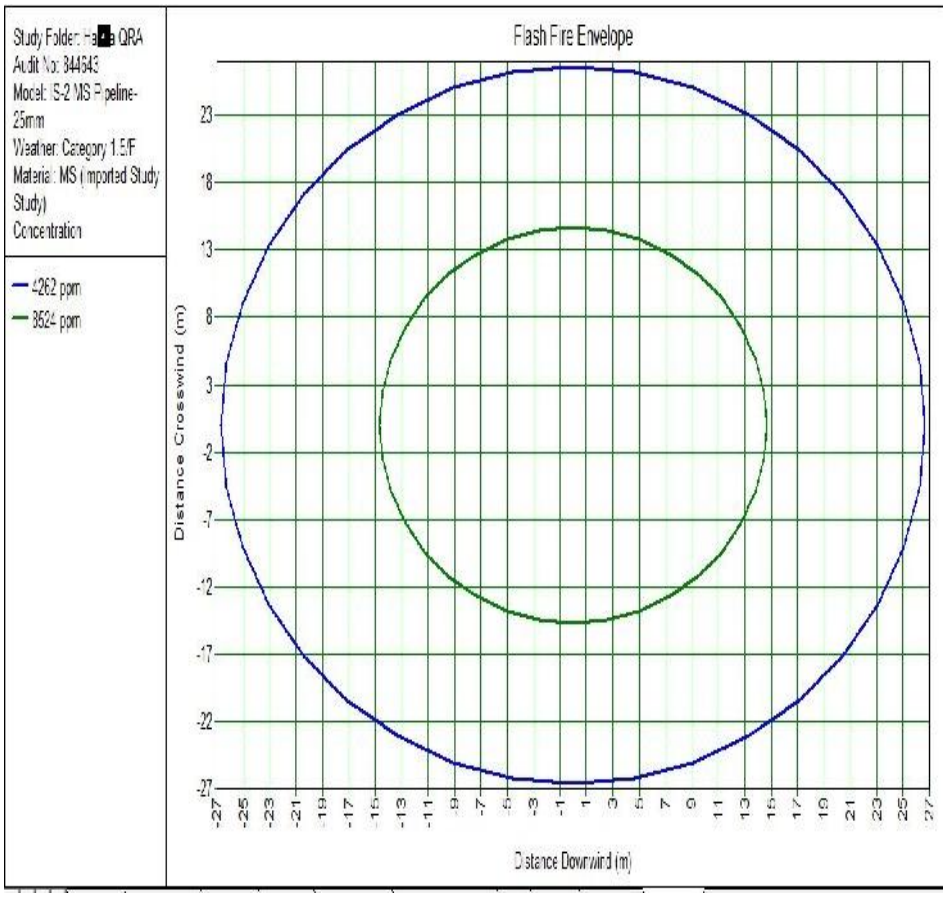
Note: All values are in m

- **UFL & LFL Concentrations Height (m)**

Concentration	D, 5 m/s	F, 1.5m/s
4262.13 ppm	14.16	15.07
8524.26 ppm	12.78	21.17

Note: All values are in m

Flash fire envelope due leak of MS pipeline is shown in **Figure.**



CHAPTER 5

FREQUENCY ANALYSIS

CHAPTER 5: FREQUENCY ANALYSIS

5.1 PREAMBLE

The failure frequency analysis aims at estimation of the "probability" of the incident. Failure frequencies may be classified as generic and synthesised for a particular situation, especially for more complex systems. Generic failure frequencies are preferred wherever available, as these reduce variances arising out of analyst judgement in the failure frequency estimation. Fault trees make use of generic failure frequencies of components for a system or its subsystems to conclude the overall probability of failure.

The standard method of calculating the failure rate of an isolated section of an equipment or a chosen set of equipment items is to count the different items and associated line lengths. The failure rate for a certain item is then broken down into the correct proportions for required release rate bands. The overall frequency for a particular set of equipment is then:

$$Ft = \sum F\ N$$

Where:	*Ft*	=	*total failure frequency/per year/per unit*
	F	=	*individual item frequency/per year*
	N	=	*number of items or length of piping unit*

5.2 FAILURE FREQUENCY DATA BASE

An incident frequency can be derived from internationally well known generic databases incase the design is sufficiently similar to facilities represented in the historical failure records. There are several accepted sources of international failure rate data for underground pipelines, which include CONCAWE (Conservation of Clean Air and Water in Europe), European Oil and Product Lines, US Gas Transmission Lines, UK Onshore Pipeline Operators' Association (UKOPA), International Association of Oil and Gas Producers (OGP) data base, TNO data base and others.

The generic failure data base selected for calculating the failure frequencies was the UK Onshore Pipelines Operators' Association (UKOPA) database. UK OPA report (No: 6957 Issue 1.0, "UKOPA PIPELINE FAULT DATABASE, Pipeline Product Loss Incidents, (1962 - 2006), 5th Report of the UKOPA Fault Database Management Group). Failure data for process equipment items including flanges connection and valves, etc. can be obtained from various reliability data bases derived from industry historical records.

This database can be used to meet the project scope requirements of pipeline failure data. Using these data, the frequencies of incidents can be estimated. The frequency of each incident is equal of the failure frequencies of all individual components.

5.3 Pipeline Failure Frequencies

UKOPA Failure data base has been used for estimation of pipeline failure rates. The UKOPA data base is built from reports on large number of accidents, which occurred on onshore pipeline system. The pipeline frequency rates are as given in Table 6.1.

Table 6.1: Frequencies of Pipeline Failure

Sl. No	Hole Size	Failure Rate /year
1.	5 mm	7.208E-4
2.	25 mm	4.148 E-4
3.	100 mm	1.836 E-4
4.	Rupture	8.160 E-5

5.4 Process Piping Failure Frequencies

Most data bases of pipe failure rates are not sufficiently detailed to allow a determination of the failure frequency as a function of the size of the release (i.e. size of the hole in the pipe). However, British Gas has gathered such data on piping release. The data shows that well over 90% of all failure are less than a 1-inch (25 mm) diameter hole and 3% are greater than a 3 inch (75 mm) diameter hole. Since most full rupture of piping system are caused by outside forces, full rupture are expected to occur more frequently on small-diameter pipes.

The failure frequencies of process piping are as given in Table 6.2.

Table 6.2: Frequencies of Process Piping Failure

Sl. No	Hole Size	Failure rate /year
1.	5 mm	1.476 E-5
2.	25 mm	1.312 E-5
3.	Rupture	1.64 E-6

5.5 VALVES FAILURE FREQUENCIES

The valves are a common possible source of leaks. Such leaks are usually from the packing around the valve stem. Leaks from valves are usually minor and the rates of release are mostly insignificant. Leak detection is typically carried out before a critical situation develops that may cause a safety problem. However, in some cases the leak from valves may be significant and could cause a hazard to people and property in the vicinity. With regard to the main body of the valve (valve casing) the wall thickness is generally quite large compared with process piping and leaks from the casing are deemed unlikely.

5.5.1 CONTROL VALVES

The data given in OREDA (1992) for control valves that are pneumatically operated globe valves (20 to 30 mm valves) records a critical failure rate of 3.89 failures per 106 hours, or 3.4E-2 failures per valve-year.

A breakdown of leak frequency by leak size is not given in these sources and thus additional analysis is required. All leaks from the control valves reported by OREDA (1992) are small leaks. Assuming that about 1% of all leaks could be large enough to be relevant to a risk assessment studies i.e. above pinhole size. Hence, these leaks have a frequency of 4.0E-4 per year per valve. The distribution of leak sizes is taken to be similar to that of piping. This leak frequency distribution is given in Table 6.3.

Table 6.3: Frequencies of Control Valve Failure

Sl. No.	Normalized Hole Size(d/D)	Failure Rate /year
1.	0.1	2.6x10-4
2.	0.2	1.0x10-4
3.	0.45	34.0x10-5
4.	Total	4.0x10-4

5.5.2 ESD VALVES

The OREDA (1992) gives a frequency of critical external leaks from ESD valves in hydrocarbon service as 0.45 occurrences every 106 hours. This gives an annual frequency of 3.9E-3 leaks per valve year. Again, the leak frequency is not broken down by leak size. The same assumption is made that about 1% of all leaks could be large enough to be relevant to a risk assessment studies. Hence, these leaks have a frequency of 3.9E-3 per valve-year. The distribution of leak sizes is taken to be similar to that for control valves as given in Table 6.4.

Table 6.4: Frequencies of ESD Valves Failure

Sl. No	Normalized Hole Size(d/D)	Failure Rate /year
1.	0.1	2.5 E-5
2.	0.2	9.8 E-6
3.	0.45	3.9 E-6
	Total	3.9 E-5

5.5.3 FLANGES

For flanges, industrial sources give figures covering the range of 6E-4 to 1.6E-4 failures per year. Whittle (1993) quotes a lower failure rate of 6.2E-5 failures per year, while the failure rate quoted by Sooby (1992) is even lower by over an order of magnitude of 3.3E-6 failures per year. Since the quality of the pipe flanges varies enormously with application, it seems sensible to regard this range as a reflection of flange and gasket quality.

A failure frequency of 1E-5 per year is used for high quality flanges (e.g. raised face, ring type, or grey lock flanges used in high pressure, high temperature service). An analysis of flange failure hole sizes shows them to be small. The analysis shows that the maximum equivalent hole diameter for a flange leak from a 6 inch (15 mm) pipe is 12 mm. It has been assumed that for pipes greater than 6 inch (15 mm) in diameter that 10% of all flange leaks contribute to leaks in the range of 10 to 50 mm (i.e. 25 mm holes). For pipes of 6 inch (15 mm) diameter or smaller all leaks are taken to fall into the 0 to 10 mm hole size range (i.e. 5 mm holes). Table 6.5 summarizes the leak frequencies for flanges by hole size.

Table 6.5: Frequencies of Flange Failure

Sl. No	Hole size(mm)	Failure Rate /year
1.	5	9.0 E-5
2.	25	1.0 E-5
3.	Total	1.0 E-4

Leak frequencies for valve and flanges are summarized in Table 6.6 by hole size.

Table 6.6: Frequencies of Valves and Flange Failure

Sl. No	Hole size(mm)	Failure Rate /year
1.	5	4.22 E-5
2.	25	1.38 E-4
3.	Rupture	5.11 E-5

5.6 FREQUENCIES DATA BASE FROM TNO

5.6.1 FOR LEAKAGE AND RUPTURE OF PIPING AND PIPELINES

Several studies from the past have led to a distribution in failure probability for two categories of pipelines. The figures accounts for the following assumptions:

Regarding the more fluctuating process conditions in and more frequent activities around process pipelines, it is expected that failure probabilities in this group are higher than for transport pipelines.

It is assumed that larger diameter pipeline will have a larger integrity and consequently a lower frequency of being damaged than small ones. For pipeline with a D>6" (150 mm) guillotine rupture in not credible.

Generic failure case frequencies per year per meter for transfer and process pipelines are given below:

Diameter	Transfer Pipeline			Process Piping		
	Rupture	Hole 10"	Hole 1%	Rupture	Hole 10"	Hole 1%
d<3"	1E-6	3E-6	1E-5	3E-6	1E-5	3E-5
3"<d<6"	1E-7	1E-6	3E-6	1E-6	3E-6	1E-5
d>6"	--	3E-7	1E-6		1E-6	3E-6

5.6.2 Catastrophic Failure for Pipeline

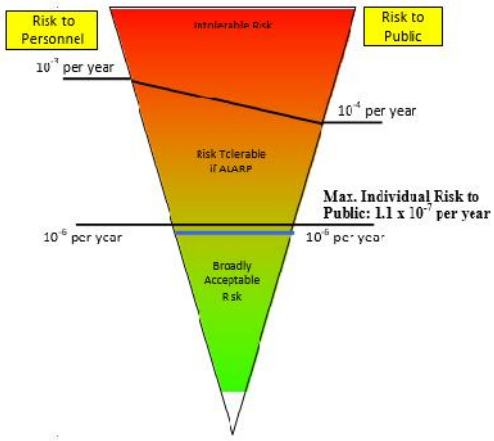
Pipeline : 1E-7/Yr

The maximum individual risk contour observed along the pipeline route is 1E-07 /Yr.

Risk transects at different points show the value of maximum individual risk as 1.1E-07/yr.

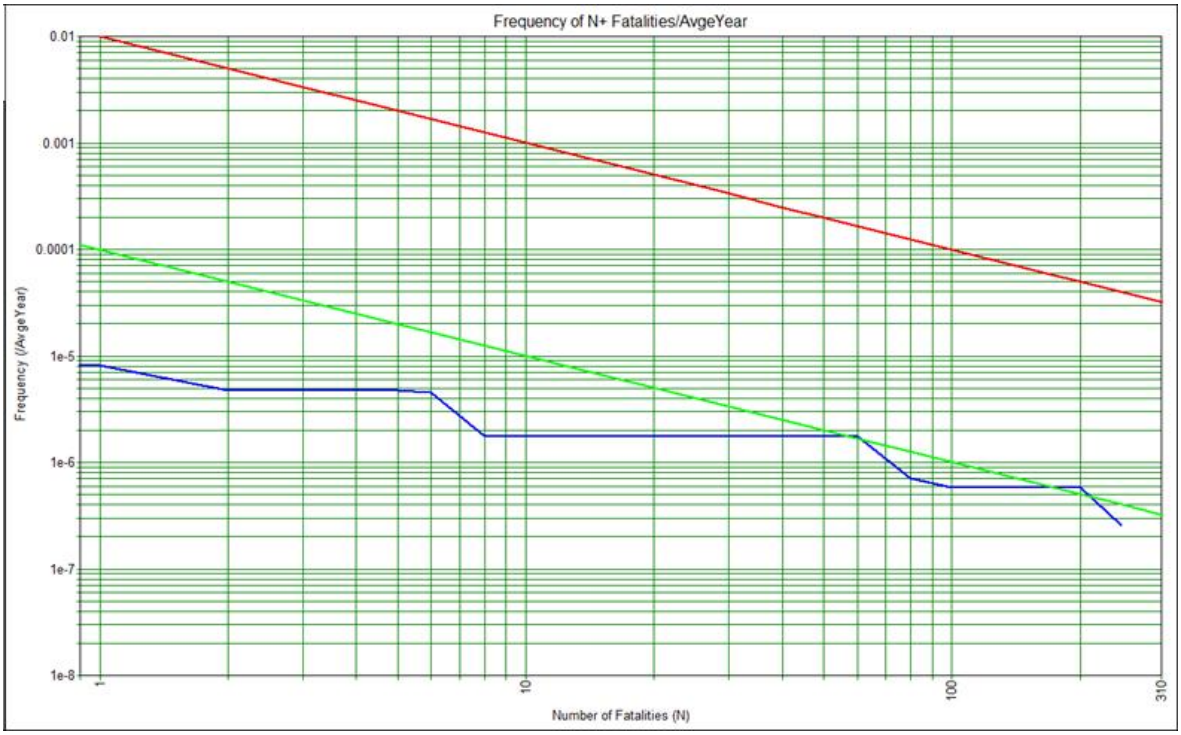
This is in the "Broadly Acceptable Region"

INDIVIDUAL RISK ALONG THE PIPELINE



5.7 SOCIETAL RISK FOR BPCL PIPELINE

The FN Curves for societal risk for sections along pipeline route with some nearby population are shown below



For the frequency assessment, it is necessary to estimate the probability of ignition if a leak occurs. Ignition of a leak may occur either at the point or at some distance from it. The cause of ignition may be the leak itself (e.g. a leak may generate static electricity) or an ignition source, which then gives a spark and ignites the leak.

For small (0-25 mm) leaks probability

- Jet Fire (Immediate ignition- 25% probability)
- Flash Fire (75% probability)

For Medium (25-100mm) leaks probability

- Jet Fire (Immediate ignition- 25% probability)
- Flash Fire (75% probability)

The probability of ignition depends on the availability of a petroleum product, the flammable mixture and ignition source and the type of ignition source (energy etc).

CHAPTER 6

DMP FOR PIPELINES CARRYING PETROLEUM PRODUCTS

CHAPTER 6: DMP FOR PIPELINES CARRYING PETROLEUM PRODUCTS

6.1 DMP FOR THE PETROLEUM PRODUCT TRANSPORTATION PIPELINE

Disaster is an undesirable occurrence of events of such magnitude and nature that adversely affect production, cause loss of human lives and property as well as damage to the environment. Industrial installations are vulnerable to various kinds of natural and manmade disasters. Examples of natural disasters are flood, cyclone, earthquake, lightning etc. and manmade disasters are like major fire, explosion, sudden heavy leakage of toxic/poisonous gases, civil war, nuclear attacks, terrorist activities etc. It is impossible to forecast the time and nature of disaster, which might strike an undertaking. However, an effective disaster management plan helps to minimize the losses in terms of human lives, plant assets and environmental damage and resumes working condition as soon as possible.

However, population around the pipeline is nil. Since the pipeline originates from Haldia oil Jetty No.3 and terminates in the plant a detailed off- site emergency plan shall be prepared by District Collectorate in consultation with M/s BPCL and the neighbouring industries, local municipality, Hospital and other Statutory Bodies.

6.2 ABOUT BPCL PIPELINES

Pipelines are assuming importance as a means of transport of hazardous Chemicals. MS/HSD are among the main substances transported by pipelines.

Though the Pipeline Operator shall take steps for safe operation of the pipelines, an action plan for attending the pipeline failures which affect the People & Environment shall be put in place and practiced by the Operator.

- BPCL has two dedicated pipelines from HOJ-1 to Installation. These are 24” Dia black oil and 16” Dia MS BS III (We also have 16” pipe earlier laid as Naphtha later on converted to MS BS IV).
- BPCL has planned to lay MS/HSD pipelines of approx 9 km length from HOJ-3 to their installation at Patikhali at Haldia, West Bengal. The transportation capacity will be 1.3 MMTPA.

- The direction of flow of the proposed route from Haldia Oil Jetty 3 to BPCL installation at Patikhali with the objective that the new pipeline to be laid entirely in the acquired area owned by Port authority of Haldia.

HOJ-3 to BPCL installation at Patikhali Terminal:

- HOJ-3 is set up in the year of 2000. The occupancy of this jetty is about 45%.
- Haldia is a rescue location for Eastern Region with TW loading facility and BPCL need the port and jetty facilities to sustain their business interest.
- BPCL planned to lay MS/HSD pipelines of approx. 9 km length from HOJ-3 to their installation at Patikhali.
- In this connection BPCL, A Government of India enterprises proposes to construct a pipeline for transporting the imported petroleum products to their existing terminal at Patikhali, Haldia, in the district of Purba Medinipur in the state of West Bengal.

Type of Disaster

FIRE / EXPLOSION	✓ At cross country location.
LEAKAGE AND DAMAGE	✓ To mainline. ✓ To other pipelines
OPERATIONAL	✓ Fire at Mainline – Leakage, Pilferage, Sabotage, Burst of pipeline etc. ✓ Spillage – Leakage due to line breakage or open valves. ✓ Leakage from mainline due to corrosion.
NATURAL CALAMITIES	✓ Heavy rains resulting in washout or breaches. ✓ Earthquakes ✓ Cyclonic Winds ✓ Landslides ✓ Tsunami
MAN MADE	✓ Sabotage ✓ Pilferage ✓ War ✓ Riots ✓ Civil Commotion ✓ Terrorist activity

6.3 VAPOUR CLOUD FORMATION DUE TO UNCONTAINED MS/HSD LEAK

Information regarding the Emergency will be communicated to BPCL through West Bengal Police. Details of the leak and its severity will also be communicated.

Plan for Handling:

1. Information received by any of the Units will be communicated to HOJ-3 to stop pumping immediately and inform BPCL, Patikhali.
2. Terminal Managers of BPCL, Patikhali will rush to the leak spot along with the required materials and Manpower.
3. Mobile Fire Tender shall be arranged by BPCL through Fire and Safety Department.
4. West Bengal Pipeline patrolling police will inform the Fire Brigade for positioning the Fire Tender
5. Leak arresting Clamps and Non-Sparking Tools will be Mobilized by BPCL, Patikhali and Efforts will be made to provide the Clamp over the leak Spot.
6. Terminal Manager of BPCL, Patikhali will assess the situation and

    a. Make arrangements through Dock line Cell for Informing regarding the leak to District Collector, WBPCB, DISTRICT EMERGENCY RESPONSE CELL, West Bengal Fire and Rescue Services.
    b. If required, inform WBSEB to cut off the Power Transmission through the High Voltage Overhead transmission tower.
    c. Cardon Off the area through West Bengal Police.
    d. Make arrangements for checking the Hoogly river for any Oil Contamination

7. DSO/Safety Officer Patikhali will co-ordinate with BPCL for taking necessary action on their line.

The role of District Administration:

- Cordoning off the Area
- Cut off the HV Power transmission in the area
- Divert the Traffic through an alternate route
- Advise BPCL on further course of action (if required).

6.4 Break Out of Fire Due to Leakage From The Pipeline and Ignition Source

Information regarding the Emergency will be Communicated to BPCL through West Bengal Police. Details of leak and severity of Fire will also be communicated.

Plan for Handling:

1. Information received by any of the Units will be communicated to HOJ-3 to stop pumping immediately and inform BPCL, Patikhali.
2. Terminal Managers of BPCL, Patikhali will rush to the leak spot along with the required materials and Manpower.
3. Terminal Managers of BPCL, Patikhali will depute Officers to the leak spot.
4. Mobile Fire Tender shall be arranged by BPCL through Fire and Safety Department.
5. West Bengal Pipeline patrolling police will inform the Fire Brigade for positioning the Fire Tender
6. Leak arresting Clamps and Non-Sparking Tools will be mobilized by BPCL, Patikhali.
7. Efforts will be made to provide the Clamp over the leak Spot.
8. Terminal Manager of BPCL, Patikhali will assess the situation and
    a. Make arrangements for Informing regarding the Emergency to District Collector, Purba Medinipur, WBPCB, DISTRICT EMERGENCY RESPONSE CELL, West Bengal Fire and Rescue Services.
    b. If required, inform WBSEB to cut off the Power Transmission through the High Voltage Overhead transmission tower.
    c. Cardon Off the area through West Bengal Police.
    d. Use DCP Fire Extinguishers and Fire Tenders to fight the Fire.
    e. Cool the adjoining pipelines with the help of Fire Tenders.
9. DSO / Safety Officer Patikhali will co-ordinate with BPCL for taking necessary action on their line.

The role of District Administration:

- Cordoning the Area
- Cut off the HV Power transmission in the area
- Divert the Traffic through an alternate route
- Fire Fighting using BPCL and Fire Brigade

In case of any leakage in pipeline, it is necessary to isolate the supply with minimum delay. For this purpose effective communication system with emergency control centre is to be established.

6.5 EMERGENCY COMMAND CENTRE

Admin Block of Haldia terminal of BPCL may be identified as Emergency Command Center during emergency in order to have command over the emergency & control the emergency in an effective manner. This will be headed by District Collectorate or Chief Coordinator at BPCL.

6.5.1 FACILITIES/DOCUMENTS IN EMERGENCY COMMAND CENTRER

Following facilities and documents will be available in the Emergency Command Center:

- P&T/Mobile telephone/Internal Telephonic like VHF sets.
- Hazardous area drawing of pipeline route and surroundings.
- Piping & Instrumentation Diagram.
- Route map of mainline under respective jurisdiction.
- Disaster Management Plan.
- Map of the adjoining area.

6.6 ORGANIZATION STRUCTURE AND RESPONSIBILITIES

6.6.1 ORGANIZATION

District Collectorate or Chief Manager of BPCL will be the Chief Coordinator. He will be assisted by junior officers from the various departments to effectively combat the situation. The organization during the disaster control period for the emergencies in the station and at the cross country locations is given in earlier section.

District Collectorate & Chief Manager of BPCL should name the coordinators and should make charges whenever there are movements. The alternate coordinators to take care of the situations when the coordinators are on leave/tour are also to be named. The

remaining junior officers should be assigned to different coordinators. Both the lists should be displayed in the control room of BPCL.

The organogram for disaster management are required to be prepared based on typical set up of M/s BPCL, Haldia Dock Complex, District Authority and KOPT. For mobilizing the resources, Safety Department of KOPT will take action in consultation with M/s BPCL. GMs/DGMs and other officers of mutual aid will be the crisis coordinators at the time of emergencies.

6.6.2 Emergency Equipment

The equipment required for handling the emergencies is identified. These are stacked separately and not used for normal maintenance work. It is also ensured that the equipment like portable generator, radio set etc. are in working condition by checking them at predetermined intervals. The tentative list of the normal equipment required shall be as per OISD requirement and shall be regularly updated.

6.6.3 Responsibility of the Various Coordinators

- **Chief Coordinator**
  - Emergency control centre shall be decided in consultation with the District Administration and concerned neighbouring industries.
  - To inform top management and Chairman about the incident, magnitude of the disaster, combating operations and number of casualties, if any etc.
  - To contact crisis cell of the ministry and inform about the incident, magnitude of the disaster, combating operations, number of causalities if any and any assistance required from outside agencies at the national level.
  - To approve release of information to Press, TV and Government agencies.
  - To supply manpower from BPCL and other mutual aid partners as required by Crisis Coordinators.
  - To arrange mobilization of material and equipment from BPCL and outside agencies as required by Crisis Coordinators.
  - To arrange mock drill for emergency.
  - To assess the scale of emergency and decide if a major emergency situation exists or is likely. On this decision he will declare a state of emergency.

- To supply manpower, equipment and machinery from the units and other mutual aid companies as per the requirement of the Crisis Coordinators.
- To ensure and confirm about the contact of statutory bodies/Governmental agencies viz.
  - ✓ District Collectorate
  - ✓ Executive Director of OISD.
  - ✓ Chief Inspector of factories.
  - ✓ Chief Controller of Explosives, Nagpur.
  - ✓ State and Central Pollution Control Board.
  - ✓ State Chief Secretary, Home Secretary, Director General of Home
  - ✓ Guard, Civil Defense and Coast Guard authorities.
- Maintain a speculative continuous review of possible development and assess these to determine most probable course of events.
- Prepare the message of incident for the release of information to the Press & Television.

❑ **Crisis Co- ordinate (Fire Fighting)**

On getting the information, he will instruct fire services of BPCL and Municipality to be present at the Disaster Management Control Room / Emergency Control Centre along with Fire Tender. His jobs will be –

- To instruct personnel at ship to stop pumping and close valves in ship.
- To instruct to spray DCP compound to prevent fire or to extinguish fire.
- To arrange more Fire Tenders from state Fire Services, if necessary.
- To involve Coast Guards, if necessary for fire fighting.

❑ **Administration Coordinator**

- He will be overall responsible for any administrative affair.
- He will be responsible to liaise with civil administrative affair.
- He will liaise with concerned town police station.
- He will be responsible to provide all medical facilities with the help of medical coordinator.
- He will ensure all welfare facilities to the company employees and to the affected people at site through Welfare/Media Coordinator.

- He will be responsible to convey all necessary information regarding security, medical and welfare activities to the Chief Coordinators.
- He will be responsible to set up a Public Address System in coordination with communication in-charge and will make the public conscious about the incident through Welfare/Media Incharge.
- He will contact all statutory bodies and Government agencies to feed necessary information about incident.
- He will inform custom /excise authorities.
- To ensure mobilization of all available vehicles and transport for emergency use, including renting of vehicles as needed.

❑ **Security Coordinator**

- He will be responsible to make all security arrangement.
- He will be always in contact with Administration Coordinator and will pass all information to him.
- He will be responsible for necessary arrangement to cordon off the danger zone.
- He will be responsible to escort jeeps to bring higher authorities, fire tenders etc.
- He will ensure arrangement of security personnel, if required.
- He will be responsible to arrange extra security personnel, if required.
- He will be responsible to liaise with local police stations.
- To ensure gates and roads clear of traffic for easy movement of fire tenders, ambulance's staff on emergency duty.
- To ensure liaison with Chief Coordinator.

❑ **Medical Coordinator**

- He will be responsible to set up First Aid Centre at site.
- He will mobilize first aid team and start giving first aid measures to the injured persons.
- He will arrange ambulance and nurse at site round the clock.
- He will ensure procurement of required drugs/appliances through Material Coordinator. Hospital staff (if any) will report to Medical Coordinator.

- To ensure maintenance of casualties register, type of injury, number, hospitalization etc. and will coordinate with police for completing the formalities, if anyone is found dead.
- He will be responsible to send the required persons to the hospitals /nursing home.
- He will inform Chief Coordinator if there are any constraints/difficulties.

❑ **Welfare / Media Coordinator**

- He will provide all welfare facilities to company personnel and the affected people.
- He will coordinate with Public Bodies like Police, Civil Authorities, Civil Defence, and Hospital etc.
- He will liaise with Admn. Coordinator for transportation arrangement to send the victims to Hospital.
- He will arrange for announcement for families of staff who are injured and to avoid panic in the nearby locality.
- He will ensure release of approved press statements.
- He will ensure arrangement for photographs/video filming of the incident and liaison with various press media, handle media interviews.
- To assist and provide food, clothing to all affected persons and for fire brigade and mutual aid personnel.
- To ensure arrangement of providing mineral water, soft drinks, snacks etc. to firefighting crews/medical teams/personnel on emergency duties.
- The food would be required depending upon the situation, however, arrangement shall be made to have enough provisions to provide additional 50 meals during 24 hours period.

❑ **Maintenance Coordinator**

- He will promptly mobilize a technical/engineering team of all disciplines of maintenance as per the requirement.
- To promptly arrange for renting/hiring equipment and men to meet emergency requirements.
- To keep liaison with Admn. Coordinator for transport service.
- After reaching the site he will make arrangement to contain the disaster.

- To mobilize all necessary materials at site.
- He will coordinate with the authorities of Refinery, Marketing, Irrigation and PWD for necessary requirements of equipment, materials and manpower.
- To provide all engineering help needed by Fire and Safety crews/ Civil Defense and other Civil/Govt. agencies in consultation with Chief Coordinator.
- To ensure arrangement of urgent fabrication jobs from outside agencies if the need arises.
- He will test and commission the affected pipeline after the repairing work is over and will be responsible to issue work completion certificate to Chief Coordinator.

❑ **Electrical Coordinator**

- To arrange all electrical facilities at site.
- To ensure electrical safety at work place.
- To arrange electrical generator and other major electrical equipment as an emergency standby.
- To keep informed Chief Coordinator.

❑ **Communication Coordinator**

- To arrange entire communication system and to keep the system alive.
- To install the portable radio set with antenna and establishes communication with portable mobile radio set.
- To arrange PA system, install it and make public aware of the danger involved.
- To ensure local P&T telephone line is in order.
- To maintain a liaison with other coordinator for their communication needs.
- To keep informed Chief Coordinator.

❑ **Mechanical Coordinator**

- To carry out all operational work at site.
- To stop and contain spillage.
- To perform pipeline repair job.
- To test and commission the repaired pipeline.
- To be in close contact with maintenance coordinator and will inform constantly the progress of the work.
- To keep informed Chief Coordinator.

- **Material Coordinator**
  - Incharge of urgent materials procurement, receipt and issue.
  - To provide any equipment required by maintenance and fire and safety coordinator.
  - To give feed back to Chief Coordinator regarding material procurement.
  - To coordinate with marketing division of BPCL for diesel procurement.
  - To ensure positioning of staff at purchase and warehouse.
  - To maintain liaison with other coordinators.
- **Search Party Coordinator**
  - He will promptly proceed to find out the actual location of incident.
  - To close the main valve to isolate the section.
  - After locating the site, ensure the closing of the upstream/downstream valves to contain the leaks.
  - Assess the situation i.e. quality of oil spillage, how far it has spread, likely consequences, resources required and give feed back to the Chief Coordinator and request for the following assistance:
    - ✓ F&S personnel
    - ✓ Maintenance group with all resources
    - ✓ Labourers
  - Ask for local fire brigade, inform police and take assistance in evacuating the areas, if necessary.
  - Identify nearby water sources for fire fighting.
  - Ensure security at site by posting Chowkidar, Patrolman, local police or Home Guards.
  - He will work as the off-site coordinator and be a part of the Maintenance Coordinator.
- **Fire & Safety Coordinator**
  - As soon as the Fire & Safety Coordinator receives the call, he will immediately mobilize his trained fire fighting personnel with all necessary firefighting equipment and extinguishing agents, Fog nozzles etc.

- He will immediately contact fire brigade station at Haldia & BPCL and mobilize the necessary help.
- He will ensure immediate information to all mutual aid agencies for turnouts.
- After involvement of all the fire services, it will be duty of F&S Coordinator to direct and assist them with necessary information and other requirement to achieve the target.
- He will be fully responsible to mobilize all the activities related with fire and safety equipment, materials and personnel's.
- He will liaison with other coordinators and feed all information to Chief Coordinator.
- To liaison with Chief Coordinator for replacing of fire fighting materials and shall arrange to despatch it to the site or scene of fire.

❑ **Finance Coordinator**

- To ensure arrangement of finance for the coordinators for emergency purchase.
- To ensure care of insurance formalities.
- To provide other financial help, if required.
- Inform Chief Coordinator on the fund doled out to affected persons through welfare coordinator.
- Assist Welfare/Medical Coordinator in actual disbursements of funds.
- Keep a record of all expenses.
- Ensure that such expenses are included in the insurance claim.

6.6.4 Assistance Required from Outside Agencies

❑ **Liaison**

Assistance may be required during the course of an emergency from any or all of the coordinators and they will be responsible for establishing liaison with them to effect assistance in as rapid manner as possible.

❑ **District Collector and police for emergency on the pipeline**

- To inform M/s BPCL about leak/burst on the mainline when the public brings it to the notice of BPCL, HDC, Police & Fire Brigade.
- In case of Spillage, to ensure security at site to cordon off the areas and post guards for preventing the outside personnel going near the site of the spillage.

- In case of fire, mobilization of fire Tenders and Crew from local Fire Stations/other agencies are required.
- For deployment of Home Guards, if necessary.
- Traffic Control and Diversion, Wireless communications facilities.
- Evacuation of civilian population, if necessary.
- Maintenance of communication with the public.

❑ **Assistance required from neighbouring industry**

- Repair equipment like portable Generator, Compressor and Welding Machine.
- Technicians for carrying out the Welding/Repairs.
- Fire Tender and Crew.
- Pneumatic Pumps and Hoses.
- Lories and trucks for movement of labour, equipment.
- Facilities for radiography.

6.7 OFFSITE EMERGENCY PLAN

Offsite emergency plan deals with measures to prevent and control emergencies that would affect public and environment outside the premises. The main purposes of offsite plan are:

- To provide the local/District Authorities, Police, Fire Brigade, Doctors, surrounding industries and the public the basic information of risk and environmental impact assessment and to apprise them of the consequence and the protection/prevention measures and control plans to seek their help to communicate with the public in case of a major emergency.
- To assist the District Authorities for preparing contingency plan for the District or particular area and to organize rehearsals from time to time and initiate corrective actions based on past experience.
- Organization structure for offsite emergency plan is given before and therefore organogram is not repeated.
- Chief Controller Room shall organize various exercises to cultivate site preparedness and estimate offsite requirements in case of disaster.
- Central Control Room shall display address and phone nos. of all industries in the area and that of Govt. Authorities like District Collector, DSP, Fire Brigade and

Hospitals, etc. Central Control Room shall be in touch with all these agencies and help District Authorities to plan their contingency plans.

- The lists of Government Agencies featuring in offsite action plan are mentioned elsewhere.

6.7.1 Responsibilities of the Services

1. District Collectorate

- He will activate the District Hazard Management Group and Local Crisis Management Group to act according to Off-Site Emergency Plan.

2. Police

- To control traffic & mob by cordoning off the area.
- Arrange for evacuation of people on advice from the Site Controller/District Collector/any Authorised person in District Crisis Group or Local Crisis Group.
- Broadcast/communicate through public address systems to the community (where available) on advice from the District Collector/SDO.
- Inform relatives about details of injured and casualties.

3. Fire Brigade

- Fighting fire & preventing its spread.
- Rescue & salvage operation.

4. Medical/Ambulance

- First Aid to the injured persons.
- Shifting critically injured patients to the hospitals.
- Providing medical treatment.

5. Technical/Statutory Bodies

(Constitutes Factory Inspectorate, Pollution Control Board, Technical Experts from Industries)

- Provide all technical information to the emergency services, as required.
- Investigate the cause of the disaster.

6. Rehabilitation

- Arrange for evacuation of persons to nominated rescue centre and arrange for their food, medical and hygienic requirements.

- Co-ordinating with the Insurance Companies for prompt disbursement of compensation to the affected persons.
- Maintain communication channels like telephone, fax etc. in perfect working condition.

However, formulation of Off-Site Emergency Plan designating the team members, training of team members and creating awareness amongst local people are of utmost importance.

6.7.2 Medical Facilities

There are good medical facilities provided at Haldia. The names and phone numbers of hospitals and nursing homes are as below:

Sl.No	Name of Hospital/ Nursing home	Contact details
1	Dr. BC Roy Hospital Banbishnupur, Balughata	03224-269048
2	Haldia Sub-Divisional Hospital Basudevpur, Haldia	03224-274108, 278112
3	Midland Nursing Home Manjushree, HPL Link Road, Haldia	03224-275200
4	Sab Nursing Home and Diagnostic Centre HPL Link Road, Haldia	03224-274318

CHAPTER 7

CONCLUSION AND RECOMMENDATIONS

CHAPTER 7: CONCLUSION AND RECOMMENDATIONS

7.1 RISK REDUCTION MEASURES FOR THE PROPOSED PIPELINE

The following measures are suggested for reducing the risk involved in pipeline system:

A. Routine Inspection of Pipeline Route

Routine inspection of the pipeline along its entire route shall be done periodically. Some of the important aspects to be checked during the inspection are:

- Any breaches and soil erosion along the route of the pipeline especially earth wash outs from the pipe supports.
- Unauthorized occupation and use of right of way, growth of vegetation etc.
- If there is any digging or ploughing in the vicinity of the pipeline which may result damage to the pipeline supports due to mechanical interference.
- Any leakages, etc.

Inspection to be done during pre-commissioning, commissioning, during transfer of petroleum products as well as periodic checking.

B. Instruments

- All the recorders should be periodically calibrated.
- The pressure, temperature and alarm switches and safety interlocks should be tested for their intended application as per the preventive maintenance schedule.
- The emergency shutdown system should be tested as per the preventive maintenance.
- Pressure safety valve (if any) should be tested as per the preventive maintenance schedule.

7.2 RECOMMENDATIONS

- Prevailing OISD standard, petroleum rules and all other national & international standards/ codes and practices shall be considered during design/ procurement and installation of the pipelines.
- Only trained operators shall be deployed for operation of the pipeline system. Hence all the operators/ officers should be trained in similar facility.
- Such facility already exists at Haldia as M/s BPCL transporting other ptero-products through Haldia Oil Jetty.

- Flow meters should be installed at storage plant side as well as on the ship side. If any mismatch is there which indicates the leakage, the ship pump should be immediately stopped.
- 100% radiography to be done for all welded joints.
- The pipelines should be coated and then provided with proper insulation in the upper layer.
- In order to reduce the frequency of failures and consequent risk, codes, rules and standards framed e.g. OISD 214, SMPV rules (Unfired) etc. should be strictly followed.
- Use of naked light or hot work must be restricted to the areas designated for the purpose.
- The sprinkler system and Remote Operated Valves (ROVs) at jetty area must be checked regularly for timely actuation of the safety system. Gas detection system should be checked regularly.
- The DG sets at jetty area must be periodically tested on load to ensure that they remain always in operating condition.
- Training of all the employees for fire fighting and use of safety apparatus must be conducted regularly. Mock drills for emergency should be conducted at regular intervals of 6 months (as per MSIHC rule) keeping liaison with local administration and fire-fighting facilities available in the area.
- Mock drill for fire should be done at a regular interval of 1 month.
- The use of PPEs should be strictly followed.
- Inspection and testing of the pipelines should be done at regular intervals for ensuring their health and condition monitoring.
- Patrolling of the pipeline route should be done at least once in a week as well as during unloading operation.
- Mutual aid arrangement should be done with nearby hospitals, fire services, and nursing homes for help during emergency.
- Suitable type of leak detection system should be provided. Provision should be there to stop pump if any leak is detected.
- PLC/ SCADA based leak detection system for pipelines have to be provided.

- The pipelines should be coated and then provided with proper insulation in the upper layer.
- Design and construction of the pipe supports should be rigid to avoid failure of the pipe supports due to earthquake or other natural calamities.