RISK ASSESSMENT

The outlines of the proposed project, the pre-project environmental status and the impact assessment along with proper mitigation measures have been duly addressed in the previous Chapters. This Chapter briefly encompasses the additional aspects that were also dealt upon while conducting EIA study for the proposed project to be sited at Kachchh district, Gujarat.

ENVIRONMENTAL RISK ASSESSMENT

The safety and protection of people, equipment and the environment is a serious concern in Engineering industries. Steel Plants have recognized the significance of Safe Working Environment and are progressively trying to prevent hazardous events, avoid production & manpower losses and other fallouts associated with industrial accidents by conducting risk assessment, onsite & off site management plan and adopting the safety measures as proposed. This also assists industries to enhance employee knowledge of operations, improve technical procedures, maintain accurate process safety information and increase overall facility productivity. This Chapter, accordingly, gives an outline of the associated environmental and other risk prone hazards, their assessment and remedial measures. It also describes an approach to emergency planning to be adopted by the Plant management.

OBJECTIVES

The objectives of environmental risk assessment are governed by the following, which excludes natural calamities:

a) Identifying the potential hazardous areas so that adequate design safety measures can be adopted to reduce the likelihood of accidental events.

RISK ASSESSMENT (cont'd)

b) Identifying the stakeholders and evaluating their risk along with proposing adequate control techniques.

c) Identifying the probable areas of environmental disaster which can be prevented by proper design of the installations and its controlled operation.

d) Managing the emergency situation or a disastrous event, if any, during the plant operation.

Environmental risk assessment is a systematic approach for identification, evaluation, mitigation and control of hazards that could occur as a result of failures in process, procedures, or equipment. Increasing industrial accidents, loss of life & property, public scrutiny, statutory requirements and intense industrial processes, all contribute to a growing need to ensure that risk management is conducted and implemented.

Managing a disastrous event would require prompt action by the operators and plant emergency staff using all their existing resources like deployment of fire fighting equipment, operation of emergency shut off valves, water sprays etc.

Minimising the immediate consequences of a hazardous event include cordoning off, evacuation, medical assistance and providing correct information to the families of the affected persons and local public to avoid rumours and panic.

Lastly, an expert committee is required to probe the cause of such an event, even if it is a "near miss" situation, note the loss incurred/would have been incurred, and suggest remedial measures for implementation so that in future such events or similar events do not recur.

RISK ASSESSMENT (cont'd)

DEFINITION OF ENVIRONMENTAL RISKS

The following terms related to environmental risks are defined before reviewing the environmental risks:

- Harm .. Damage to person, property or environment.
- Hazard .. Situation that poses a level of threat to life, health, property, or environment. A hazardous situation that has come to pass is called an incident. Hazard and possibility interact together to create risk. An environmental hazard is thus going to be a set of circumstances, which leads to direct or indirect degradation of environment and damage to the life and property.
- Risk .. The probability of harm or likelihood of harmful occurrence and its severity. Environmental risk is a measure of the potential threats to the environment, life and property.
- Consequence .. Effect due to occurrence of the event, which may endanger the environment permanently or temporarily and, or, loss of life and property.
- Environmental disaster .. The consequence can extensively damage any one or all the four components of the environment, namely, (i) physico-chemical, (ii) biological, (iii) human and (iv) aesthetics.

IDENTIFICATION OF HAZARDS

This is an early check of major hazards, which are of risk potential - including the potential for disastrous interactions of the various plant operational activities. This checklist, though not strictly speaking a Hazard and Operability Study (HAZOP) would considerably facilitate a full scale HAZOP Study for final drawing up of risk management measures when the 'design-freeze' stage commences. The identification of hazards anticipation for the proposed project activities are presented below.

TABLE - HAZARD IDENTIFICATION OF THE PROPOSED STEEL PLANT

Group	Item	Nature of Hazard	Hazard Potential	Remarks
Raw materials handling	Coal for coking	Fire	Moderate	Fire hazard
	Water Treatment Chemicals like acids/alkalis	Toxic	Major	Bio-corrosive
	Lube oils/greases	Fire	Moderate	Flammable
Production units				
- Coke Plant	Dusts and fumes	Asphyxiation	Moderate	Air pollution
	VOC emissions from battery	Toxic	Moderate	Health hazard
	Coke oven gas	Fire & Toxic	Major	Fire and CO hazard
	Tar	Fire & Toxic	Moderate	Flammable
- Agglomeration (Sintering)	Dusts	Respiratory	Moderate	Ambient air pollution
- Iron making in	Release of untreated BF wastewater	Toxic	Major	Severe pollution of surface water
	BFG handling	Fire	Major	Fire hazard
	Hot metal & slag Handling	Fire	Major	Fire hazard
- Steel making in	Release of untreated BOFs wastewater	Toxic	Major	Severe pollution of surface water
	BOFG handling	Fire	Major	Fire hazard
	Hot liq. Steel & Slag Handling	Heat radiation	Major	Bio-corrosive
- Rolling Mills	Gas firing	Fire	Major	Fire hazard
	Release of untreated wastewater	Toxic	Major	Severe pollution of surface water
- Captive Power Plant (CPP)	TRT	Fire	Major	Fire hazard
Utilities				
- Fuel gas	Gas leaks	Fire & Toxic	Major	Fire & CO pollution
- Electric Power Supply	Short circuit	Fire	Major	Fire hazard
- Liquid fuel	Fuel handling & storage area	Fire & Toxic	Major	Fire hazard
- Hydraulic oil and lubricants	Accidental discharge of hydraulic oil under pressure	Fire & Toxic	Moderate	Fire & personal injury

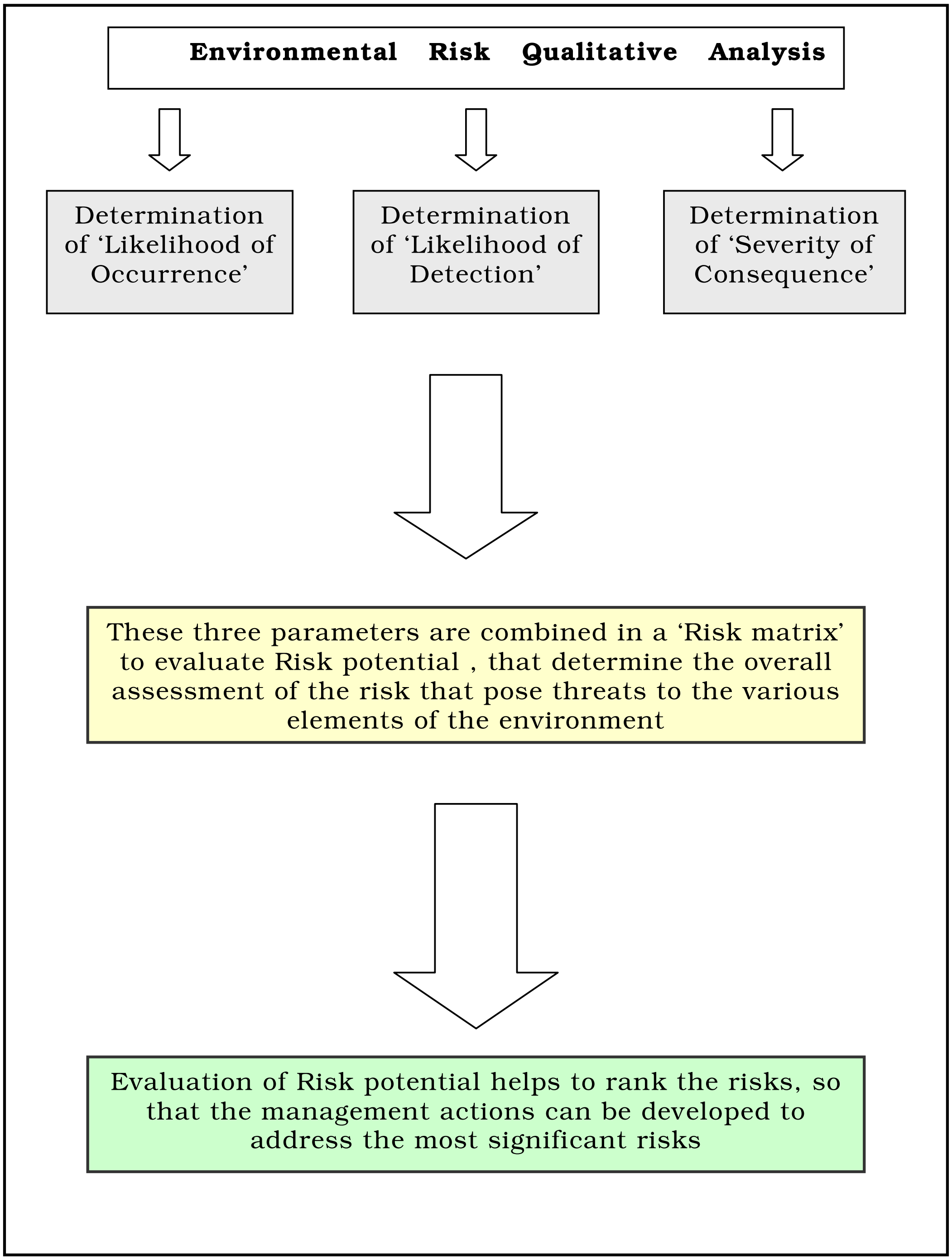
RISK ASSESSMENT (cont'd)

From the Table, it may be observed that major on-site emergency situation may occur from the organic coal chemicals storage and handling, fuel gas handling, molten metal and slag handling, acids and alkali storage and handling and electrical short-circuit. The off-site environmental disaster may arise if large-scale fire or explosion occurs, the effect of which extends beyond the plant boundary. The off-site environmental disaster may take place due to significant environmental degradation for a sustained period.

ENVIRONMENTAL RISK EVALUATION

From environmental hazards point of view, risk analysis (RA) acts as a scrutinizing vehicle for establishing the priority in risk management that concerns human health and environmental quality in general. Though the proposed facilities are not manufacturing, storing or handling any potentially hazardous/toxic chemicals as scheduled in Manufacture, Storage and Import of Hazardous Chemicals (MSHC) Rules, 1989 and its amendments thereof, the proposed facility would have installations, such as, storage and handling of coal, fuel oil, and fuel gases. Environmental Qualitative Risk Analysis Flow Chart Procedure is explicitly depicted on the next page.

RISK ASSESSMENT (cont'd)



ENVIRONMENTAL RISK QUALITATIVE ANALYSIS FLOW SHEET

RISK ASSESSMENT (cont'd)

As revealed in the chart in the preceding page, raw materials & consumable chemicals, and processing of the same in various production units, along with relative risk potential analysis is made on the following three factors using a P/I (Probability/ Impact) analysis methodology:

i) likelihood of occurrence
ii) likelihood of detection
iii) severity of consequence

Each of these factors is graded and compiled to determine the risk potential. The factors governing the determination of relative risk potentials are presented below.

TABLE - DETERMINATION OF RISK POTENTIAL

(A) Likelihood of occurrence		(B) Likelihood of detection		(C) Severity of consequence	
Criteria	**Rank**	**Criteria**	**Rank**	**Criteria**	**Rank**
Very High	5	Very High	1	None	2
High	4	High	2	Minor	4
Moderate	3	Moderate	3	Low	6
Low	2	Low	4	Moderate	8
Very Low	1	Very Low	5	High	10

RISK POTENTIAL (RP) = (A + B) x C

Based on the above stated criteria for assessing the risk, each probable event has been evaluated by addressing several questions on the probability of event occurrence in view of the in-built design features, detection response, operational practice and its likely consequence. A summarised list of environmental risk potential for the likely events is presented on the next page.

This assessment is based from the past experience in the operation of an integrated iron and steel plant and best practicable designs for the proposed Project. The present risk potential evaluation is primarily based on human errors or faulty operation or failure of the control systems.

RISK ASSESSMENT (cont'd)

TABLE - ENVIRONMENTAL RISK POTENTIAL EVALUATION

		Rank			
Sl. No.	**Event**	**Likelihood of occurrence**	**Likelihood of detection**	**Severity of consequence**	**Risk potential**
i)	Fuel gas leaks from the pipe line/valves	High (4)	Low (4)	High (10)	80
ii)	Propane storage and handling	Moderate (3)	Low (4)	High (10)	70
iii)	Unsafe disposal of oily wastes of Rolling Mills	High (4)	Low (4)	Moderate (8)	64
iv)	Occurrence of static electricity/electric spark in the Mill Cellar Room	Very low (1)	Very low (5)	High (10)	60
v)	Leakage of acids/ alkalis	Low (2)	Very low (5)	Moderate (8)	56
vi)	Uncontrolled dust emissions/failure of emission control system	High (4)	Moderate (3)	Moderate (8)	56
vii)	Failure of Gas Cleaning Plant/Fume Extraction System	Moderate (3)	High (2)	High (10)	50
viii)	Wet scrubbers running dry	Low (2)	Moderate (3)	High (10)	50
ix)	Oil wastes/oil sludge handling	Low (2)	High (2)	Moderate (8)	32
x)	Fire at the coal stockyard	Very low (1)	High (2)	High (10)	30
xi)	Collapsing of Gas Holders	Very low (1)	High (2)	High (10)	30
xii)	Splashing of molten metal and slag	Low (2)	Very High (1)	High (10)	30
xiii)	Release of untreated wastewater	Low (2)	Very high (1)	High (10)	30
xiv)	Collapsing of acid/ alkali storage tanks	Very low (1)	High (2)	High (10)	30

From the Table, it appears that some events carry risk potential above 50. These would be considered as hazardous events, where effective safe-design for operation and maintenance is highly essential to reduce the risk.

RISK ASSESSMENT (cont'd)

A HAZOP Study for the selected units/areas needs to be undertaken at the 'design-freeze' stage, when P&I diagrams, shop layout drawings, control logic diagrams, technical specifications etc are made ready. For these areas, 'Fault Tree Analysis' of the failure of equipment/valve component or due to human error can be carried out to assess more realistically the risk involved and draw up final management measures. It is also suggested to conduct HAZOP/HAZID Study for the fuel gas distribution network to incorporate last minute corrections in the design of the system from fail-safe angle, prior to commissioning.

SAFETY DURING CONSTRUCTION

Safety during construction would be an important aspect with regards to risk analysis of the project. The safety during construction would be prescribed as follows:

i) Ensure that all employees and contract workers are well versed with the safety guidelines of the organisation and well equipped with the Personal Protective equipments (PPEs) such as safety helmets, safety shoes, goggles, hand gloves, safety jackets, earmuffs, etc.

ii) Ensure that Construction Safety Manual elaborating all the safety rules/guidelines is in place and is followed by all concerned directly or indirectly involved in construction.

iii) Ensure that Safety gears like Fall arresters, lifelines etc are used compulsorily for height work

iv) Ensure that the Operating procedures and control management system is in place and meticulously followed by all workers.

v) Ensure regular safety suit, identify and analyse hazards to reduce risk associated with the particular operation.

vi) Arrange display signs for material strictly prohibited inside any work premises like inflammable materials, firearms, weapons & ammunitions, etc.

vii) Arrange display signs for restricted area

viii) Arrange direction signs (night glowing) and speed limit signs along the construction roads.

ix) Arrange clear demarcation of passage within Construction area with proper safety arrangements,

x) Developing 'Dos' & 'Don'ts' during various types of works like working at heights, etc.

xi) Ensure that emergency control mechanisms like switch, valve and emergency lamp are covered with shield, water & shock resistance cover during rain etc and peddle switch for bigger rotating machinery mixer etc. There should be no temporary cable joints and open air working switch yard at enriched level.

xii) Adequate information about emergency numbers shall be displayed everywhere. There would be emergency control room, emergency controller, shift emergency controller to take proper control of any unwanted situation and have an overall control.

Following the above measures would ensure that safety is being strictly followed during all construction activities.

RISK MANAGEMENT MEASURES

The risk management measures for the proposed project activities require adoption of best safety practice at respective construction zones within the Works boundary. In addition, the design and engineering of the proposed facilities would take into consideration proposed protection measures for air and water environment as outlined in earlier Chapter.

Electrical Safety

Adequately rated quick-response circuit breakers, aided by reliable, selective digital/microprocessor-based electro-magnetic protective relays would be incorporated in the electrical system design for the proposed Project. The metering instruments would be of proper accuracy class and scale dimensions. Appropriate use of ELCBs shall be ensured for all construction related low voltage work.

RISK ASSESSMENT (cont'd)

Fire Prevention

In addition to the yard fire hydrant system, each individual shop would be provided with fire and smoke detection alarm system. Fire detection system would be interlocked with automated water sprinklers.

CO Detection and Prevention

Carbon Monoxide (CO), a potential toxic gas, is produced due to incomplete combustion of carbonaceous fuel. Exposure to CO, due to leakage and other accidental causes, is associated with headache, dizziness, fatigue, and even death at elevated concentration. Hence, it is important to install carbon monoxide detector/alarm in BF areas and pieplines to detect the presence of carbon monoxide (CO) and sounds an alarm to alert personnel in case there is CO leakage. This would immediately stir probe and management of the scenario. Proper maintenance of the detector system is crucial.

ON-SITE EMERGENCY PLAN

Emergency planning is an integral part of the environment and safety management of an organisation. Emergency may arise due to man made reasons resulting in heavy leakage, fire, explosion, failure of critical control system, design deficiency, unsafe acts, etc, and natural causes like earthquake, flood, cyclone, excessive rain, etc. It is crucial for effective management of an accident to minimize the losses to the people and property, both in and around the facility, termed as on-site and off-site emergency plan.

The vital aspect in emergency management is to prevent accidents and losses by technical and organizational measures. Emergency planning demonstrates the organizational commitment to the safety of employees and adds to the organization's safety awareness.

RISK ASSESSMENT (cont'd)

The objective of the on-site emergency plan is to make maximum use of the combined resources of the factory and the outside services to:

i) Initially contain and ultimately bring the incident under control
ii) Minimize damage to property and environment
iii) Effective rescue and treatment of casualties
iv) Safeguard personnel in the premises (Profision of safe assembly points and escape route)
v) Provide information to relatives
vi) Identify any casualty
vii) Provide authoritative information to news/media
viii) Secure safe rehabilitation of affected areas
ix) Preserve relevant records and equipment for subsequent inquiry into the cause and circumstances of emergency

The on-site emergency plan relates to a laid-down procedure after taking care of all precautionary measures at the time of design-freezing and plant trial testing. The Operations General Manager would have the responsibility to implement this procedure manual. Implementation involves the following:

i) The Environment Management Division (EMD) would have separate group manned by only those persons, who are capable of keeping themselves unperturbed and cool during emergency. They would be fast in taking decision and implementation of the same.

ii) The command area, duties and responsibilities to the assigned person would be defined as -

   a) These key personnel of EMD would work as 'Works Incident Controller' for respective areas and one man as 'Works Main Controller'.

   b) These key personnel would be trained with various simulated cases, if necessary, and how the problems need to be tackled.

iii) EMD would be equipped with communication and public alarm system.

iv) Assessment of the size and nature of the events foreseen, its probability of occurrence and if happens, the advanced action plan.

v) Liaison with the outside local authorities including the emergency services.

vi) Rehearsing emergency procedures.

The most important task of these key personnel of the EMD is their quick assessment of the event and organising the resources within shortest possible time so that the event is taken under control immediately.

Emergency planning rehearsals and exercises should be monitored by the experienced persons from other factories or Factory Inspectorate, who can help in updating the emergency plan procedure.

ACCIDENT STATISTICS

The section of EMD dealing with Emergency would record the events of both minor and major accidents, listing all the details such as place, date & time, duration, probable cause, extent of damage, personnel affected, man-hours lost, medical assistance provided etc so as to analyse these data for drawing up necessary corrective measures.

SAFETY INSPECTIONS

Monthly safety inspection of all departments would be carried out by Health & Safety Department. Additionally, half-yearly Safety Audit is performed including all aspects of Occupational Health & Safety for all the areas

OFF-SITE EMERGENCY PLANNING

The off-site emergency plan is also an integral part of any major hazard control system. This particular plan relates to only those accidental events, which could affect people and the environment outside the plant boundary. Incidents, which would have very severe consequences, yet have a small probability of occurrence would be in this category.

RISK ASSESSMENT (cont'd)

The implementing authority of the off-site plan is the local authority and not the plant authority. But EMD would have a written document on how to ask for off-site plan implementation in case the consequence of any event escalates to such an extent that it goes beyond the plant authority's jurisdiction. Probability of such occurrence is though remote, but still there remains a probability.

The EMD would therefore have laid down procedure covering the following:

i) Identification of local authorities like civil defense, police, district collectors, their names, addresses and communication links.

ii) Details of availability and location of heavy duty equipment like bull dozers, fire-fighting equipment etc.

iii) Details of specialist agencies, firms and people upon whom it may be necessary to call.

iv) Details of voluntary organisation.

v) Meteorological information.

vi) Humanitarian arrangements like transport, evacuation centres, first aid, ambulance, community kitchen etc.

vii) Public information through media, informing relatives, public address system etc.

TESTING OF EMERGENCY PLANNING

The plant authority would test from time to time the efficacy of off-site emergency plan in conjunction with on-site emergency plan. One essential component of this mock drill is to see that whether procedures related to communication, mobilisation of equipment and overall co-ordination to face the crisis is in order or not.

RISK ASSESSMENT (cont'd)

DISASTER MANAGEMENT PLAN (DMP)

A disaster is a catastrophic event that causes serious injuries, loss of life & extensive damage to Plant & property. It is a situation which goes beyond the control of the available resource of any authority or organization. A number of factors could trigger accidents leading to a disaster, some of which are as follows: (a) Process and safety system failures - Technical errors - Human errors (b) Natural Calamities: earthquake, Tsunami etc.

The DMP is formulated with an aim of taking precautionary measures to control the hazard propagation and to take such action that the damage following a disaster is the minimum.

The objective of the DMP is to make use of the combined resources of the plant and the outside services to achieve the following:

i) Effective rescue and medical treatment of casualties
ii) Safeguard other people
iii) Minimize damage to property and the environment
iv) Initially contain and ultimately bring the incident under control
v) Identify any dead
vi) Provide for the needs of relatives
vii) Provide authoritative information to the news media
viii) Secure the safe rehabilitation of affected area
ix) Preserve relevant records and equipment for the subsequent inquiry into the cause and circumstances of the emergency.

In effect, DMP helps to optimize operational efficiency to rescue rehabilitation and render medical help and to restore normalcy.

The following hazards for disaster management have been considered:

i) Fire
ii) Explosion & Toxic release
iii) Oil spillage/liquid metal spillage
iv) Electrocution
v) Accident

RISK ASSESSMENT (cont'd)

These hazards and the events that can lead to these hazards have already been discussed in the preceding sections.

Few elementary disaster management measures to prevent disaster due to the above mentioned hazards are as follows:

i) Design, manufacture, operation and maintenance of all plant machineries/structures as per applicable national and international standards as laid down by statutory authority,

ii) Intelligent formulation of layout to provide 'Assembly Point' and safe access way for personnel in case of an hazardous event/disaster, as can be inferred from Risk & Consequence modeling.

iii) Proper emergency (both on site & off-site) preparedness plan, emergency response team, emergency communication, emergency responsibilities, emergency facilities, and emergency actions shall be developed.

iv) Proper Alarm system and training the personnel for appropriate response during disastrous situation.

v) Complete fire protection coverage for the entire plant as per regulatory stipulations.

vi) Creation and maintenance of Disaster Management cell with adequately trained personnel who can handle all sorts of emergency situation.

vii) Provision of funds for prevention of disaster, mitigation, capacity-building and preparedness.

It would be advisable to carry out a detail DMP at the design stage itself to frame a proper scheme for disaster management. However, this would be subjected to subsequent improvements as and when required for safe and efficient operation of the plan.