RISK ASSESSMENT

The outline of the proposed expansion 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 expansion project.

Environmental Risk Assessment

The safety and protection of people, equipment and the environment is a serious concern in the manufacturing industries. Steel Plants have also 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 force majeure:

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

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 appropriate design of the installation 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 deployment of area specific emergency plans 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 cordonning 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 reoccur.

**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 is so severe that it 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 high risk potential - including the potential for disastrous interactions of the various plant operational activities. The checklist, though
7 - Additional Studies (Cont’d)

not strictly speaking a Hazard and Operability Study (HAZOP), but
would facilitate a full scale HAZOP Study for final drawing up of
risk management measures when the ‘design-freeze’ stage
commences. The hazards identified for the proposed project
activities are presented in Table 7-1.

Table 7-1 - Hazard Identification of the Steel Plant

<table>
<thead>
<tr>
<th>Group</th>
<th>Item</th>
<th>Nature of Hazard</th>
<th>Hazard Potential</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw materials Management</td>
<td>Coal for coking</td>
<td>Fire</td>
<td>Moderate</td>
<td>Fire hazard</td>
</tr>
<tr>
<td></td>
<td>Water treatment chemicals like acids/alkalis</td>
<td>Toxic</td>
<td>Major</td>
<td>Bio-corrosive</td>
</tr>
<tr>
<td></td>
<td>Lube oils/greases</td>
<td>Fire</td>
<td>Moderate</td>
<td>Flammable</td>
</tr>
<tr>
<td>Production units</td>
<td>Dusts and fumes</td>
<td>Asphyxiation</td>
<td>Moderate</td>
<td>Air pollution</td>
</tr>
<tr>
<td></td>
<td>VOC emissions from battery</td>
<td>Toxic</td>
<td>Major</td>
<td>Health hazard</td>
</tr>
<tr>
<td></td>
<td>Coke oven gas</td>
<td>Fire &amp; Toxic</td>
<td>Major</td>
<td>Fire and CO hazard</td>
</tr>
<tr>
<td></td>
<td>Tar</td>
<td>Fire &amp; Toxic</td>
<td>Moderate</td>
<td>Flammable</td>
</tr>
<tr>
<td>Agglomeration</td>
<td>Dusts</td>
<td>Respiratory</td>
<td>Moderate</td>
<td>Air pollution</td>
</tr>
<tr>
<td>Iron making in BF</td>
<td>Release of untreated wastewater</td>
<td>Toxic</td>
<td>Major</td>
<td>Severe pollution of surface water</td>
</tr>
<tr>
<td></td>
<td>BFG handling</td>
<td>Fire</td>
<td>Major</td>
<td>Fire hazard</td>
</tr>
<tr>
<td></td>
<td>Hot metal &amp; slag Handling</td>
<td>Heath</td>
<td>Major</td>
<td>Fire hazard</td>
</tr>
<tr>
<td>Steel making in LD shops</td>
<td>Release of untreated wastewater</td>
<td>Toxic</td>
<td>Major</td>
<td>Severe pollution of surface water</td>
</tr>
<tr>
<td></td>
<td>LD gas handling</td>
<td>Fire</td>
<td>Major</td>
<td>Fire &amp; CO hazard</td>
</tr>
<tr>
<td></td>
<td>Hot liquid steel &amp; slag handling</td>
<td>Heath</td>
<td>Major</td>
<td>Fire hazard</td>
</tr>
<tr>
<td>Rolling Mills</td>
<td>Gas firing</td>
<td>Fire</td>
<td>Major</td>
<td>Fire hazard</td>
</tr>
<tr>
<td></td>
<td>Release of untreated Waste water</td>
<td>Toxic</td>
<td>Major</td>
<td>Severe pollution of surface water</td>
</tr>
<tr>
<td>Captive Power Plant</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Utilities</td>
<td>Fuel gas</td>
<td>Gas leaks</td>
<td>Fire &amp; Toxic</td>
<td>Major</td>
</tr>
<tr>
<td></td>
<td>Electric Power supply</td>
<td>Short circuit</td>
<td>Fire</td>
<td>Major</td>
</tr>
<tr>
<td></td>
<td>Liquid fuel</td>
<td>Fuel handling &amp; storage area</td>
<td>Fire &amp; Toxic</td>
<td>Major</td>
</tr>
<tr>
<td></td>
<td>Hydraulic oil and lubricants</td>
<td>Accidental discharge of hydraulic oil under pressure</td>
<td>Fire &amp; Toxic</td>
<td>Moderate</td>
</tr>
</tbody>
</table>
7 - Additional Studies (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.

**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 the 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. An Environmental Qualitative Risk Analysis Flow Chart Procedure is depicted in Fig. 7-1.
Environmental Risk Qualitative Analysis Flow sheet

- Determination of 'Likelihood of Occurrence'
- Determination of 'Likelihood of Detection'
- Determination of 'Severity of Consequence'

These three parameters are combined in a 'Risk matrix' to evaluate Risk potential, which determines the overall assessment of the risk that poses threats to the various elements of the environment.

Evaluation of Risk potential helps to rank the risks, so that the management actions can be developed to address the significant risks appropriately.

Fig 7-1 - Environmental Risk Qualitative Analysis Flow sheet
7 - Additional Studies (Cont’d)

As revealed in the Fig. 7-1, the relative risk potential analysis is made on the following three factors using a P/I (Probability/Impact) analysis methodology:

- likelihood of occurrence
- likelihood of detection
- 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 in Table 7-2 below.

Table 7-2 - Determination of Risk Potential

<table>
<thead>
<tr>
<th>(A) Likelihood of occurrence</th>
<th>(B) Likelihood of detection</th>
<th>(C) Severity of consequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criteria</td>
<td>Rank</td>
<td>Criteria</td>
</tr>
<tr>
<td>Very High</td>
<td>5</td>
<td>Very High</td>
</tr>
<tr>
<td>High</td>
<td>4</td>
<td>High</td>
</tr>
<tr>
<td>Moderate</td>
<td>3</td>
<td>Moderate</td>
</tr>
<tr>
<td>Low</td>
<td>2</td>
<td>Low</td>
</tr>
<tr>
<td>Very Low</td>
<td>1</td>
<td>Very Low</td>
</tr>
</tbody>
</table>

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

Based on the Table 7-2 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 the likely consequence. A summarised list of environmental risk potential for the likely events is presented in Table 7-3.

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.
### Table 7-3 - Environmental Risk Potential Evaluation

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

From the Table 7-3, it is evident that some events carry a risk potential greater than 50. These would be considered as hazardous events, where effective safe-design for operation and maintenance is highly essential to reduce the risk.

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 by the suppliers. For these areas, ‘Fault Tree Analysis’ of the failure/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 is an important aspect with regards to risk analysis of the project. The safety during construction would be prescribed as follows:

- Ensure that all employees and contract workers are well versed with the thorough 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.

- 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.

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

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

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

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

- Arrange display signs for restricted area.

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

- Arrange clear demarcation of passage within Construction area with proper safety arrangements.

- Adequate information about emergency numbers shall be displayed everywhere. There would be emergency control room, emergency controller and shift emergency controller to take proper control of any unwanted situation and have an overall control.
7 - Additional Studies (Cont’d)

- 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.

- Developing ‘Dos’ & ‘Don’ts’ during various types of works like working at heights, etc.

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 the adoption of best safety practice at respective construction zones within the Works boundary. In addition, the design and engineering of the proposed facilities will take into consideration proposed protection measures for releases to air, land 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.

**Fire Prevention:** In addition to the yard fire hydrant system, each individual shop and offices are provided with fire and smoke detection alarm system along with the portable fire extinguishers. Fire detection system would be interlocked with automated water sprinklers. TSL have an on-site full fledged fire brigade department with 13 fire tenders which also provide the services to the town in emergency situations.
**CO detection and prevention:** TSL have installed more than 1000 carbon monoxide detectors/alarms to detect the presence of carbon monoxide (CO) and sounds an alarm to alert personnel in case there is CO concentration beyond 50 ppm. The plant personnel always carry a portable CO detector as part of their personal protective equipment.

**On-Site Emergency Plan**

Emergency planning is an integral part of the environment and safety management of TSL. Emergencies may arise due to manmade reasons and/or natural causes resulting in fire, explosion, failure of critical control system, 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. Tata Steel already has a comprehensive Onsite Emergency Plan which is approved by the Chief Inspector of Factories, Ranchi, Jharkhand vide their letter No. 42 dtd. 29/01/2013 this is appended in Appendix 7-1.

**Accident Statistics**

The safety and ergonomics department deals with emergency records, 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 to analyse these data for drawing up necessary corrective measures.

**Safety Inspections**

Monthly safety inspection of all departments is carried out by the respective Department. Additionally, half-yearly Environmental, Health and Safety Audit is performed including all aspects of Environment, 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.

The implementing authority of the off-site emergency plan is the local public administration. Although TSL will ask for an off-site plan implementation in case the consequence of any on-site event escalating to such an extent that it goes beyond the plant authority’s jurisdiction.

TSL emergency preparedness and disaster management plan covers the following:

i) Identification of local authorities like civil defense, police, district commissioner, 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, and stakeholders 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 and communication through media, informing relatives, public address system etc.

Testing of emergency planning

The plant authority will regularly test the effectiveness of on-site emergency plan. An essential component of this is a mock drill to test whether procedures related to communication, mobilisation of equipment and overall co-ordination to face the incident are effective.
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 that goes beyond the control of the available resource of any authority or organization. A number of factors could trigger accidents leading to a disaster, e.g. process and safety system failures (technical errors, human errors), 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 minimized and controlled.

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

- Effective rescue and medical treatment of casualties
- Safeguard other people
- Minimize damage to property and the environment
- Initially contain and ultimately bring the incident under control
- Identify any dead
- Provide for the needs of relatives
- Provide authoritative information to the news media
- Secure the safe rehabilitation of affected area
- 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.
7 - Additional Studies (Cont’d)

The following hazards for disaster management have been considered:

- Fire
- Explosion & Toxic release
- Oil spillage/liquid metal spillage
- Electrocution
- Accident

These hazards and potential causes have already been discussed in the preceding sections. A selective disaster management measures to prevent disaster due to the above mentioned hazards are as follows:

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

- Intelligent formulation of layout to provide ‘Assembly Point’ and safe access way for personnel in case of a hazardous event/disaster, as can be inferred from Risk & Consequence modeling.

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

- Proper Alarm system and training the personnel for appropriate response during disastrous situation.
- Complete fire protection coverage for the entire plant as per regulatory stipulations.

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

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

Disaster Management Institute, Bhopal had already carried out a detail DMP for Tata Steel Works to provide an effective plan for disaster management.