Chapter– 6

Additional Studies

(Risk Assessment and Disaster Management Plan)

6.1 Risk Assessment

6.1.1 Introduction -

Risk assessment is a methodology to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability that could pose a potential threat or harm to people, property, livelihoods and the environment on which they depend.

Risks are inherent in proposed thermal power plant operations since they involve working with

- High pressure super-heaters, re-heaters, economizer units exchanging heat with the hot flue gases
- Turbines that utilize the HP steam to generate power
- Fuel oil handling units
- Hydrogen as a coolant in turbo generators drawn from hydrogen cylinders
- Switchyard including transformers, isolators

Nevertheless, a properly designed and operated plant will have a very low probability (to a level of acceptable risk) of accident occurrence. Subsequently, a properly designed and executed management plan can further reduce the probability of any accident turning into an on-site emergency and/or an off-site emergency.

The three main goals of risk assessment are

- identify risks,
- quantify the impact of the potential threats and
- provide an economic balance between the impact of risk and the cost of the safeguard

6.1.2 Salient Feature of Risk Mitigation-

- Design, manufacture and construction of buildings, plant and machineries will be as per National and International Codes as applicable in specific cases and laid down by statutory authorities
- Provision of adequate access ways for movement of equipment and personnel will be made
- Minimum of two numbers of gates for escape during disaster will be provided
- In the vicinity of main plant entrance, there will be an emergency assembly point where plant personnel will assemble in the event of any disaster.
- Adequate numbers of Fire Fighting equipments & Fire extinguishers will be installed in the work places for emergency purpose and the Supervisors / Workers will be trained to use the equipments.
- An ambulance will be provided in the factory premises.
- A qualified Doctor and a compounder will be employed for attending to any emergency.

6.1.3 Identification of Risks

For identification of risk due to proposed thermal power plant, it requires in depth study of

- Raw material
- Process Risk
- Storages
- Operations
- Maintenance
- Safety
- Fire protection
- Effluent disposal

a) Risk: Raw material

Particulars: Availability of sugar cane for crushing

The sugarcane requirement of the Indian Sugar Limited at 5000 TCD would be hardly 26 % of the currently available sugarcane of Madha Tehsil alone and sugarcane from nearby Tehsil like Barshi, Mohol, Karmala Pandharpur etc. shall be additional available of raw material. No additional sugarcane will be required for the ISMCL-2 plant operation.

b) Risk: Boiler, turbine, generator and associated areas

Particular: Failure of safety devices, including pressure relief valves and interlocks
Ensuring pressure relief valves and interlocking arrangements as per standard design of equipment. Regular inspection and periodic safety certification of all safety devices. Compliance with required rules and regulations for safety systems.

c) Risk: Potential exposure to electricity

Particular: Entire power plant, specifically the generator area, distribution panel, and control rooms
Follow up of standard operating procedures and regular training on electrical safety. Ensure suitability and adaptability of electrical equipment with respect to classified hazardous areas and protection against lightening protection and static charges. Adopting preventive maintenance practices as per testing and inspection schedules. Ensure all maintenance and repair jobs with prior work permit system. Use of personal protective equipment and ensuring compliance of the Indian Electricity Rules, 2003. Ensure all electrical circuits designed for automatic, remote shut down.

d) Risk: Fire incident

Particular: Entire power plant, specifically the Storage area, electrical wearing and fuel handling area.

Follow up of standard operating procedures and regular training on fire fighting Mock drills of fire fighting .Installation of fire alarm & proper fire extinguisher. Ensure suitability and adaptability of electrical equipment with respect to classified hazardous areas and protection against lightening protection and static charges. Adopting preventive maintenance practices as per testing and inspection.

e) Risk: Effluent Disposal

Particular: Ash generated from cogeneration plant, solid and effluent generated from sugar and Ethanol plant.

Standard operating procedures for disposal of ash need to follow like Isolated disposal of hot ash inside the plant premises, use ash for land filling, brick & cement manufacturing. Effluent will be treated as per regulatory norms and treated water will be reused. Solid organic waste will be used bio composting to produce fertilizer. Regular monitoring will be carried out as per schedule to avoid any kind of pollution

f) Risk: Health Risk

Particular: Exposure to toxic and corrosive chemicals

Provision of secondary containment system for all liquid corrosive chemicals fuel and lubricating oil storages. Constructing storage tanks and pipes for toxic chemicals and fuel oil as per the applicable standards. Inspection and radiography will follow to minimize risk of tank or pipeline failure. Provision of protective equipment such as

protective clothing and goggles, safety shoes, and breathing masks for workers working in chemical storage and handling areas. Provision of emergency eyewash and showers in the working area.

g) Risk: Safety risk

Particular: Ensure Worker Safety

Periodical SHE training of staff and contractor. Ensuring special training to develop competent persons to manage specific issues such as safety from the system, risk assessment, scaffolding, and fire protection, Training will include the proper use of all equipment operated, safe lifting practices, the location and handling of fire extinguishers, and the use of personal protective equipment. Ensure good housekeeping practices (e.g., keeping all walkways clear of debris, cleaning up oil spots and excess water as soon as they are noticed, and regular inspection and maintenance of all machinery). Daily collection and separate storage of hazardous and non-hazardous waste.

h) Risk: Force Majeure and Insurance coverage to the Project

Particular: Natural calamities like flood, earthquake, fire, and other act of God and Act of Man etc.

Mitigation: Complete plant need to be insured and also care has been considered while designing and construction of the plant to minimize the impact.

Third party Liability, Workers compensation, Employers Liability, Legal and contractual liabilities, Loss of profit due to interruption due to fire machine, break down, and related perils, Loss of profit due to loss of generation are some of the other risk against which the mitigation measures has been considered in the project by the way of insurance.

i) Risk: Transportation and Storage of Ethanol

Particular: The release of Ethanol from the pipe line over the ground from the land point to the storage terminal, storage tank failure during transportation is all the possible scenarios

Mitigation: Providing flame arrestors on the top of all the storage tanks. Flame proof fitting to all the systems which handles the alcohol. Transfer of alcohol is by pipes only. All the lightings are of flame proof. Water sump with a holding capacity. Foam Extinguishers inside the warehouse. Flame arresters' will be provided in gas lines to protect the digester from back fire from the flame and / or the boiler burner. Over / under pressure release device will be provided on biogas digester for it's safety from over pressure / vacuum.

6.1.4 Additional Risk & Mitigation

a) Risk: Performance risk

Particular: Ensured sugar cane & fuel availability

Mitigations: Sound cane development program planned, with appointment of experienced senior professionals and staff for the purpose. Biomass depots, trash bailers and entrepreneurship development / contracts with biomass traders proposed. A full time fuel manager and dedicated staff has been proposed for the cogen power plant.

b) Risk: Marketing risk

Particular: Sugar / Ethanol sale / export power trade

Mitigates: Firm marketing tie ups in offing for sugar & export power sale. Alternative marketing channels explored. Own consumption of Ethanol. Urgent follow up & securing permissions from Government of Bihar / BERC for export power trade, ethanol price subsidy & capital grants.

c) Risk: Regulatory risk

Particular: Conversion / clearances / tariff order

Mitigates: No difficulty envisaged, as various governmental agencies have already expressed their willingness to issue approvals / consents. All the approvals in pipeline. Regulatory process being initiated at BERC will ensure conducive tariff order allowing sale of exportable power to power traders.

d) Risk: Financial risk

Particular: Financial viability of the project

Mitigates: Satisfactory DSCR, IRR & pay back. Equity participation & term loans from FIs / SDF being arranged. Sensitivity analysis indicates fairly satisfactory 'Margin of Safety'

6.2 Disaster Management Plan (DMP)

6.2.1 Disasters

A disaster is a catastrophic situation in which suddenly, people are plunged into helplessness and suffering and, as a result, need protection, clothing, shelter, medical and social care and other necessities of life.

Disasters can be divided into two main groups. In the first, are disasters resulting from natural phenomena like earthquakes, volcanic eruptions, storm surges, cyclones, tropical storms, floods, avalanches, landslides, forest - fires. The second group includes disastrous events occasioned by man, or by man's impact upon the environment. Examples are armed conflict, industrial accidents, radiation accidents, factory fires, explosions and escape of toxic gases or chemical substances, river pollution, mining or other structural collapses, air, sea, rail and road transport accidents and can reach catastrophic dimensions in terms of human loss.

There can be no set criteria for assessing the gravity of a disaster, since this depends to a large extent on the physical, economic and social environment in which it occurs. However, all disasters bring in their wake similar consequences that call for immediate

action, whether at the local, national or international level, for the rescue and relief of the victims. This includes the search for the dead and injured, medical and social care, removal of the debris, the provision of temporary shelter for the homeless, food, clothing and medical supplies, and the rapid re-establishment of essential services.

6.2.2 Objectives of DMP

The DMP is aimed at ensuring safety of life, protection of environment, protection of installation, restoration of production and salvage operations in this same order of priorities. For effective implementation of the DMP, it should be widely circulated and personnel training should be provided through rehearsals/drills.

The DMP should reflect the probable consequences of the undesired event due to deteriorating conditions or through 'Knock on' effects. Further the management should be able to demonstrate that their assessment of the consequences uses good supporting evidence and is based on currently available and reliable information, incident data from internal and external sources and if necessary the reports of outside agencies.

To tackle the consequences of a major emergency inside the factory or immediate vicinity of the factory, a DMP has to be formulated

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

1. Effect the rescue and medical treatment of casualties;
2. Safeguard other people;
3. Minimise damage to property and the environment;
4. Initially contain and ultimately bring the incident under control;
5. Identify any dead;
6. Provide for the needs of relatives;

7. Provide authoritative information to the news media;
8. Secure the safe rehabilitation of affected area;
9. Preserve relevant records and equipment for the subsequent inquiry into the cause and circumstances of the Emergency.

In effect, it is to optimise operational efficiency to rescue, rehabilitate and render medical help and to restore normalcy.

6.2.3 On Site Emergency Plan

6.2.3.1 General, Industrial, Emergencies

The emergencies that could be envisaged in the plant are as follows:

1. A situation of fire at the storage areas involving chemical storages;
2. Structural failures;
3. Sabotage/Social disorder.

6.2.4 Specific Emergencies Anticipated and Their Possible Mitigation Measures

6.2.4.1 Leakage from Ethanol storage

Ethanol and diesel storage will be monitored for even minor leakages. Anybody noticing leakage from any storage shed, should immediately inform concerned officer on duty. In case of minor leakage, it is attended by suitable fire protection equipments. If the leakage is heavy, higher officers are informed immediately. For avoiding any kind of fire incident leakages inside the factory premises, the following safety measures have to be undertaken:

- Safety Equipment
    1. Fire extinguisher
    2. Fire detectors
    3. Fire Alarm

The detailed on-site precautions to be taken while handling different emergency situations have already been depicted in PHA.

6.2.5 Off-Site Emergency Preparedness Plan

The task of preparing the Off-Site Emergency Plan lies with the District Collector. However, the off-site plan could be prepared with the help of the local district authorities. The proposed plan would be based on the following guidelines.

6.2.5.1 Introduction

Off-site emergency plan follows the on-site emergency plan. When the consequences of an emergency situation go beyond the plant boundaries, it becomes an off-site emergency. Off-site emergency is essentially the responsibility of the public administration. However, the factory management should provide the public administration with the technical information relating to the nature, quantum and probable consequences on the neighbouring population.

The off-site plan in detail should be based on those events, which are most likely to occur, but other less likely events, which have severe consequence, should also be considered. Incidents which have very severe consequences yet had a small probability of occurrence should also be considered during the preparation of the plan. However, the key feature of a good off-site emergency plan is flexibility in its application to emergencies other than those specifically included in the formation of the plan.

The roles of the various parties who will be involved in the implementation of an off-site plan are described below. Depending on local arrangements, the responsibility for the off-site plan should either rest with the works management or, with the local authority. Either way, the plan should identify an emergency co-ordination officer, who would take

the overall command of the off-site activities. As with the on-site plan, an emergency control centre should be set-up within which the emergency co-ordination officer can operate.

An early decision will be required in many cases on the advice to be given to people living within the range of the accident.

a) In the case of a major fire but without explosion risk, houses close to the fire only are likely to need evacuation, although a severe smoke hazard may require this to be reviewed periodically;
b) If a fire is escalating and in turn threatening a store of hazardous material, it might be necessary to evacuate people nearby, but only if there is time; if insufficient time exists, people should be advised to stay indoors and shield themselves from the fire. This latter case particularly applies if the installation at risk could produce a fireball with severe thermal radiation effects.
c) For release or potential release of toxic materials, limited evacuation may be appropriate down wind if there is time. The decision would depend partly on the type of housing "at risk". Conventional housing of solid construction with windows closed offers substantial protection from the effects of a toxic cloud, while shanty house, which can exist close to factories, offer little or no protection.

Although the plan will have sufficient flexibility built in to cover the consequences of the range of accidents identified for the on-site plan, it will cover in some detail the handling of the emergency to a particular distance from each major hazard works.

6.2.6 Aspects Proposed To Consider In Off-Site Emergency Plan

The main aspects, which should be included in the emergency plan, are:

- Organization
  - Details of command structure, warning systems, implementation procedures, emergency control centers.

- Names and appointments of the incident controller, site main controller, their deputies and other key personnel.

- Communications

Identification of personnel involved, communication centre, call signs, network and list of telephone numbers.

- Specialized Knowledge

Details of specialist bodies, firms and people upon whom it may be necessary to call e.g. those with specialised chemical knowledge, laboratories.

- Voluntary Organizations

Details of organizers, telephone numbers, resources etc.

- Chemical Information

Details of the hazardous substances stored or procedure on each site and a summary of the risk associated with them.

- Meteorological Information

Arrangements for obtaining details of whether conditions prevailing at the time and whether forecasts.

- Humanitarian Arrangements

Transport, evacuation centres, emergency feeding treatment of injured, first aid, ambulances, and temporary mortuaries.

- Public Information

Arrangements for a] dealing with the media press office; b] informing relatives, etc.

- Assessment

Arrangements for: (a) collecting information on the causes of the emergency; (b) reviewing the efficiency and effectiveness of all aspects of the emergency plan.

6.2.7 Role of the Emergency Co-ordination Officer (ECO)

The ECO should co-ordinate various emergency services. The ECO should co-ordinate closely with the site main controller. Again depending on local arrangements, for very severe incidents with major or prolonged off-site consequences, the external control

should be passed to a senior local authority administrator or even an administrator appointed by the central or state government.

6.2.8 Role of the Local Authority

The duty to prepare the off-site plan lies with the local authorities. The emergency planning officer (EPO) appointed should carry out his duty in preparing for a whole range of different emergencies within the local authority area.

It will be the responsibility of the EPO to ensure that all those organisations which will be involved off site in handling the emergency, know of their role and are able to accept it by having for example, sufficient staff and appropriate equipment to cover their particular responsibilities. Rehearsals for off-site plans should be organised by the EPO.

6.2.9 Role of Police

Formal duties of the police during an emergency include protecting life and property and controlling traffic movements.

Their functions should include controlling bystanders, evacuating the public, identifying dead, dealing with casualties, and informing relatives of death or injury.

6.2.10 Role of Fire Authorities

The control of a fire should normally be the responsibility of the senior fire brigade officer who would take over the handling of the fire from the site incident controller on arrival at the site. The senior fire brigade officer should also have a similar responsibility for other events, such as explosions and toxic release. Fire authorities in the region should be appraised about the location of all stores of flammable materials, water and foam supply points, and fire-fighting equipment. They should be involved in on-site emergency rehearsals both as participants and, on occasion, as observers of exercises involving only site personnel.

6.2.11 Role of Health Authorities

Health authorities, including doctors, surgeons, hospitals, ambulances, and so on, should have a vital part to play following a major accident, and they should form an integral part of the emergency plan. For major fires, injuries should be the result of the effects of thermal radiation to a varying degree, and the knowledge and experience to handle these in all but extreme cases may be generally available in most hospitals. Injuries should be the result of the effects of thermal radiation to a varying degree, and the knowledge and experience to handle this in all but extreme cases may be generally available in most hospitals. For major toxic releases, the effects vary according to the chemicals in question. The health authorities should be appraised about the likely toxic releases from the plant, which will unable then in dealing with the aftermath of a toxic release.

Major off-site incidents are likely to require medical equipment and facilities additional to those available locally, and a medical " mutual aid " scheme should exist to enable the assistance of neighbouring authorities to be obtained in the event of an emergency

6.2.12 Role of Government Safety Authority

There will be the factory inspectors available in the region. They may wish to see well-documented procedures and evidence of exercise undertaken to test the plan.

In the event of an accident, local arrangements regarding the role of the factory inspector will apply. These may vary from keeping a watching brief to a close involvement in advising on operations. In cases where toxic gases may have been released, the factory inspectors may be the only external agency with equipment and resources to carry out tests.

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