Risk Assessment

Hazard analysis involves the identification and quantification of various hazards (unsafe conditions) that exist in the plant. On the other hand, risk analysis deals with the identification and quantification of risks, the Mining equipment and personnel are exposed to, due to accidents resulting from the hazards present in the Mine.
Risk analysis follows an extensive hazard analysis. It involves the identification and assessment of risks the neighboring populations are exposed to as a result of hazards present. This requires a thorough knowledge of failure probability, credible accident scenario, vulnerability of populations etc. Much of this information is difficult to get or generate. Consequently, the risk analysis is often confined to maximum credible accident studies.
In the sections below, the identification of various hazards, probable risks in the plant, maximum credible accident analysis and consequence analysis are addressed which gives a broad identification of risks involved in the Mining. Based on the risk estimation, disaster management plan has also been prepared.

Approach to the Study

Risk involves the occurrence or potential occurrence of some accidents consisting of an event or sequence of events. The risk assessment study covers the following:

- Identification of potential hazard areas;
- Identification of representative failure cases;
- Visualization of the resulting scenarios in terms of fire (thermal radiation) and explosion;
- Assess the overall damage potential of the identified hazardous events and the impact zones from the accidental scenarios;
- Assess the overall suitability of the site from hazard minimization and disaster mitigation point of view;
- Furnish specific recommendations on the minimization of the worst accident possibilities; and
- Preparation of broad Disaster Management Plan (DMP), On-site and Off-site Emergency Plan, which includes Occupational Health and Safety plan.

Disaster Management Plan

Introduction

Disaster Management Plan for an industrial unit is necessarily a combination of various actions which are to be taken in a very short time but in a pre-set sequence to deal effectively and efficiently with any disaster, emergency or major accident with an aim to keep the loss of men, material, plant/machinery etc., to the minimum.

Creation and establishment of a cell within the industrial unit is a pre-requisite for an effective implementation of any disaster management plan. The main functions of the disaster management cell are to prepare a detailed disaster management plan, which includes:

- Identification of various types of expected disasters depending upon the type of the industrial unit;
- Identification of various groups, agencies, departments etc. necessary for dealing with a specific disaster effectively;
- Preparation - by intensive training - of relevant teams/groups within the organization to deal with a specific disaster and keep them in readiness;
- Establishment of an early detection system for the disasters;
- Development of a reliable instant information/communication system; and
- Organization and mobilization of all the concerned departments/
- Organizations/ groups and agencies instantly when needed.

Emergency Action Plan

The emergency action plan consists of:

- First information;
- Responsibilities of work incident controller;
- Responsibilities of chief incident controller;
- Responsibilities for declaration of emergency;
- Responsibilities for emergency communication officer;
- Responsibilities of key personnel;
- Responsibilities and action to be taken by essential staff and various teams during emergency; and
- Responsibilities for all clear signal.

First Information

The first person who observes/identities the emergencies shall inform by shouting and by telephone to the shift engineer and fire station about the hazard. The shift engineer will inform to works incident controller, chief incident controller and also telephone operator, who shall communicate it to all key personnel.

Responsibilities of Work Incident Controller (WIC)

The work incident controller on knowing about an emergency immediately will rush to the incident site and take overall charge and inform the same to chief incident controller (CIC). On arrival, he will assess the extent of emergency and decide if major emergency exists and inform the communication officer accordingly.

Responsibilities of Chief Incident Controller (CIC)

The manager, who is also the chief incident controller, will assume overall responsibilities for the plant/storage site and its personnel in case of any emergency. His responsibilities are to:

1. Assess the magnitude of the situation and decide if staff needs to be evacuated from their assembly point to identified safer places. Declare onsite/off site emergency;
2. Exercise direct operational control over areas other than those affected;
3. Undertake a continuous review of possible developments and assess in consultation with key personnel as to whether shutting down of the plant or any section of the plant and evacuation of personnel are required;
4. Laison with senior officials of police, fire brigade, medical and factories inspectorate and provide advice on possible effects on areas outside the plant premises;
5. Look after rehabilitation of affected persons on discontinuation of emergency; and
6. Issue authorized statements to news media, and ensures that evidence is preserved for enquiries to be conducted by the statutory authorities.

Responsibilities for Declaration of Major Emergency

It is important to make the emergencies known to everyone in the Mine area. The major emergency will be made known to everyone inside the mine by sounding the alarm. Separate alarms to warn different types of major emergencies such as fire and explosion or toxic gas escape are provided. Public address system is also available throughout the mine area. Announcement will be made by the concerned official/interpreter in local language.
Similarly, announcement for termination of the emergency will also be announced.

Responsibilities of Emergency Communication Officer (ECO)

On hearing the emergency alarm he will proceed to Emergency Control Center. He will

- Report to Chief Incident Controller (CIC) and Work Incident Controller (WIC) and maintain contact with them;
- On information received from the WIC of the situation, recommending if necessary, evacuate the staff from the assembly points;
- Identify suitable staff to act as runners or messengers who are listed in the Essential staff, between him and the Works Incident Controller if the telephone and other system of communication fail due to any reason;
- Maintain inventory of items in the emergency control center;
- Contact local meteorological office to receive early notification of changes in weather condition in case of gas leak and prolonged action;
- Maintain a log of incidents;
- Keep in constant touch with happenings at the emergency site and with WIC;
- Liaise with neighbor fire brigade, hospital, civil and police authorities on advice from CIC.

Emergency Facilities

Emergency Control Center (ECC)

For the time being, Office Block is identified as Emergency Control Center. It would have external Telephone, Fax, Telex facility. All the Site Controller/ Incident Controller Officers,

Senior Personnel would be located here. Also, it would be an elevated place. The following information and equipment are to be provided at the Emergency Control Center (ECC).

- Intercom, telephone;
- P and T telephone;
- Safe contained breathing apparatus;
- Fire suit/gas tight goggles/gloves/helmets;
- Hand tools, wind direction/velocities indications;
- Public address megaphone, hand bell, telephone directories;
- (internal, P and T) mine area layout, site plan;
- Emergency lamp/torch light/batteries;
- Plan indicating locations of hazard inventories, plant control room, sources of safety equipment, work road plan, assembly points, rescue location vulnerable zones, escape routes;
- Hazard chart;
- Emergency shut-down procedures;
- Nominal roll of employees;
- List of key personnel, list of essential employees, list of Emergency Coordinators;
- Duties of key personnel;
- Address with telephone numbers and key personnel, emergency coordinator, essential employees; and
- Important address and telephone numbers including Government agencies, neighboring industries and sources of help, outside experts, chemical fact sheets population details around the mining area

Assembly Point

Number of assembly depending upon the plant location would be identified wherein employees who are not directly connected with the disaster management would be assembled for safety and rescue. Emergency breathing apparatus, minimum facilities like water etc. would be organized. In view of the size of plant, different locations are ear marked as assembly points. Depending upon the location of hazard, the assembly points are to be used.

Emergency Medical Facilities

Stretchers, gas masks and general first aid materials for dealing with minor & major injuries etc. would be maintained in the medical center as well as in the emergency control room. Private medical practitioners help would be sought. Government hospital would be approached for emergency help. Breathing apparatus and other emergency medical equipment would be provided and maintained. The help of nearby industrial management's in this regard would take on mutual support basis.

An ambulance with driver availability in all the shifts, emergency shift vehicle would be ensured and maintained to transport injured or affected persons. Number of persons would be trained in first aid so that, in every shift first aid personnel would be available.

Emergency Warning

Communication of emergency would be made familiar to the personnel inside the mine area and people outside. An emergency warning system would be established.

Evacuation of Personnel

There could be more number of persons in the storage area and other areas in the vicinity. The area would have adequate number of exits, stair cases. In the event of an emergency, unconnected personnel have to escape to assembly point. Operators have to take emergency shutdown procedure and escape. Time Office maintains a copy of deployment of employees in each shift, at ECC. If necessary, persons can be evacuated by rescue teams. Also, at the end of an emergency, after discussing with Incident Controllers and Emergency coordinators, the Site Controller orders an all clear signal. When it becomes essential, the Site Controller communicates to the District Emergency Authority, Police, and Fire Service personnel regarding help required or development of the situation into an Off-Site Emergency.

Mock Drills

Emergency preparedness is an important aspect in the planning of Industrial Disaster Management. Personnel would be trained suitably and prepared mentally and physically in emergency response through carefully planned, simulated procedures. Similarly, the key personnel and essential personnel shall be trained in the operations.

Important Information

Once the plant goes into stream, important information such names and addresses of key personnel, essential employees, medical personnel, out side the mine area, transporters address, address of those connected with Off Site Emergency such as Police, Local Authorities, Fire Services, District Emergency Authority shall be prepared and maintained.

Off-Site Emergency Preparedness Plan

The task of preparing the Off-Site Emergency Plan lies with the district collector; however the off-site plan will be prepared with the help of the local district authorities. The proposed plan will be based on the following guidelines.

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

management will provide the public administration with the technical information relating to the nature, quantum and probable consequences on the neighboring population.

The off-site plan in detail will be based on those events, which are most likely to occur, but other less likely events, which have severe consequence, will also be considered. Incidents, which have very severe consequences yet have a small probability of occurrence, shall 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 offsite plan are described below. Depending on local arrangements, the responsibility for the off-site plan shall be either rest with the works management or, with the local authority. Either way, the plan shall identify an emergency co-coordinating officer, who would take the overall command of the off-site activities. As with the on-site plan, an emergency control center shall be setup within which the emergency co-coordinating officer can operate.

An early decision will be required in many cases on the advice to be given to people living **"within range"** of the accident - in particular whether they shall be evacuated or told to go indoors. In the later case, the decision can regularly be reviewed in the event of an escalation of the incident. Consideration of evacuation may include the following factors:

- In the case of a major fire but without explosion risk (e.g. oil storage tank), only houses close to the fire are likely to need evacuation, although a severe smoke hazard may require this to be reviewed periodically; and
- 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 shall 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 very severe thermal radiation effects.

Occupational Health and Safety

Large industries, in general where multifarious activities are involved during construction, erection, testing, commissioning, operation and maintenance, the men, materials and machines are the basic inputs. Along with the boons, the industrialization generally brings several problems like occupational health and safety. The industrial planner, therefore, has to properly plan and take the steps to minimize the impacts of industrialization and to ensure appropriate occupational health, safety including fire plans. All these activities again may be classified under construction and erection, and operation and maintenance.

Safety Plan

Safety of both men and materials during construction and operation phases is of concern. The preparedness of an industry for the occurrence of possible disasters is known as emergency plan. The disaster in proposed plant is possible due to leakage of fuels,

collapse of structures and fire/explosion etc. Keeping in view the safety requirement during construction, operation and maintenance phases, the plant shall formulate safety policy with the following regulations:

- To allocate sufficient resources to maintain safe and healthy conditions of working environment;
- To take steps to ensure that all known safety factors are taken into account in the design, construction, operation and maintenance of plants, machinery and equipment;
- To ensure that adequate safety instructions are given to all employees;
- To provide wherever necessary protective equipment, safety appliances and clothing and to ensure their proper use;
- To inform employees about materials, equipment or processes used in their work, which are known to be potentially hazardous to health or safety;
- To keep all operations and methods of work under regular review for making
- necessary changes from the point of view of safety in the light of experience and upto date knowledge;
- To provide appropriate facilities for first aid and prompt treatment of injuries and illness at work;
- To provide appropriate instruction, training, retraining and supervision to
- employees in health and safety, first aid and to ensure that adequate publicity is given to these matters;
- To ensure proper implementation of fire prevention methods and an appropriate fire fighting service together with training facilities for personnel involved in this service;
- To organize collection, analysis and presentation of data on accident, sickness and incident involving personal injury or injury to health with a view to taking corrective, remedial and preventive action;
- To promote through the established machinery, joint consultation in health and safety matters to ensure effective participation by all employees;
- To publish/notify regulations, instructions and notices in the common language of employees;
- To prepare separate safety rules for each types of occupation/processes involved in a project; and
- To ensure regular safety inspection by a competent person at suitable intervals of all buildings, equipment, work places and operations.