Risk Assessment:

Hazard analysis involves identification and quantification of the various hazards (unsafe conditions) that exist in the mine and plant. On the other hand, risk analysis deals with the identification and quantification of risks; the equipment and personnel are exposed to, due to accidents expected to arise from the hazards present in the mine and plant.

Risk analysis follows an extensive hazard analysis. It involves the identification and assessment of risks the working group & neighboring population are exposed to as a result of hazards present. This requires a thorough knowledge of failure probability, credible accident scenario, vulnerability of population, etc. Much of this information is difficult to get or generate. Consequently, the risk analysis is often confined to maximum credible accident studies.

"Risk" is defined as a likelihood of Occurrence of an undesired event (accident, injury or death) within a specified period or under specified circumstances. This may be either a frequency or a probability depending on the circumstances.

The term "Hazard" is defined as a physical source or situation, which may cause human injury, damage to property or the environment or some combination of these criteria.

"Disaster" is defined as a catastrophic situation that causes damage, economic disruptions, loss of human life and deterioration of health and health services on a scale sufficient to warrant an extraordinary response from outside the affected area or community. Disasters occasioned by man are factory fire, explosions and release of toxic gases or chemical substances, etc.

"Accident" is an unplanned event, which has a probability of causing personal injury or property damage or both.

"Emergency" is defined as a situation where the resources out pass the demand. This highlights of the typical nature of emergency, "it will be after experience that enough is not enough", in emergency situations. Situations of this kind are avoidable but it is not possible to always avoid them.

"Emergency preparedness" is one of the key activities in the overall management. Preparedness, though largely dependent upon the response

capability of the persons engaged in direct action, will require support from others in the organization before, during and after an emergency.

In the sections below, the identification of various hazards, probable risks in the mine and beneficiation plant, maximum credible accident analysis, consequence analysis are addressed which gives a broad identification of risks involved in the project.

Scope of Study:

- Identification of various scenarios
- Advance planning to overcome the problem
- Actions in case of disaster phase, which includes warning, evacuation of personnel, rescue relief operations to people affected in mishappening & containment of disaster.

Sanindpur Iron and Bauxite Mine observes all the rules as described by Director General Mine & Safety. Further, all the associated risks and emergency situations (both off site & on site) are taken care of ISO certification has been obtained.

Risk Assessment:

(i) Failure of slime pond
(ii) Surface fire
(iii) Failure of waste dump
(iv) Failure of pit slope
(v) Lubricant & HSD storage chambers/ tankers
(vi) Storage of explosive in the magazine

Disaster due to failure of slime pond:

- Inspection of the pond at regular intervals.
- Security guard provision at the pond 24 hrs a day.
- Provision of communication facility (Walky-talky) at the site is kept to plug the leakages immediately, if any.
- Carrying out mock-drills at defined frequencies.
- Review of the emergency preparedness procedure once in a quarter and taking necessary actions.

Disaster due to surface fire:

Sufficient fire extinguishers have been installed at selected locations on surface like Workshop, Garage, Diesel depot, Stores, etc. Besides, sufficient water hydrants with sufficient hose pipes will be made available at designated locations for fire protection. Action will be taken as per, on site and off site emergency planning.

However following steps are taken to deal with the disaster due to surface fire:

- Cordoning of the area
- Shifting injured personnel, if any, to hospital
- Arranging water tanker / fire brigade to deal with the fire
- Roll call to search for missing person
- Assessing the impact and restore the normal situation
- Investigating reasons for failure and taking necessary corrective action to prevent reoccurrence.

Disaster due to failure of waste dump:

Sliding of waste dump causes more hazards as compared with quarry slope failure. Hence, it is imperative that the degree of hazard against potential failure of waste dump slope should be identified and precautionary measures adopted. However during the operation of last decade, no waste dump failure has been reported.

All measures for scientific mining are being taken for stabilization of dumps. Use of geo-textiles, tree plantations and grass patching on the dump are being implemented to stabilize the waste dump. The details are given below:

1. Gullies will be cut for flow of water from the waste dump to prevent erosion of waste dump here and there due to erratic flow of rainwater.
2. On the slope of the terrace, small pits of 0.5 x 0.5 x 0.5 m^3 will be cut and seedlings will be planted and also over the 1.5 M width of terrace from edge of the bench similar plantation shall be done so that the bench slope and consequently the waste dump slope gets stabilized.
3. A stone barrier/toe wall will be made all around the waste dumps on down side to prevent waste dump wash-off material being carried out of the dump area and mixing with the general drainage system. The toe wall will act as wedge and prevent its slipping/failure.

4. A garland drain along with settling tank will be constructed all around the waste dump area for smooth flow and settling of suspended solids in water and safety of the dump.

Disaster due to failure of PIT slope:

The benches are kept 12 m high. As the depth planned is shallow and the iron ore, in which benches are to be made, is very strong in nature, no failure of pit slope is anticipated. More so, as there are no weak strata at top or in subsequent layers. The ultimate quarry slope is designed at 45^0 angles.

Hence, no pit slope failure is envisaged.

Damage due to lubricant and HSD storage chambers/tankers:

The following are required to deal with the emergency:

(a) Shifting of injured personnel, if any, to the hospital.
(b) Cordoning of the area.
(c) Plugging the leakages, as far as possible
(d) Preventing spillages to spread to larger areas
(e) To collect the spilled material, as far as possible
(f) Scrapping the contaminated ground, if possible and dispose of the same as oily waste
(g) Assessing the impact and cause of the incident.
(h) Taking necessary corrective action to prevent such type of incidents in future.

Possible dangers due to storage of explosives in the magazine:

There is no habitation close-by. Proper watch and guard has been provided, hence no danger from the magazine is anticipated.

Appointment of personnel and definition of duties:

In order to prevent emergency situations the roles and responsibilities have been established. Similarly documented procedure is in place with the roles and responsibilities defined and the actions to be taken in case of happening of any emergency incident. The inspection team dealing with emergency situations are trained and re-trained from time to time and the effectiveness of the procedures is reviewed.

Emergency Control Centers:

The emergency control center is the place from where the operations to handle the emergency is directed and coordinated. It is attended by the site main controller, key personnel and the senior officers of the fire and police services.

The center is equipped to receive and transmit information and directions from and to the incident controller and other work areas, as well as outside.
Emergency control centers contain the following:

a) An adequate number of external telephones;
b) An adequate number of internal telephones;
c) A work plan to show;
   i) Areas where there are inventories of LPG, HSD, etc.
   ii) Sources of safety equipment;
   iii) The fire-fighting system and additional sources of water;
   iv) Site entrances and roadways, including up-to-date information on roadwork's;
   v) Assembly points,
   vi) The location of the works in relation to the surrounding community.
   vii) Lorry parks,
d) A nominal roll of employee,
e) A list of key personnel, with addresses, telephone numbers, etc.

The emergency control center should be located at Central place, if possible.

Action on site:

The primary purpose of the on-site emergency plan is to control and contain the incident and so to prevent it from spreading to nearby areas. It is not possible to cover every eventuality in the plan and the successful handling of the emergency will depend on appropriate action and decisions being taken on the spot. Other important aspects to be considered include the following:

a) Evacuation of non essential personnel
b) Accounting for personnel affected
c) Access to record and communicate the information to the friends and relatives of the affected personnel.
d) Public relation
e) Rehabilitation of the affected persons

Post disaster analysis and evaluation:

When the emergency is over, the team will carry out a detailed analysis of the causes of the accident, evaluate the influence of various factors and take necessary measures for future. At the same time, the adequacy of the Disaster Preparedness Plan will be evaluated and shortcomings if any, will be rectified for subsequent improvement of the plan.

Emergency services:

The provision of following emergency services have been made available in the existing plant

a) Fire protection system
b) Medical facilities
c) Rescue facilities
d) Plant safety arrangements
e) Emergency action within 15 minutes of occurrence.

Off-site emergency plan:

Introduction:

The off-site emergency plan is an integral part of any major hazard control system. They are the accidents identified by the management, which could affect people and the environment outside the works. Thus, the off-site plan follows logically from the analysis that took place to provide the basis for the on-site plan and the two plans should therefore complement each other. 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 that may be involved in the implementation of an off-site plan are described below. The responsibility for the off-site plan will be likely to rest either with the works management or with the local authority.

Aspects to be included in an off-site emergency plan

Some of the aspects to be included in off-site emergency plan are as follows:-

Organization:

Details of command structure, warning systems, implementation procedures, emergency control center, Names and appointments of incident controller, site main controller, their deputies and other key personnel.

Communication:

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

Special emergency equipment:

Details of availability and location of heavy lifting gear, bulldozers, specified fire-fighting equipment, fireboats.

Voluntary Organizations:

Details of organisers, telephone numbers, resources, etc.

Meteorological information:

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

Humanitarian arrangements:

Transport, evacuation centers, emergency feeding, treatment of injured, first aid, ambulances, 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.

Role of the emergency co-coordinating officer:

The various emergency services will be coordinated by an emergency coordinating officer (ECO) who is likely to be a senior police officer but, depending on the circumstances, could be a senior fire officer. The ECO will liaise closely with the site main controller. Again depending on local arrangements, for very severe incident with major or prolonged off-site consequences, the external control may pass to a senior authority/ administrator.

Role of major hazard works management:

The role of works management in off-site emergency planning will be to establish liaison with those preparing the plans and to provide information appropriate to such plans.

Advice shall be provided by works management to all the outside organizations, which may get involved in handling the emergency off-site and which may need to familiarize themselves with some of the technical aspects of the works activities, e.g. emergency services, medical departments etc.

Role of the Fire authorities:

The control of fire normally is the responsibility of the senior fire brigade officer on arrival at the site. The senior fire brigade officer may also have a similar responsibility for other events, such as explosions and toxic releases. Fire authorities having major works in their area will have familiarized themselves with the location on site of all stores of flammable materials, water and foam supply point and fire-fighting equipments.

Role of the health authorities:

Health authorities, including doctors, surgeons, hospitals, ambulances and so on, have a vital part to play following a major accident and they will form an integral part of any emergency plan.

For major fires, injuries will 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.