CHAPTER – 7
ADDITIONAL STUDIES

7.1 RISK ASSESSMENT [TOR # 3 – ix & 7 – xiii]

7.1.1 INTRODUCTION

Risk analysis deals with the identification and quantification of risks, the plant equipments and personnel are exposed to, due to accidents resulting from the hazards present in the factory. Hazard analysis involves the identification and quantification of the various hazards that are likely to occur in the industry.

Both hazard and risk analysis are very extensive studies, and require a very detailed design and engineering information.

The various hazard analysis techniques that may be applied are Hazard and Operability (HAZOP) studies, Fault - Tree Analysis (FTA), event –tree analysis and, failure and effects mode analysis.

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 through knowledge of failure probability, credible accident scenario, vulnerability of populations etc. Much of these information's are difficult to get or generate. Consequently, the risk analysis is oftenly confined to maximum creditable accident studies.

7.1.2 SCOPE OF THE STUDY

The scope of study includes the study of proposed operations, storage and handling of raw materials with respect to Hazard Identification. Risk Assessment and preparation of Disaster Management plan. Based on the Hazard Identification and analysis, the major disaster scenarios would be worked out to estimate the consequence of failure. A Disaster Management Plan (DMP) would also be evolved to meet the emergency situation including the occupational health and safety.

7.1.3 FIRE PROTECTION SYSTEM

The following Fire Protection system will be provided in the plant.

- Hydrant system covering the entire plant including all important auxiliaries and buildings. The system will be complete with piping, valves, instrumentation, hoses, nozzles and hydrants, etc.
- Sprinkler system for cable galleries / vaults / spreader room etc.
- High velocity water system for LDO storage tanks.
- Portable fire extinguishers such as pressurized water type, carbon dioxide type and foam type will be located at strategic locations through out the plant.
- Modular type carbon dioxide panel injection fire extinguishing system will be provided in control equipment room, cable space below control room and at other unmanned electrical and electronic equipment room.

The following pumps will be provided in the fire protection system.

Fire water pumps:

(Fire water reservoir is part of the main water reservoir)

a) AC motor driven fire water pumps for hydrant, medium velocity water spray system and foam system.
b) AC motor driven fire water pumps for high velocity water spray system.
c) Diesel engine driven pump as stand by for the above.
d) AC motor driven Jackey pump 1 No. for maintaining pressure.

Suitable number of electric motor driven and diesel engine operated hydrant and spray pumps with automatic starting will be provided for the above systems. The fire water pumps will take suction from the fire water reservoir to be created in the plant area.

7.1.4 METHODOLOGY OF MCA ANALYSIS

The MCA Analysis involved ordering and ranking of various sections in terms of potential vulnerability. The following steps were involved in MCA Analysis.

- Preparation of an inventory of major storages and rank them on the basis of their hazardous properties.
- Identification of potentially hazardous storage sections and representative failure cases from the vessels and the pipelines.
- Visualization of chemical release scenarios.
- Effect and damage calculation from the release cases through mathematical modeling.
- Inventory Analysis and Fire & Explosion and Toxicity Index (FETI) are the two techniques employed for hazard identification process.

7.1.5 FIRE & EXPLOSION AND TOXICITY INDEX

The role of Fire & Explosion Index (FEI) aids quantitative hazard identification. The FEI is calculated by evaluating the loss potential of all the units in the storage area and the hazardous areas are classified accordingly. The FEI plays an important role in

- Identification of the equipment/areas that could likely contribute to the creation or escalation of incident and relative ranking of the incidents.
- Quantification of the expected damage of potential fire and explosion incidents.
- Preparation of guidelines for mitigating fire hazards.

The loss potential which could actually be experienced under the most adverse operating conditions is quantitatively evaluated. The FEI is used for any operation in which a flammable, combustible or reactive material is stored, handled or processed.

FEI = MF * GPH * SPH

Where MF : Material factor

GPH : General Process Hazard

SPH : Special Process Hazard

TOXICITY INDEX

The Toxicity Index is calculated using the the following formula.

$$TI = \frac{(Nh + Ts) * (1 + GPH + SPH)}{100}$$

Where Nh:

Ts:

GPH: General Process Hazard

SPH: Special Process Hazard

7.1.6 ASSESSMENT OF RISK AT SHRI GIRIJA ALLOY & POWER (I) PVT. LTD.

Based on the storage inventory the following areas are identified as potential safety risk areas, shown in table 7.1

TABLE 7.1

POSSIBLE RISKS FROM THE STEEL PLANT

S.No.	Area	Hazards identified
1.	Transformer	Explosion & fire
2.	LDO tank farms	Fire

7.1.7 RISK & CONSEQUENCE ANALYSIS OF FIRE

The principle objective of this study is to identify the potential hazards, estimate the effects of hazards to people both with in and outside the plant premises.

- Identification of possible failure cases of the facilities which might affect the population and property within the plant boundary.
- Assessment of consequential effect on surrounding population, property etc., due to onset of such failures.
- Suggest recommendations based on consequence analysis relevant to the situations.

7.1.7.1 METHODOLOGY

The hazards expected from this plant include the pool fire situation due to the leakage of LDO from the storage tanks. There will be one No. of storage tank for LDO with a capacity of 25 m^3.

The tanks, made of Mild steel, will be provided with dyke. The most credible failure is due to the rupture of the pipe connecting the storage tank. The worst case can be assumed as when the entire contents leak out into the dyke forming a pool, which may catch fire after getting source of ignition.

LDO STORAGE TANK - POOL FIRE SCENARIO

The maximum quantity of LDO stored at site will be 1 x 25 m^3 capacity. In the event of oil spillage through a small leakage or due to rupture of pipeline connecting the tank fire will follow after getting ignition source. As the tank will be provided with dyke, the fire will be confined within the dyke. Threshold limit for first degree burns is 4.5 kw/m^2. Based on these results it may be concluded that the vulnerable zone in which the thermal fluxes above the threshold limit for first degree burns (4.5 kw/m^2) is restricted to 26 m.

The hazard distances for various radiation intensities are shown in table 7.2

TABLE 7.2

HAZARD DISTANCES (Four Tanks on fire - scenario)

LDO Quantity: 1 x 25 m^3

Radiation intensity		**Hazard Distances**
37.5 kw/m^2	(100% lethality)	3 m
25.0 kw/m^2	(50% lethality)	7 m
12.5 kw/m^2	(1% lethality)	12 m
4.5 kw/m^2	(1^{st} degree burns)	21 m

The hazard distances for Thermal radiation are confined to the plant premises only. Hence there will not be any thermal radiation impact on outside the population due to the pool fire scenario. The thick green belt developed will help to further mitigate the radiation intensity level outside plant boundary.

7.2 DISASTER MANAGEMENT PLAN

7.2.1 DISASTERS

A disaster is 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. The first group includes those disasters which result from natural phenomena like earthquakes, volcanic eruptions, cyclones, tropical storms, floods, avalanches, landslides etc. The second group includes disastrous events occasioned by humans, or by their impact upon the environment. Examples are industrial accidents, radiation accidents, factory fires, explosions, escape of toxic gases or chemical substances from an industrial unit, river pollution, mining or other structural collapses; air, sea, rail and road transport accidents. These disastrous events can reach catastrophic dimensions in terms of human loss.

There can be no set criteria for assessing the gravity of a disaster because it depends, to a large extent, on the physical, economic and social environment in which it occurs. What would be considered a major disaster in developing country, equipped to cope with the problems involved, may not mean more than temporary emergency elsewhere. 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.

7.2.2 OBJECTIVES OF DISASTER MANAGEMENT OF PLAN

The disaster Management Plan is aimed to ensure safety of life, protection of environment, protection of installation, restoration of production and salvage operations in this same order of priorities. Effective implementation of Disaster Management Plan will be ensured by its wide circulation among the staff and workers and training of the personnel through rehearsals.

The Disaster Management Plan would reflect the probable consequential severity of 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 based on currently available and reliable information, incident data from internal and external sources and if necessary the reports of out side agencies.

To tackle the consequences of a major emergency inside the factory or immediate vicinity of the factory, a Plan has to be formulated and this emergency plan is called Disaster Management Plan.

The objective of the Industrial Disaster Management Plan is to make use of the combined resources of the Plant and the outside services to achieve the following:

- Pool fire scenario due to LDO storage
- Minimize damage to the property and the environment.
- Effect the rescue and medical treatment of victims.
- Fulfill the needs of relatives.
- Provide authoritative information to news media.
- Secure the safe rehabilitation of affected areas.
- Safeguard other people.
- Initially contain and then ultimately bring the situation under the control.
- Preserve subsequent records and equipment for subsequent enquiry of the cause and circumstances leading to emergency.

7.2.3 EMERGENCIES

7.2.3.1 GENERAL EMERGENCIES ANTICIPATED:

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

- Pool fire scenario at LDO storage tanks.
- Contamination of food / water.
- Sabotage / social disorder.
- Structural failures.
- Slow isolated fires.

7.2.3.2 SPECIFIC EMERGENCIES ANTICIPATED

During the study of risk assessment, the probabilities of occurrence of hazards are worked out along with the nature of damage. This is the reason why one should study risk assessment in conjunction with DMP.

7.2.3.3 EMERGENCY ORGANISATION

It is recommended to setup an Emergency Organization. A senior executive who has control over the affairs of the Plant would be heading the Emergency Organization. He would be designated as Site Controller. In the case of stores, utilities, open areas which are the not under the control of production heads, executive responsible for maintenance of utilities would be designated as Incident Controller. All the Incident Controllers would be reporting to the Site Controller.

Each Incident Controller organizes a team responsible for controlling the incident with the personnel under his control. Shift in-charge would be the Reporting Officer, who would report the incident to the Incident Controller.

Emergency Coordinators would be appointed who would undertake the responsibilities like fire fighting, rescue, rehabilitation, transport and support services. For this purposes, Security in-charge, staff of the Personnel Department/ Essential services would be engaged. All these personnel would be designated as key personnel.

In each shift, electrical supervisor, pump house incharge and other maintenance staff would be drafted for emergency operations. In the event of Power communication system failure, some of staff members in the office/ Plant offices would be drafted and their services would be utilised as messengers for quick passing of communications. All these personnel would be declared as essential personnel.

7.2.3.4 EMERGENCY COMMUNICATION

Whosoever notices an emergency situation such as fire, growth of fire, leakage etc. would inform his immediate superior and Emergency Control Center. The person on duty in the Emergency Control Centre would appraise the site controller. Site controller verifies the situation from the Incident Controller of that area or the shift incharge and takes a decision about implementing on Site Emergency Plan. This would be communicated to all the Incident

Controllers and Emergency Coordinators. Simultaneously, the emergency warning system would be activated on the instructions of the Site Controller.

7.2.3.5 EMERGENCY RESPONSIBILITIES

The responsibilities of the key personnel are appended below

7.2.3.5.1 SITE CONTROLLER

On receiving information about emergency, he would rush to Emergency Control Centre (ECC) and take the charge of ECC and the situation. He would assess the magnitude of the situation in consultation with the incident controller and decide:

- Whether affected area needs to be evacuated.
- Whether personnel who are at assembly points need to be evacuated.
- Declares Emergency and orders for operation of emergency siren.
- Organizes announcement by public address system about location of emergency.
- Assesses the areas which are likely to be affected, and need to be evacuated or alerted.
- Maintains a continuous review of possible development and assesses the overall situation to decide whether shutting down of any section or whole of the Plant is required.
- Directs personnel of rescue, rehabilitation, transport, fire brigade, medical and other designated mutual support systems, locally available, for meeting emergencies.
- Controls evacuation of affected areas. If the situation is likely to go out of control or effects are likely to go beyond the premises of the factory, informs to District Emergency Authority, Police, and Hospital and seeks their intervention and help.
- Informs Inspector of factories, Deputy Chief Inspector of factories, APPCB and other statutory authorities.
- Gives public statement, if necessary.
- Keeps record of chronological events and prepares an investigation report and preserves the evidences.

After managing the emergent situation and binging the normalcy at the work place, he makes an statement accordingly

7.2.3.5.2 INCIDENT CONTROLLER

- Assembles the incident control team.
- Directs operations within the affected areas with the priorities for safety to personnel, minimizes damage to the plant, property and environment and minimizes the loss of materials.
- Directs the shutting down and evacuation of Plant and areas likely to be adversely affected by the emergency.
- Ensures that all-key personnel help is sought.
- Provides advice and information to the Fire and Security officer and the local Fire Services as and when they arrive.
- Ensures that all non-essential workers / staff of the effected areas evacuated to the appropriate assembly points and the areas are searched for victims, if any
- Understands the need for preservation of evidence so as to facilitate any enquiry into the cause and circumstances, which resulted or escalated the emergency.
- Coordinates with emergency services at the site.
- Provides tools and safety equipments to the team members.
- Keeps in touch with the team and advise them regarding the method of control to be used.
- Keeps the Site Controller informed continuously about the progress being made?

7.2.3.5.3 EMERGENCY COORDINATOR - RESCUE, FIRE FIGHTING

- Rushes to Emergency Control Centre after knowing about the emergency.
- Helps the Incident Controller in containment of the emergency.
- Ensures fire pumps in operating conditions and instructs pump house operator to be ready for any emergency.
- Guides the fire fighting crew i.e. Firemen, trained Plant personnel and security staff.
- Organizes shifting the fire fighting facilities to the emergency site, if required.
- Takes guidance of the Incident Controller for fire fighting as well as assesses the requirements of outside help.
- Arranges the traffic control at the gate and the incident area.

- Directs the security staff to the incident site to take part in the emergency operations under his guidance and supervision.
- Evacuates the people in the Plant or in the near by areas as advised by site controller.
- Searches for any casualties and arranges proper aid for them.
- Assembles search and evacuation team.
- Decides paths for the workers evacuating the site
- Maintains law and order in the area, and if necessary seeks the help of police and local administration.
- Arranges safety tools/equipments for the members of his team.

7.2.3.5.4 EMERGENCY COORDINATOR - MEDICAL, MUTUAL AID, REHABILITATION, TRANSPORT AND COMMUNICATION

- The event of failure of electric supply and there by internal telephone, sets up communication point and establishes contact with the Emergency Control Center (ECC) in the event of failure of electric supply and communication network.
- Organizes medical treatment to the injured and if necessary, will shift them to nearby hospitals.
- Mobilizes extra medical help from outside, if necessary
- Keeps a list of qualified first aid providers of the factory and seek their assistance.
- Maintains first aid and medical emergency requirements.
- Makes sure that all safety equipments are made available to the emergency team.
- Assists Site Controller with necessary data and coordinates the emergency activities.
- Assists Site Controller in updating emergency plan.
- Maintains liaison with Civil Administration.
- Ensures availability of canteen facilities and maintenance of rehabilitation centre.
- Remains in liaison with Site Controller / Incident Controller.
- Ensures availability of necessary cash for rescue / rehabilitation and emergency expenditure.
- Controls rehabilitation of affected areas at the end of emergency.
- Makes available diesel/petrol for transport vehicles engaged in emergency operation.

7.2.3.5.5 EMERGENCY COORDINATOR – ESSENTIAL SERVICES

He would assist Site Controller and Incident Controller

- Maintains essential services like Diesel Generator, Water, Fire Water, Compressed Air / Instrument Air, Power Supply for lighting.
- Plans alternate facilities in the event of Power failure, to maintain essential services such as lighting, etc.
- Organizes separate electrical connections for all utilities and during emergency ensures that the essential services and utilities are not affected.
- Gives necessary instructions regarding emergency electrical supply, isolation of certain sections etc to shift incharges and electricians.
- Ensures availability of adequate quantities of protective equipments and other emergency materials, spares etc.

7.2.3.5.6 GENERAL RESPONSIBILITIES OF EMPLOYEES DURING AN EMERGENCY

When an emergency warning is raised, the workers, if they are incharge of any process equipment, should adopt safe and emergency shut down and attend any prescribed duty as an essential employee. If no such responsibility has been assigned, he should adopt a safe course to assembly point and await instructions. He should not resort to spread panic. On the other hand, he must assist emergency personnel towards objectives of DMP.

7.2. 3.6. EMERGENCY FACILITIES

7.2.3.6.1 EMERGENCY CONTROL CENTRE

During the emergency, the office block would function as Emergency Control Centre. It would have external Telephone & Fax facility. All the Incident Controllers, Officers, senior personnel would be available there.

The following information and equipments will be provided at the ECC.

- Intercom, telephone
- Fire suit / gas tight goggles / gloves / helmets
- Factory layout, emergency site plan
- Emergency lamp / torchlight

- Plan indicating locations of hazardous inventories, Plant control room, sources of safety equipment, work road plan, assembly points, rescue locations, vulnerable zones, escape routes.
- Hazard chart
- Self-contained breathing apparatus
- Hand tools, wind direction, wind velocity indications
- Public Address Megaphone, Hand bell, Telephone directories (Internal and P&T).
- Address with telephone numbers of key personnel, Emergency coordinator.
- Important addresses, telephone numbers of experts from outside, government agencies, neighboring industries etc.
- Emergency shut down procedures.
- Nominal roll of employees.

7.2.3.6.2 EMERGENCY POWER SUPPLY

Plant facilities would be connected to Diesel Generator and would be placed in auto mode.

7.2.3.6.3 FIRE FIGHTING FACILITIES

First Aid and Fire Fighting equipment suitable for emergency should be maintained as per statutory requirements/ TAC Regulations. Fire hydrant line covering major areas would be laid. It would be maintained at 6 kg / sq.cm. pressure.

7.2.3.6.4 LOCATION OF WIND SOCK

On the top of production block and on the top of administrative block wind socks would be installed to indicate direction of wind during emergency period.

7.2.3.6.5 EMERGENCY MEDICAL FACILITIES

Gas masks and general first aid materials for dealing with chemical burns, fire burns etc. would be maintained in the medical centre as well as in the emergency control room. Private medical practitioners help would be sought. Government hospital would be approached for emergency help.

Apart from Plant first aid facilities, external facilities would be augmented. Names of Medical Personnel, Medical facilities in Kakinada would be prepared and updated. Necessary specific

medicines for emergency treatment of burnt patients and for those affected by toxicity would be maintained.

Breathing apparatus and other emergency medical equipment would be provided and maintained. The help of near by industrial managements in this regard would also be taken on mutual support basis.

7.2.3.7 EMERGENCY ACTIONS

7.2.3.7.1 EMERGENCY WARNING

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

7.2.3.7.2 EMERGENCY SHUTDOWN

There are number of facilities which can be provided to help in dealing with hazardous conditions. The suggested arrangements are

- Stop feed
- Deluge contents
- Remove heat
- Transfer contents

Methods of removing additional heat include removal by the normal cooling arrangements or by the use of an emergency cooling system. Cooling facilities which vaporizes liquid may be particularly effective, since a big increase in vaporization can be obtained by reducing pressure.

7.2.3.7.3 EVACUATION OF PERSONNEL

The area would have adequate number of exits and staircases. In the event of an emergency, unrelated 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 Emergency Communication Centre. If necessary, persons can be evacuated by rescue teams.

7.2.3.7.4 ALL CLEAR SIGNAL

At the end of emergency, after discussing with Incident Controllers and Emergency Coordinators, the site controller orders an all clear signal.

7.3 OCCUPATIONAL HEALTH AND SURVEILLANCE

Large industries 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 booms, the industrialization generally brings several problems related with health and safety of the workmen.

7.3.1 OCCUPATIONAL HEALTH

Occupational health needs attention both during construction and operation phases. However, the problem varies both in magnitude and variety in the above phases.

7.3.2 CONSTRUCTION & ERECTION

The occupational health problems envisaged at this stage can mainly be due to constructional activities and noise.

To overcome these hazards, in addition to arrangements required to reduce it within TLV'S, personnel protective equipments should also be supplied to workers.

7.3.3 OPERATION & MAINTENANCE

The working personnel would be given the following appropriate personnel protective equipments.

- Industrial Safety helmets
- Crash helmets
- Face shield with replacement acrylic vision
- Zero power plain goggles with cut type filters on both ends
- Zero power goggles with cut type filters on both sides and blue colour glasses
- Welders equipment for eye and face protection
- Cylindrical type earplug
- Ear plugs
- Canister gas masks
- Self contained breathing apparatus
- Leather apron
- Safety belt / line man's safety belt

- Leather hand gloves
- Asbestos hand gloves
- Canvas cum leather hand gloves with leather palm
- Industrial safety shoes with steel toe
- Electrical safety shoes without steel toe and gum boots

7.3.4 OCCUPATIONAL HEALTH [TOR # 8 – i]

Anticipated Occupational & Safety Hazards

- Heat Stress & Stroke
  - Physical activity
  - Extremes of age, poor physical condition, fatigue
  - Excessive clothing
  - Dehydration
  - Cardiovascular disease
  - Skin disorders
  - Dust Exposure
- Metallic dust exposure
- Noise
- Illumination
- Burns and shocks due electricity

Note: The air and water samples at the site revealed that Arsenic is Below Detectable Level. Hence Arsenicosis Management Plan is not envisaged.

The health of workers will be protected by adopting the following measures:

- Proper Designing of building, Work area.
- Relaxation facilities to workers in working in furnace are in separate rooms with good ventilation & air circulation. This will help in relieving of thermal stress.
- Good Housekeeping practices
- Well engineered ventilation & exhaust system
- Enclosure
- Isolation of specific areas

- Enforcement of usage of Personal Protective Devices.
- Regular Work Environment Monitoring
- Statistical Monitoring
- Working hours
- Rotation of employees in specific areas to avoid continuous exposure

Frequency of Periodical Examination:

For employees <30 Years once in five years

Between 31-50 Years once in four years

Between 41-50 Years once in two years

Above >50 years once a year

Personal Protective Devices and Measures

- Industrial Safety helmets
- Crash helmets
- Face shield with replacement acrylic vision
- Zero power goggles with cut type filters on both sides and blue color glasses
- Welders equipment for eye and face protection
- Ear muffs
- Canister gas masks
- Self contained breathing apparatus
- Leather apron
- Safety belt / line man's safety belt
- Leather hand gloves
- Asbestos hand gloves
- Canvas cum leather hand gloves with leather palm
- Industrial safety shoes with steel toe
- Electrical safety shoes without steel toe and gum boots
- Protective clothing etc.

Plan of pre-placement and periodical health status of workers:

Pre-employment check up will be made mandatory and following test will be conducted:

- Plan of evaluation of health of workers
- Chest x rays
- Audiometry
- Spirometry
- Vision testing (Far & Near vision, color vision and any other ocular defect)
- ECG
- Haemogram (examination of the blood)
- Urine (Routine and Microscopic)
- Complete physical examination
    - Musculo-skeletal disorders (MSD)
    - Backache
    - Pain in minor and major joints
    - Fatigue, etc.
- Medical records of each employee will be maintained separately and will be updated as per finding during monitoring. Age, sex wise, department wise data on the above parameters will be maintained and submitted to the ministry.
- Medical records of the employee at the end of his / her term will be updated.

List of equipment for Occupational Health Monitoring

- ECG
- Analytical Pan Balance
- Dust Sampling devices
- Heat stress monitoring device (Personal)
- Spectrophotometer
- Noise Monitoring device (dosimeter)
- Spiro meter
- Audiometric device
- Vision screener

7.4 SAFETY PLAN

Safety of both men and materials during construction and operation phases is of great concern. The preparedness of an industry for the occurrence of possible disasters is known as emergency plan. The disaster in Project is possible due to collapse of structures and fire / explosion etc. The details of fire fighting equipments to be installed are given below:

- Carbon dioxide type
- Foam type
- DCP type
- Soda acid type
- Fire buckets
- Fire hydrants

Keeping in view the safety requirement during construction, operation and maintenance phases, **Shri Girija Alloy & Power Pvt. Ltd.** has formulated safety policy with the following regulations.

- 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 allocate sufficient resources to maintain safe and healthy conditions of work.
- To ensure that adequate safety instructions are given to all employees.
- To provide where ever necessary protective equipment, safety appliances and clothing and to ensure their proper use.
- To inform employees about materials, equipments or processes used in their work which are known to be potentially hazardous to health and safety.
- To keep all operations and methods of work under regular review for making necessary changes from the safety point of view in the light of experience and up to date knowledge.
- To provide appropriate facilities for first aid and prompt treatment of injuries and illness at work.
- To provide appropriate instructions, training and supervision to employee's health and safety, first aid and to ensure that adequate publicity is given to these matters.

- To ensure proper implementation of fire preventive methods and an appropriate fire fighting service along with training facilities for personnel involved in this service.
- To publish / notify regulations, instructions and notices in the common language of employees.
- To prepare separate safety rules for each type of process involved.
- To ensure regular safety inspection by a competent person at suitable intervals of all buildings, equipments, work places and operations.

7.4.1 SAFETY ORGANISATION

7.4.1.1 CONSTRUCTION AND ERECTION PHASE

A highly qualified and experienced safety officer will be appointed. The responsibilities of the safety officer include identification of the hazardous conditions and unsafe acts of workers and advice on corrective actions, conduct safety audit, organize training programmes and provide professional expert advice on various issues related to occupational safety and health. In addition to employment of safety officer, every contractor, whose employees will be more than 250, would also be asked to employ one safety officer to ensure safety of the workers in accordance with the conditions of the contract.

7.4.1.2 OPERATION & MAINTENANCE PHASE

After the completion of construction, the posting of safety officer would be in accordance with the requirements of Factories Act and he will be assigned the duties and responsibilities accordingly.

7.4.1.3 SAFETY CIRCLE

In order to fully develop the capabilities of the employees in identification of hazardous processes and improving safety and health, safety circles would be constituted in each area of work. The circle would consist of 5-6 employees from that area. The circle would normally meet for about an hour every week.

7.4.2 SAFETY TRAINING

A full fledged training centre will be established at **Shri Girija Alloy & Power Pvt. Ltd.** Safety training will be provided by the safety officers with the assistance of faculty members called from professional safety institutions and universities. In addition to regular employees, limited

contractor labours will also given safety training. To create safety awareness safety films will be shown to workers and leaflets etc. will be distributed.

7.4.3 HEALTH AND SAFETY MONITORING PLAN

All the potential occupational hazardous work places will be monitored regularly. The health of employees working in these areas will be monitored once in a year

7.5 SOCIAL IMPACT ASSESSMENT

The local areas will be benefited by way of generation of employment opportunities, increased demand for local products and services. There will be an improvement in the income level of the local people.

The project will generate employment opportunities for about 300 persons during construction stage and for about 150 persons once the plant is commissioned. Priority will be given to locals for Semi-Skilled and Unskilled jobs.

Due to this the economic conditions, the educational and medical standards of the people living in the study area will certainly move upwards which will result in overall economic development, improvement in general aesthetic environment and increase in business opportunities.

The successful commissioning and running of the proposed expansion plant will attract more industrial investments which in turn will benefit the society and the nation.

7.6 R & R ACTION PLAN

The proposed expansion will be taken up in the existing plant premises of 150 acres for which Environmental clearance has been issued vide no. J – 11011 / 679 / 2009 – IA II (I) dated 24-12-2010. Hence no Rehabilitation & Resettlement Action Plan is prepared.