RISK ASSESSMENT

INTRODUCTION
Risk analysis deals with the identification and quantification of risks, the plant equipment’s 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 thorough 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.

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.

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 throughout 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.

**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.

**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.

\[
\text{FEI} = \text{MF} \times \text{GPH} \times \text{SPH}
\]

Where
- MF: Material factor
- GPH: General Process Hazard
- SPH: Special Process Hazard

TOXICITY INDEX

The Toxicity Index is calculated using the following formula.

\[
\text{TI} = \frac{(\text{Nh} + \text{Ts}) \times (1 + \text{GPH} + \text{SPH})}{100}
\]

Where
- Nh: General Process Hazard
- Ts: Special Process Hazard

ASSESSMENT OF RISK AT AMMAN-TRY SPONGE & POWER PRIVATE LIMITED.

Based on the storage inventory the following areas are identified as potential safety risk areas, shown in Table 1.

TABLE NO. 1: TYPE OF HAZARDOUS IDENTIFIED DURING STORAGE & HANDLING

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Area</th>
<th>Capacity / quantity</th>
<th>Hazards identified</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Steam turbine generator building</td>
<td>3X8 MW 1X20 MW</td>
<td>Fires in a) Lube oil system, b) Short circuit in control room / switch gears, c) Cable galleries, d) Fire in oil drum storage</td>
</tr>
<tr>
<td>2.</td>
<td>Transformer</td>
<td>---</td>
<td>Explosion &amp; fire</td>
</tr>
<tr>
<td>3.</td>
<td>Boilers</td>
<td>4 Nos.(WHRB &amp; CFBC)</td>
<td>Fire (mainly near oil burners)</td>
</tr>
</tbody>
</table>
The degree of hazard is identified based on FEI & TI range as per the criteria given below.

**FEI RANGE**

- 0 – 60: LIGHT
- 61 - 96: MODERATE
- 97 - 127: INTERMEDIATE
- 128 - 158: HEAVY
- 159 & Above: SEVERE

**TI RANGE**

- 0 – 5: LIGHT
- 5 - 10: MODERATE
- > 10: SEVERE

Fire and Explosion are the likely hazards which may occur due to the fuel storage. Hence F&EI has been calculated for storage capacities of fuels in the plant and are shown in Table No. 2.

**Table No.2: Fire & Explosion and Toxicity Index for Storage Facilities**

<table>
<thead>
<tr>
<th>Fuel</th>
<th>Total quantity of storage</th>
<th>F &amp; EI</th>
<th>Category</th>
<th>TI</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDO</td>
<td>2 x 25 m³</td>
<td>1.5</td>
<td>Light</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>HFO</td>
<td>1 x 25 m³</td>
<td>1.5</td>
<td>Light</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

**TABLE.3 : POSSIBLE RISKS FROM THE STEEL PLANT & MITIGATION MEASURES**

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Process</th>
<th>Potential Hazard</th>
<th>Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRI PLANT</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Sponge Iron Kiln | Reduction of Iron Ore | Falling of Hot Mass & Dust | • Ensuring before opening the kiln bottom door, first clean the inner surface of the stack cap, such that the dust particle and hard clinkers which deposited in the cap is fallen into the DSC.  
• Ensure before opening the DSC bottom door to check the DSC bar position and condition and to clean if big block of castables or any hard clinkers which is blocking the dust flow passage to wet scraper chute.  
• Ensure to clean the dust by opening the man |
### Expansion of Steel Plant

**Sirasnanbedu Village, Pellakur Mandal, SPSR Nellore District, Andhra Pradesh**

### Equipment

<table>
<thead>
<tr>
<th>Sponge Iron Kiln</th>
<th>Reduction of Iron Ore</th>
<th>Air emission</th>
</tr>
</thead>
</table>

### Provision

- A hole provided in the chute and check the spiking rods and the screen. In-built safety system is provided in the construction of furnace with suitable refractory walls.
- Allow the wet scrapper to run to remove the sludge, then open the drain pipe of the wet scrapper, which is located at bottom on either side, pour sufficient water to clean the sludge and the slurry dust to flow through drain pipe.
- Ensure to stop the wet scrapper and open the top plate to check the alignment, weak and tear of the plates and take necessary precaution against the excessive worn out plate.
- Adequately designed ESP and other Air Pollution control systems will be provided with internal lock to the kiln feeding system in order to prevent by-passing of emissions through safety cap and also during non-operation of ESP or any other pollution control devices.

### Sponge Iron Kiln

#### Reduction of Iron Ore

#### Air emission

- Adequately designed ESP and other Air Pollution control systems will be provided with internal lock to the kiln feeding system in order to prevent by-passing of emissions through safety cap and also during non-operation of ESP or any other pollution control devices.

### POWER PLANT

#### Turbine

- Convert pressure in the flue gas into Mechanical Energy
- Mechanical & Fire Hazards
- Noise

- Layout of Equipment / Machinery will be in accordance to factory and electrical inspectorate.
- Acoustic enclosure to Turbine

#### Generator

- Convert Mechanical energy into electrical energy
- Mechanical & Fire Hazards
- a) Lube Oil System
- b) Cable galleries
- c) Short circuits
- Noise

- Layout of Equipment / Machinery will be in accordance to factory and electrical inspectorate.
- Acoustic enclosure
- Isolated panel rooms
- Special foundation with vibration absorbers
- Automatic fire fighting system will be provided. Isolated with fencing and restricted entry.
- All electrical fittings and cables are provided as per the specified standards.

#### Power Transformers

- ---

#### Switch Yard transformer

- ---

#### Switch Yard

- Fire

#### Fire in cable galleries and switch

- Fire and explosion

### Coal storage

- Storage yard will be continuously sprinkled
## Equipment
### Performance

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Process</th>
<th>Potential Hazard</th>
<th>Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td>shed</td>
<td>coal for 10 days requirement.</td>
<td>spontaneous combustion</td>
<td>with water with garden type sprinklers.</td>
</tr>
<tr>
<td>Coal handling bunkers</td>
<td>----</td>
<td>Fire and dust explosions</td>
<td>Continuous water sprinkling</td>
</tr>
<tr>
<td>Compressor House</td>
<td>Plant operation</td>
<td>Governor failure due to the failure of pins and springs leading to opening of safety valves</td>
<td>The design precautions of safety will be followed in manufacture and erection of compressors.</td>
</tr>
<tr>
<td>Coal storage yard</td>
<td>Coal dust is combustible</td>
<td>Explosion Hazard</td>
<td>• Coal storage shall be minimized</td>
</tr>
<tr>
<td>STG, draft fans, soot blowing from boiler, ventilation pipes</td>
<td>Noise generated due to operation of STG, working of fans, ventilation system,</td>
<td>Noise hazard</td>
<td>• Coal piles shall not be located above heat sources such as steam lines.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• All mechanical &amp; electrical equipment inside the coal storage area shall be approved for use in hazardous locations and provided with spark proof</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Acoustic enclosures will be provided to STG.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Enclose fans, insulating ventilation pipes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Use of dampeners.</td>
</tr>
</tbody>
</table>

### INDUCTION FURNACE

IF  
- Converts charge into hot metal  
- Re-circulating water may come in contact with molten hot metal leading to spurting of metal or under extreme conditions explosion may also occur. Charging materials being rusty and moisturized which may lead to spurting of metal  
- Presence of oil and grease and other  
- Power supply into the furnace will be regulated and will be controlled by PLC systems.
### RE-HEATING FURNACE

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Process</th>
<th>Potential Hazard</th>
<th>Provision</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDO/ HFO storage area</td>
<td>MS tanks</td>
<td>Fire &amp; Explosion</td>
<td>Precautions as per TAC and OISD will be implemented.</td>
</tr>
<tr>
<td>Failure of APCS</td>
<td>Dust / Smoke</td>
<td>Air Emission</td>
<td>• Interlocking system will be provided and whenever APCS is not working, then raw material feed will be stopped. Consequently, there will be no production in the unit till APCS is rectified.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• The unit cannot be stopped immediately and it will take some time to stop. During this period release of particulate matter will take place, hence mobile dust suppression system will be provided to suppress the particulate matter immediately to mitigate the impact of PM on surroundings.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Depending upon the wind direction at the time of emergency, Mobile dust suppression equipments will be provided to suppress the dust within the plant and also outside the plant to reduce the impact on habitation, water body, crops etc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Immediately upon failure of any APCS, emergency siren will be blown to inform the employees and nearby villagers about the emergency.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Dust masks will be provided to the employees and near by villagers. Immediately upon hearing siren, every employee and villager must wear the dust mask.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Mock drills will be conducted in the nearby villages for the emergency preparedness.</td>
</tr>
</tbody>
</table>
### TABLE NO. 4: PROCESS HAZARD ANALYSIS RELATED TO INDUCTION FURNACE & NECESSARY RISK CONTROL MEASURES

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Area/Section</th>
<th>Hazards</th>
<th>Risk Control Measures</th>
</tr>
</thead>
</table>
| 1) A) | ELECTRIC INDUCTION FURNACE | Explosion hazard due to Water Leakage from coil, Water Cooled panel or power cables. | ✷ Stop operation.  
✦ Stop tilting or stop any Furnace movement  
✦ Identify the leakage point  
✦ Develop and Follow SOP  
 Меtal splash or explosion due to water coming into contact with molten metal. (Water may be present in scrap material or from leaks in the furnace cooling systems) | ✷ Stop operation.  
✦ Ensure use of PPEs  
✦ Proper protection system like Ground Leak Detector (GLD) etc. in place  
✦ Ensure No unauthorized person on furnace platform  
✦ Ensure no wet scrap and leakage of water  
 Меtal splash or explosion due to improper scrap charging / wet scrap / chemicals in scrap | ✷ Stop operation  
✦ Proper Segregation of scrap  
✦ Inspection of scrap and approval process for worthiness.  
✦ Safe scrap charging through cranes/vibrators charging trolley  
✦ Use of Hydraulic pusher for melting  
 Injury from Material Handling like DRI, Pig Iron, Scrap shifting to furnace floor | ✷ Regular Maintenance of EOT cranes in respect of wire ropes, brakes, lifting hook, rails/wheels, electrical system/motors etc.  
✦ Provision of proper limit switches  
✦ Emergency main switch of cranes to be provided near platform or at an easily accessible place.  
✦ Bell/Siren is to be provided in the cabin for crane operator  
✦ Annual inspection of Cranes/Lifting tackles/Magnets by competent person every year as per factory act  
✦ Display of safe working load on each crane  
✦ Proper Guarding of all stairs and crane’s CT Trolley  
 Explosion due to high temperature/thinning of refractory with improper Melting system protection  
Additionally-Bridging in IF: Leading to superheating of furnace bottom and erosion of ramming mass and rupture of cooling water tubes and subsequent explosion. | ✷ Water Temperature & flow sensors  
✦ Ground leak detector  
✦ Circuit breakers and tripping mechanism  
✦ Frequency monitoring  
✦ Lining conditions of crucibles & ladle etc.  
✦ Develop and follow SOP  |
<p>| 2)    | IF turnaround | Burn Injury due to splashing slag | ✷ Proper PPE and visor. |</p>
<table>
<thead>
<tr>
<th>activity</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Injury from Pressurized Vessels</td>
<td>Covering of all exposed area with cloth. Air compressors/pressure vessels should be checked regularly for proper working of Pressure switches, safety valves and Pressure gauges. Auto drain valve is to be provided on each pressure vessel. Six monthly testing of PV Thickness and hydraulic testing every four years by competent person as per the factory act.</td>
</tr>
<tr>
<td>Person hit by moving machines</td>
<td>Siren, gong bell during movement machines. Auto announcement during any operation. Permit to work prior to undertaking any maintenance job.</td>
</tr>
<tr>
<td>3) Electrical system</td>
<td>Electrical failures and shock</td>
</tr>
<tr>
<td></td>
<td>Proper Earthing pits. Earthing of all electrical motors/gadgets. Work permit system. Transformer testing (dielectric strength and dehydration of Transformer oil).</td>
</tr>
</tbody>
</table>

**TABLE NO.5: PROCESS HAZARD ANALYSIS RELATED TO ROLLING MILLS & NECESSARY RISK CONTROL MEASURES**

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Area/Section</th>
<th>Hazards</th>
<th>Risk Control Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>Raw material section</td>
<td>Injury in grinding operation</td>
<td>Wear goggles for all grinding machine operations. Operate grinding wheels at recommended speed with recommended depth of cut. Use proper wheel guards on all grinding machines. Use PPEs. Develop and Follow SOPs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hazards due to conveyors</td>
<td>Avoid sitting, standing, or walking on conveyors. All conveyor to be provided with proper guards. Never perform maintenance while a conveyor is in operation. Ensure correct operation of conveyor controls. Avoid loose clothing, long hair, jewellery and other loose items near conveyor. Emergency &quot;shut-off&quot; devices to be provided. Follow lock-out / tag-out procedures for</td>
</tr>
<tr>
<td>Hazards in Material handling &amp; stacking area</td>
<td>Maintenance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------------------------</td>
<td>-------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Only authorized / trained personnel to operate or maintain the conveyor.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. Reheating Furnace</td>
<td>Gas poisoning due to leakage of gas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire hazards</td>
<td>• All the gas line to be insulated from circuit by &quot;U&quot; seal and also fill up water in water seal and ensure overflow of water to drain.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Blanking of gas line to be done before Removal of valves or flanges.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Proper packing to be provided in fixing of valves or flanges.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Regular inspection of gas lines to detect leakage if any.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Use Portable &quot;CO&quot; monitors to detect gas leakage.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Ensure the closure of main valve to cut off supply</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Check all the flange/ welded joints for gas leakage.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Purge the gas pipe line with nitrogen in small segments by opening the bleeder valve</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Develop and Follow SOP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Burn injury hazards, Exposed to hot flames and hot billets / ingots</td>
<td>• Use personal protection equipment.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Keep the first aid kit having burn injury medicine on standby</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Develop and Follow SOP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hazards associated with re-lining of furnace with refractory bricks</td>
<td>• Work permit system to be followed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Monitor the temperature of area before starting work</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Hand held 24 V bulb to be used during repairs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hazard due to mechanical &amp; Electrical Maintenance</td>
<td>In furnace</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>-----------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>✷ Detail job safety protocol may be prepared to undertake the job, if job is irregular.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>✷ Develop and Follow SOP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>✷ All electrical equipment/ machines to be earthed properly</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>✷ Use electrical PPEs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>✷ Develop and Follow SOP</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C) Rolling Mill</th>
<th>Injury from Moving roller table</th>
</tr>
</thead>
<tbody>
<tr>
<td>✷ Shutdown / permit to work with electrical isolation.</td>
<td></td>
</tr>
<tr>
<td>✷ No work to be done on conveyor in running condition.</td>
<td></td>
</tr>
<tr>
<td>✷ Local emergency switch to be operated for approaching conveyor.</td>
<td></td>
</tr>
<tr>
<td>✷ Availability of Pull chord.</td>
<td></td>
</tr>
<tr>
<td>✷ Siren system prior to restarting conveyor.</td>
<td></td>
</tr>
<tr>
<td>✷ Loose cloths prohibited.</td>
<td></td>
</tr>
<tr>
<td>✷ Area barricading if material is removed from height.</td>
<td></td>
</tr>
<tr>
<td>✷ Develop and Follow SOP</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Injury from Rotating machineries</th>
</tr>
</thead>
<tbody>
<tr>
<td>✷ Coupling guards to be in place.</td>
</tr>
<tr>
<td>✷ Loose cloths to prohibited</td>
</tr>
<tr>
<td>✷ Develop and Follow SOP</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Injury during Working on mill stands</th>
</tr>
</thead>
<tbody>
<tr>
<td>✷ &quot;Permit to work&quot; practice to be followed strictly.</td>
</tr>
<tr>
<td>✷ Display of “Men at Work” board is to be done at Operator Control Panel</td>
</tr>
<tr>
<td>✷ Develop and Follow SOP</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Injury during Roll Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>✷ During Roll Change, Rolls to be cooled with water spray before work to avoid burn injury.</td>
</tr>
<tr>
<td>✷ Ensure to take Power Shutdown for Roller Table and connected drive.</td>
</tr>
<tr>
<td>✷ Ensure written Work Clearance to be given to concerned personnel for doing the work.</td>
</tr>
<tr>
<td>✷ Cleanliness of area with respect to presence of oil, grease, jute and other inflammable materials before gas cutting/ welding job.</td>
</tr>
<tr>
<td>✷ Availability of fire hydrant to be ensured if job involves gas cutting etc.</td>
</tr>
<tr>
<td>✷ Display “Men at Work” board at Operator Control Panel.</td>
</tr>
<tr>
<td>Condition</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Place a plate on rollers table for smooth entry of personnel.</td>
</tr>
<tr>
<td>Use required PPE when changing roll and after completion of jobs, ensure that men and materials are removed from site.</td>
</tr>
<tr>
<td>Ensure that “Job completion Report” is given in writing and then cancel “Power Shutdown,” remove “Caution Tags” and give clearance for operation.</td>
</tr>
<tr>
<td>Develop and Follow SOP</td>
</tr>
<tr>
<td>Electric shock</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Develop and Follow SOP</td>
</tr>
<tr>
<td>Entanglement/ injury at Gear box/ coupling</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Injury while Working on EOT Cranes</td>
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<tr>
<td>Injury in Motors with belt/chain drives</td>
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</table>
| Injury with Flywheel | Flywheel to run below safe speed limits.  
| | Appropriate guard to be provided around flywheel.  
| | Develop and Follow SOP  
| Person hit by rolling hot material during looping and play | Auto Announcement during  
| | Proper guards to be provided to avoid material coming in the way of workmen.  
| | Proper pathways to be provided for safe movement.  
| | Use of appropriate PPE hand gloves, gum boots, Face shield, dust mask, goggles by persons working on stands and handling hot materials.  
| | Proper leg / arms guards / safety goggles to be provided to tongs men  
| | Permit to work prior to undertaking any maintenance job.  
| | Develop and Follow SOP  
| Injury from Cooling Fans | Appropriate guards to be provided around fan blades.  
| | Proper stand to be provided.  
| | Earthing to be provided.  
| | Develop and Follow SOP  
| Injury from Manual Handling of Heavy loads | Use appropriate lifting tackles like chain pulley block, hoist etc to lift heavy parts  
| | Develop and Follow SOP  
| Injury from Handling of stock at stands | All hand tools to be well designed, frequently inspected and well maintained.  
| | Rivets of tongs used at mills to be renewed frequently.  
| | Develop and Follow SOP  
| Injury during Mill maintenance | Ring spanners and impact wrenches should be provided for roll changing crews;  
| | Bent-out, open-ended spanners not be used.  
| | Adequate training to be given to fitters in the use of all hand tools.  
| | Develop and Follow SOP  
| Injury from Capital Repair Job in Rolling Mill (Semi Automatic) | All the power shutdowns of the required system to be taken as per the dully filled work permit form and necessary clearance from concerned operation and electrical area.  
| | Using required PPE as per requirement.  
| | Ensure that all lifting tools & tackles (winches, Hug-zugs, Chain Pulley Blocks etc.), mobile
cranes are tested by a competent person and test certificates are submitted.

- For working at height, a “Work at heights pass” to be obtained from safety department and use of appropriate safety belts.
- All portable electrical equipment, welding machines to be earthed effectively (body earthing).
- Before any heavy structural member is gas cut, it is to be supported by ropes, chains or any other means to prevent its dropping or swinging.
- Suitable fire extinguisher in working condition must be kept close to all welding and gas cutting operations.
- Rolling of gas cylinders to be avoided and transferred / shifted by proper trolleys.
- Proper protection to be provided to conveyor and electrical cables to prevent fall of sparks from welding/gas cutting.
- Isolation of electrical power and written clearance to be obtained from electrical section before start of dismantling operation.
- Area of work to be illuminated, before starting the job.
- Movement of the employees to be restricted to working area only.
- Mono rail hoist/EOT crane, to be operated with in safe working load (SWL) of the equipment.
- All the openings created during dismantling to be immediately covered/barricaded.
- Compressed air vessels and pipelines to be de-pressureized before dismantling.
- Combustible / Inflammable materials such as coal powders, oil spillages etc. are to be removed from the place where gas cutting/welding jobs are to be carried out.
- A charged water hose pipe may be kept near the place of work.
- People involved in hazardous area to be imparted first aid & fire fighting training.
- Prior to actuation it must be ensured that no persons are in the active area of the dangerous energy (mechanical, electrical, hydraulic, pneumatic, etc.).
- Only the hydraulic / pneumatic specialist is allowed to perform switching operations on hydraulic / pneumatic valves,
| D) | General safety norms for rolling mills (Semi Automatic) | provided the following conditions are fulfilled:

- personnel involved in plant start-up and control must be warned of any operations that are to be carried out in the enclosed area before starting the machine
- No persons must be present in the danger zone,
- Voice contact must be established with a responsible person at the workplace in charge of monitoring the sequence of functions.
- Develop and Follow SOP

- All required PPEs are to be used while working
- Use properly maintained tools & tackles. 
- Hand tools to be checked in every six months.
- All the lifting tools and tackles to be every year as per statutory requirement.
- Permit-to-work to be filled up before taking any job.
- Before starting any job compliance to be proper safety isolation procedure to be ensured by concerned agencies.
- Compliance of special measures to be undertaken such as cooling of rolls in hot areas, use of supports, use of stoppers, closing of valves, housekeeping in the area, availability of fire hose / extinguishers.
- Standard Operation Practices (SOPs) and Standard Maintenance Practices (SMPs) are to be followed strictly.

- All the mechanical moving equipments are to be barricaded / guarded properly. 
- All electrical equipments to be earthed properly.
- All high- pressure vessels are to be tested as per statutory requirements.
- Oil Cellar to be checked every month for leakages.
- Proper loading / unloading procedure for raw materials / finished products to be prepared and followed.
- Ensure the availability of firefighting equipment.
- Ensure proper illumination
- Proper housekeeping to be done.
- Before restoration of power of the equipment, it is to be ensured that men, materials including tools and tackles, supports, scaffolding etc. are removed.
Develop and Follow SOP

Safety signs are intended to ensure the safety of personnel at their workplace. Depending on the kind of hazard, the following signs must be placed:

- Prohibitive signs
- Warning signs
- Mandatory signs
- Rescue signs
- Informative signs
- Signs identifying permanent danger areas

Signs for operating areas requiring individual safeguarding

In operating and danger areas of the plant/machine, it is necessary to place the signs listed above before equipment is put into operation.

Before commencing their activities, all personnel must be instructed as to the significance of the safety signs, and renewed instruction must be given at appropriate intervals, but at least once per year.

In addition to the signs listed above, the user of the equipment shall clearly and distinctly indicate and place signs for the following:

- Escape routes/emergency exits
- First-aid stations
- Places where stretchers are available
- Emergency showers/eye washing facilities

The operational reliability and the safe use of the plant/machine are ensured (among other things) by electrical and mechanical interlock devices. These must be inspected at regular maintenance intervals.

Emergency push buttons / switches to be checked for their functioning at regular intervals.

All fixed guards, when removed for any work on the machine, must be correctly replaced and secured at the end of the work.

### Coal Handling Plant - Dust Explosion

Coal dust when dispersed in air can explode if it gets ignition source. Crusher houses and conveyor systems are most susceptible to this hazard. The minimum of explosive concentration of coal dust (33%
volatiles) is 50 grams/m$^3$. Failure of dust extraction & suppression systems may lead to abnormal conditions and may increase the concentration of coal dust upto the explosive limits. The sources of ignition are incandescent bulbs, electric equipment & cables, friction & spontaneous combustion in accumulated dust. Dust explosion may occur at any time without any warning with maximum explosion pressure of 6.4 bars. Another dangerous characteristic of dust explosions is that it sets off secondary explosions after the occurrence of initial dust explosion.

Stock pile area will be provided with automatic garden type sprinklers for dust suppression as well as to reduce spontaneous ignition/combustion in coal stock piles. Necessary water distribution network will be provided for distributing water at all transfer points, crusher house, control room, etc. A centralized control room with microprocessor-based control system has been envisaged for operation of the coal handling plant. Except locally controlled equipment like travelling tripper, dust extraction / dust suppression / ventilation equipment, sump pumps, water distribution system all other equipments will have provision for local control as well.

**Control Measures for Coal Storage Yard**

The entire quantity of coal will be stored in separate stack piles, with proper drains around to collect washouts during the monsoon. Water sprinkling system will be installed in and around the stocks of pile to prevent spontaneous combustion and consequent fire hazards. The stack geometry will be adopted to maintain minimum exposure of stock pile areas towards predominant wind direction. Temperature will be monitored regularly to detect any abnormal rise in temperature inside the stock pile to be enabled to control the same.

**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 within 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.
METHODOLOGY
The hazards expected from this plant include the pool fire situation due to the leakage of HFO and LDO from the storage tanks. Heavy Fuel Oil (HFO) and Light Diesel Oil (LDO) has been considered as the fuel for the initial startup and for intermittent use during operation. 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.

LDOSTORAGE TANK - POOL FIRE SCENARIO
The maximum quantity of HFO & LDO stored at site will be 1 x 25 m$^3$ & 2 x 25 m$^3$ capacity respectively.
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 tanks are 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 28 m.

The hazard distances for various radiation intensities are shown in table 6

**TABLE NO. 6**

<table>
<thead>
<tr>
<th>Radiation intensity</th>
<th>Hazard Distances</th>
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</thead>
<tbody>
<tr>
<td>37.5 kw/m$^2$</td>
<td>(100% lethality) 5 m</td>
</tr>
<tr>
<td>25.0 kw/m$^2$</td>
<td>(50% lethality) 9 m</td>
</tr>
<tr>
<td>12.5 kw/m$^2$</td>
<td>(1% lethality) 18 m</td>
</tr>
<tr>
<td>4.5 kw/m$^2$</td>
<td>(1$^{st}$ degree burns) 28 m</td>
</tr>
</tbody>
</table>

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 to be developed will help to further mitigate the radiation intensity level outside plant boundary.
DISASTER MANAGEMENT PLAN

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.

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 outside 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 HFO and 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.

**EMERGENCIES**

**GENERAL EMERGENCIES ANTICIPATED**

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

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

**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.
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 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.

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.

EMERGENCY RESPONSIBILITIES

The responsibilities of the key personnel are appended below
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, SPCB 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 bringing the normalcy at the work place, he makes an statement accordingly.

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?

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 firefighting 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 nearby 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.
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.

EMERGENCY COORDINATOR – ESSENTIAL SERVICES

He would assist Site Controller and Incident Controller

- 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.
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.

EMERGENCY FACILITIES

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, and 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.
EMERGENCY POWER SUPPLY
Plant facilities would be connected to Diesel Generator and would be placed in auto mode.

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.

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.

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 Naidupeta 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 nearby industrial managements in this regard would also be taken on mutual support basis.

EMERGENCY ACTIONS

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.

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.

**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.

**ALL CLEAR SIGNAL**

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

**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.

**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.

**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.
OPERATION & MAINTENANCE

The working personnel to 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
- Boiler suit
- 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

OCCUPATIONAL HEALTH [Generic TOR # 8 (i) & (iv)]

Anticipated Occupational & Safety Hazards

- Heat Stress & Stroke
- Dehydration
- Skin disorders
- Dust Exposure
- Metallic dust exposure
- Noise
- Illumination
- Burns and shocks due electricity
The health of workers can be protected by adopting the following measures:

- 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
- Good ventilation & exhaust system
- Enforcement of usage of Personal Protective Devices.
- Rotation of employees in specific areas to avoid continuous exposure.
- Earplugs will be provided to employees working in noise prone areas such as STG,
- Periodic monitoring of noise levels Fugitive emissions, emissions from stack, dust suppression system, etc.

**Frequency of Periodical Examination:**

For employees once in a year

**Personal Protective Devices and Measures**

- Industrial Safety helmets
- Fall arrestor
- Safety nets (for fall protection)
- Crash helmets
- Face shield with replacement acrylic vision
- Safety goggles
- Welders equipment for eye and face protection
- Ear plugs
- Canister gas masks
- Welding face shield
- Welding hand sleeve
- Self contained breathing apparatus
- Leather apron
- Safety belt / line man's safety belt
- Leather hand gloves
• Asbestos hand gloves
• 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 is mandatory and following tests are being conducted and will be continued:

- 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 is maintained separately and updated as per finding during monitoring. Age, sex wise, department wise data on the above parameters is maintained.
- Medical records of the employee at the end of his / her term are 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
- Spiro meter
- Audiometric device
- Vision screener

**Budget for DMP and OHS**
- Capital cost of Rs. 1.8 Crore & Recurring cost of Rs. 25.0 lakhs per annum will be allocated for DMP & Occupational health & Safety.
- Occupational health check up will be outsourced by third party. However, ambulance facility will be provided within the plant.
- Fire fighting system will be provided all through the plant.

**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, **Amman-Try Sponge & Power (P) Limited** 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 wherever 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.

SAFETY ORGANISATION

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.

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.

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.

**SAFETY TRAINING**

A full-fledged training centre to be established at Amman-Try Sponge & Power (P) Limited. Safety training 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 labour also given safety training. To create safety awareness safety films will be shown to workers and leaflets etc. will be distributed.

**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.