RISK ANALYSIS REPORT

FOR

UTTAM GALVA FEROUS LIMITED
6 MTPA INTEGRATED STEEL PLANT
AT
KUDATINI, BELLARY KARNATAKA

MEC/Q72B/01/S2/R9/00/00/0089/01 ***DECEMBER- 2016***

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Bellary, Karnataka.

Project Proponent

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CERTIFICATE NO: NABET/EIA/1013/031

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01.01 RISK ANALYSIS

Steel plant being a hazardous industry, it is expected to harbor major hazards which warrant for a detailed risk analysis study. Taking into account the fact that the plant is handling toxic gases, molten metal, fuel oils & chemical the risk analysis is carried out . The risk analysis is made both for existing plants & future projects.

Risk analysis purpose:

Risk analysis will help to identify & quantify the area of strengths & weakness &provide actions for controlling risks & provide a basis for developing safety programs& fire prevention & protection measures.

Risk analysis involves the study of:

a) Identification of major hazards.
b) Identifying failure scenario of release of gas or situations such as spillage of chemicals or leakage of molten metal etc.
c) Carrying out of effect and damage calculations.
d) Deciding who are at risk – employees, contractors, visitors etc.,
e) Evaluate the risk in terms of likelihood & severity.
f) Deciding whether the existing precautions / measures are adequate.

Method of Risk assessment:

a) This includes studying various hazards and control measures adopted to prevent accidents. Wherever possible the estimation of DOW Explosion and toxicity Index were also done in addition to PHA and other studies.
b) Maximum Credible Scenario (MCA) with a maximum damage potential is studied.
c) Dow Fire and Explosion Index: Index helps to categorize the hazardous substances into lower or higher hazard potential and help to design safety measures for storing and handling.

For determination of Toxicity and Fire and Explosion Index, the various factors are considered.

I. Material Factors: Fire load, Flash point, Flammability, heat of Combustion, Vapor pressure.
II. General Process Hazards: Exothermic, endothermic reactors, process involving mixing, burning, charging etc.

III. Special process hazards: Process Temperature, Pressures, Operation, correction, Erosion etc, Engineering Judgment, Analysis of past accidents are also taken into consideration.

Risk identified in iron & steel plant:

The risks involved in operation & maintenance of an integrated steel plant are broadly classified in to following categories.

1. Mechanical Risks.
2. Electrical Risks.
3. Fire & explosion Risks.
4. High/low temperature exposure risks.
5. Toxic gases exposure risks.
6. Corrosive/reactive chemical exposure risks.

Mechanical & Electrical Risks

These two types of risks are of universal nature associated with any industrial activity not specific to a particular plant & process. Mechanical risks are generally encountered with injuries to head, limbs, eyes etc. Usually as a result of negligence on the part of operating or maintenance personnel in the use of improper tools, bypassing safety procedure, neglect of personal protective wear & risk associated with rotating machinery.

Electrical risks which results in shock or burns are most of them a consequence of poor maintenance, handling by unauthorized personnel & use of improper / substandard electrical equipment for cables. The above two types of risks normally do not cause Emergency situation.

Other types of Risks such as Fire & explosions, Toxic gas release, Chemical spills involve the handling of molten metal, fuel oils, toxic gases & chemicals can create emergency situations.

The details of materials involved, emergency scenario, consequence of incidents, employee's exposure & the level of risk associated with these activities are given in summary of Risk analysis. The summary of risk analysis is given in **Table 01 - 01.**

Table 01 –01
Summary of Risk Analysis

Sl.No	Scenario Envisaged	Risk / causes	Consequence	Probability of occurrence
1	Release of Toxic gas such as BF gas & coke oven gas	Inhalation of "CO"	Health Hazard (Unconsciousness etc.)	Occasional
2	Fire in fuel oil storage	Ignition of Oil	Major Fire	Occasional
3	Catastrophic Rupture of LDO / FO storage Tank	Ignition of LDO / FO oil	Jet fire	Remote
4	Chemical spills (HCl / FO storage Tank)	Ignition of LDO / FO oil	Exposure to corrosive Fumes of HCL & H2SO4 & chemical burns	Remote
5	Bursting / Explosion of LPG / Acetylene cylinder	Ignition of gas	Explosion & injuries to men working	Remote
6	Molten metal explosion in Blast furnace & SMS	Puncture of ladle / furnace	Explosion & injuries to men working	Remote
7	Fire in Underground Cable galleries	Insulation failure & short circuit	Major Fire	Remote
8	Boiler Explosion	Over pressure due to failure of safety devices	Pressure wave /missile effect of exploded pieces	Remote
9	Catastrophic rupture of steam line	Over pressure	Burns to Personnel	Remote

01.02 RISK MANAGEMENT MEASURES

The risk management measures for the proposed project activities require adoption of the best safety practice at the respective construction zones within the works boundary. In addition, the design and engineering of the

proposed facilities will take into consideration of the proposed protection measures for air and water environment. The detailed risk management measures are listed below.

a. FURNACE

I. PREVENTIVE MEASURES

If any job is to be undertaken in EOF & BOF areas where the EOF & BOF gases are toxic, the following procedure has to be laid down to ensure safety of men and the equipment.

a) Gas Safety man will accompany the team and will test the atmosphere for the presence of CO, before starting the work.
b) If `CO' concentration is found exceeding the safe limit, the job will be undertaken using necessary safety appliances viz., Oxygen Breathing Apparatus/ Blower type Gas mask.
c) Any gas cutting/welding job will be undertaken with the clearance from Gas Safety man.

II. GAS EXPLOSION, PREVENTION & PREVENTIVE MEASURES

The following actions will be taken to prevent any gas explosions in case of gas leakage.

- For jobs on gas lines/equipment, non-sparking copper tools will used. If such tools are not available, grease coated steel tools will be used. Electrical drill &other electrical equipment will not be used as these can give rise to sparks.
- The gas line will be thoroughly purged with steam before undertaking the job on the same.
- Naked lights will not be used near any de-pressurized gas main or equipment unless the same has been thoroughly purged.
- In case of profuse leakage of gas, action will be taken for water sealing and isolating that portion.
- The approach road to the gas line complex will be kept free from any obstructions.
- If gas catches fire due to some leakage, it will be extinguished with plastic clay, steam or water. The portion of gas main affected will be cooled down with water. The valve will not be closed when fire is still there and the pressure in the main will be maintained at minimum 100 mm (WC).

- Gas tapping points of flow or pressure measurement will be cleaned with wooden stick or grease coated wire.
- If lighting is necessary near gas line, portable spark proof electric lamps of low voltage or explosion proof torchlight will be used for enclosed areas.

b. HOT METAL & SLAG

Sudden break out of molten metal & slag may result in heavy explosions, due to their coming in contact with water, thereby causing serious burn injuries to persons and damage to equipment.

PREVENTIVE MEASURES

- Any accumulation of water will be prevented in such vulnerable areas.
- In case of minor leakages, the flow of molten metal & slag will be controlled.
- If there is major breakout, the area will be cut off and cordoned.
- Vital connections e.g. water, gas, compressed air, oxygen etc. will be cut off or regulated, as per requirement.

Fire water sump and its details are explained in the earlier chapters.

c. RESPIRATORY HAZARDS

DUST AND GASES

Dust generated in integrated pig iron complex includes iron and metallic dusts, which are mainly present in BF, continuous casting buildings and sinter plants; and mineral dusts which are mainly present in raw material storage, BF. In the former case, workers may be exposed to iron oxide and silica dust that can be contaminated with heavy metals such as chromium (Cr), nickel (Ni), lead (Pb), and manganese (Mn), zinc (Zn), and mercury (Hg). The most significant is the dust present in the melting and casting processes (e.g. BF, continuous casting), where the dust, which is generated by high temperature operations, is finer and more easily inhaled than in the rolling processes. In raw material storage, blast furnace and coke oven plant, workers are exposed to mineral dust, which may contain heavy metals. In addition, BF tapping results in graphite release.

In the melting and casting processes where high temperature operations are conducted, workers may be exposed to gas inhalation hazards, which may contain heavy metals. In the BF, workers may be exposed to gas inhalation

hazards of carbon monoxide. To prevent exposure to gas and dust, the steps taken include the following:

- Sources of dust and gases will be separated and enclosed;
- Designing the facility ventilation to maximize air circulation. Outlet air will be filtered before discharge to the atmosphere;
- Exhaust ventilation will be installed at the significant point sources of dust and gas emissions, particularly the BF topping area
- Providing a sealed cabin with filtered air conditioning if an operator is needed in a contaminated area;
- Providing separated eating facilities that allow for washing before eating;
- Providing facilities that allow work clothes to be separated from personal clothes, and for washing / showering after work;
- Implementing a policy for periodic health checks.

Respiratory hazard control technologies will be used when exposure cannot be avoided with other means, such as manual operations such as grinding or use of non-enclosed machine-tools; and during specific maintenance and repair operations. Necessary steps/ precautions for respiratory protection include the following:

- Use of filter respirators when exposed to heavy dust (e.g. fettling works);
- For light, metallic dust and gases, fresh-air supplied respirators will be used. Alternatively, a complete facial gas mask (or an “overpressure” helmet) may be used, equipped with electrical ventilation;
- For carbon monoxide (CO) exposure, detection equipment will be installed to alert control rooms and local personnel. In case of emergency intervention in areas with high levels of CO, workers will be provided with portable CO detectors, and fresh-air supplied respirators.

d. HOT LIQUID & HEAT RADIATION EXPOSURE

High temperatures and direct infrared (IR) radiation are common hazards in pig iron complexes. High temperatures can cause fatigue and dehydration. Direct IR radiation also poses a risk to sight. Potential contact with hot metal or hot water may occur from the cooling spray zone of continuous casting, from splashes of melted metal, and from contact with hot surfaces. Precautionary measures for prevention and control of exposure to heat and hot liquids / materials include the following:

- ❖ Shielding the surfaces where close contact with hot equipment or splashing from hot materials is expected (e.g. blast furnaces, BOF, continuous casting and heating oven, and ladles);
- ❖ Implementing safety buffer zones to separate areas where hot materials and items (e.g. billets, thick slabs, or ladles) are handled or temporarily stored. Rail guards around those areas will be provided, with interlocked gates to control access to areas during operations;
- ❖ Using appropriate PPE (e.g. insulated gloves and shoes, goggles to protect against IR and ultraviolet radiation, and clothing to protect against heat radiation and liquid metal splashes);
- ❖ Installing cooling ventilation to control extreme temperatures;
- ❖ Implementation of work rotations providing regular work breaks, access to a cool rest area, and drinking water.

e. PHYSICAL HAZARDS

Precautions for the prevention and control of general physical hazards are presented below.

Potential physical hazards in pig iron complex operations are related to handling of large and heavy raw materials and product (e.g. blast furnace and storage and movement of billets and thick slabs, movement of large ladles containing molten metal); heavy mechanical transport (e.g. trains, trucks and forklifts); grinding and cutting activities (e.g. contact with scrap material ejected by machine-tools); and work at heights (e.g. platforms, ladders, and stairs).

f. HEAVY LOADS / GRINDING & CUTTING / ROLLING

Lifting and moving heavy loads at elevated heights using hydraulic platforms and cranes presents a significant occupational safety hazard in pig iron plant. Measures taken to prevent and control potential worker injury include the following;

- ❖ Clear signage in all transport corridors and working areas;
- ❖ Appropriate design and layout of facilities to avoid crossover of different activities and flow of processes;
- ❖ Implementation of specific load handling and lifting procedures, including:
  - ✓ Description of load to be lifted (dimensions, weight, position of center of gravity)
  - ✓ Specifications of the lifting crane to be used (maximum lifted load, dimensions

- ✓ Train staff in the handling of lifting equipments and driving mechanical transport devices

- ❖ The area of operation of fixed handling equipment (e.g. cranes, elevated platforms) will not cross above worker and pre-assembly areas;
- ❖ Material and product handling will remain within restricted zones under supervision;
- ❖ Regular maintenance and repair of lifting, electrical and transport equipment will be conducted.

Prevention and control of injuries related to grinding and cutting activities, and use of scrap, include the following:

- ❖ Locating machine-tools at a safe distance from other work areas and from walkways;
- ❖ Conducting regular inspection and repair of machine-tools, in particular protective shields and safety devices /equipment;
- ❖ Training staff to properly use machines-tools, and to use appropriate personal protection equipment (PPE).

g. MUSCULAR SKELETAL DISORDERS

Muscular skeletal disorders are injuries that affect muscles, tendons, ligaments and nerves. These injuries can develop when the same muscles are used over and over again or for a long time without taking time to rest. The chance of getting this type of injury increases if the force exerted is high and/or the job requires an awkward posture. Some examples of musculoskeletal disorders include back pain, carpal tunnel syndrome, tendonitis and tenosynovitis.

Preventing musculoskeletal disorders requires recognition, assessment and control of the hazards that cause them. Keep in mind that the most knowledgeable person about problems with a job is usually the person doing it.

h. CONTROL HAZARDS, PREFERABLY AT THEIR SOURCE

Consider changes to

- ❖ Mechanizing a repetitive task or process
- ❖ Designing workstations and work processes using ergonomic principles
- ❖ Using well maintained tools and equipment that decrease force or awkward position
- ❖ Providing lifting devices to eliminate heavy lifting

- Ensuring that all employees receive comprehensive training on how to do their job safely

Using ergonomic principles, to avoid

- Awkward body positions
- Overextended and awkward reaches
- Repetitive or heavy bending, twisting, reaching, lifting, lowering, pushing and pulling
- Sustained or static exertions

i. NOISE

Noise is not a new hazard. It has been a constant threat since the industrial revolution. Too much noise exposure may cause a temporary change in hearing (your ears may feel stuffed up) or a temporary ringing in ears (tinnitus). These short term problems usually go away within a few minutes or hours after leaving the noise.

However, repeated exposures to loud noise can lead to permanent, incurable hearing loss or tinnitus. Removing hazardous noise from the workplace whenever possible and using hearing protectors in those situations where dangerous noise exposures have not yet been controlled or eliminated.

01.03 HEALTH AND SAFETY MEASURES FOR THE WORKERS

- Buildings and Structures

No walls, Chimneys, Galleries, Stairways, Floor, Platform, Staging or structure whether of a permanent or temporary character will be constructed in such manner as to cause risk or bodily injury.

- Provision of crawling boards . etc.

No person will be required to stand to pass over or work on or near by any roof of ceiling cover with fragile material through which he is liable to fall, in case it breaks or gives away the distance for more than 3 meters without use of sufficient number of suitable ladders, duck ladders or crawling boards which are securely support.

- Service platforms

Whenever practicable and demanded service platforms and gangways will be provided for overhead shafting, and where required by him these will be securely fence with guardrails and toe boards.

- Belts, etc

All belts will be regularly examined to injure that the joints are safe and the belts are proper tension.

- Helmets

Helmets will be provided to the workers for safe guarding themselves against any head injuries.

- Machinery

No machineries are equipments will be Situated, Operated or maintained in such a manner as to cause risk of bodily injury.

- Methods of work

No process of work will be carried out in such a manner as to cause risk of bodily injury.

- Electricity

No electricity installation will be provided during construction so as to be dangers to human life or safety.

- Medical check-up

Medical examination for every employee will be examined by certified surgeon at least once in 3 months of a calendar.

- Inspection and maintenance of pollution control systems only after getting official shutdown or with permission of authorized officer.

- Regular cleaning of floors, road, rooftops, conveyer galleries and any other dusty place.

- Checking for availability of spray water system for moistening the coal yard/dump. Heat insulation of hot surfaces

- All pollution control systems will be interlocked with operation of process equipment.

- The workers exposed to noisy equipment will be provided with earplugs. If necessary, the duty hours will be rotated, so that noise exposure time is kept within specified limits.

a) SAFETY OF PERSONNEL

All workmen employed in working conditions will be provided with adequate personal safety equipments as applicable to the work like:

- Industrial Safety Shoes
- Industrial Helmets
- Hand gloves
- Ear Muffs
- Welder's screen
- Aprons
- Gas masks
- Respirators
- Safety Belts
- Goggles

Health register will be maintained and safety slogans will be displaced in all important work place.

01.04 EMERGENCY ACTION PLANS

i. EMERGENCY ACTION PLAN FOR CYLINDER FIRE

- When container containing LPG is involved in fire, internal pressure if not relieved, will build up above 70 Kg/cm^2 and ultimately rupture the container. Rupture weak by direct flame impingement. Ruptured containers can be propelled at distance by jet action.

- If container's pressure is not raised up to 70 Kg/cm^2 leakage from screwed valve joint can occur due to different expansion of steel and brass.

- Ignition of the escaping gas would aggravate the fire but release of fire reduces the possibility of rupture.

- No attempt should be made to extinguish the burning gas but the container under fire and other containers in vicinity should be kept cool by water spray.

- If the gas leakage does not ignite, the container should be approached from up and removed to the place of safety away from the source of ignition.

ii. EMERGENCY ACTION PLAN FOR ELECTRIC FIRE

- Disconnect the affected areas electric supply.

- Attempt to extinguish fire with the help of CO_2, DCP

- If fire is not extinguished, extinguish by spraying water with fog nozzle after ensuring complete isolation of electric circuit.

iii. EMERGENCY ACTION PLAN FOR OFFICE FIRE

- Disconnected electric supply of the affected area.
- Attempt to extinguish the fire with the help of CO_2, DCP and sand.
- If large fire, use hydrant system.
- Attempt to save the record.
- Attempt fire extinguisher.

iv. EMERGENCY ACTION PLAN FOR OIL FIRE

- Attempt to extinguish small fire with the help of DCP
- If the fire is not controlled, use water foam to blanket the fire and further action is to be taken

THE PROPOSED PROJECT WILL PROVIDE ELABORATE ARRANGEMENTS FOR MANAGING ANY INCIDENTS OF FIRE

- Water Tender
- Foam Tender
- Portable Pump
- Wireless set
- Water Hoses
- Hot line Telephone etc.,

v. EMERGENCY ACTION PLAN FOR MEDICAL AID

A. Emergency action plan for electric shock casualties electric shock results in

Irreversible damage to brain cell begins followed by deterioration of the organs.

Rescue and first aid

Do first aid quickly and without fuss and panic

- Switch off the supply if this can be done at once.
- If not possible use a dry stick, dry cloth or other non-conductor to separate the victim from electrical contact.
- The rescuer must avoid receiving shock himself by wearing gloves or using a jacket to pull the victim.
- Always keep in mind that delay in rescue and resuscitation may be fatal.
- Every sound counts.

B. Artificial respiration

Give artificial respiration if breathing has stopped. There are several methods of artificial respiration, if the victim is not injured over the face, try mouth to mouth.

I. MOUTH TO MOUTH METHOD

- If there is obstruction to breathing, remove it with your fingers if it in mouth. Several sharp blows between shoulder blade may help to is lodge an obstruction.

- Lay casually on his back, put something under his shoulder to raise them &allow his head to fall backwards. The head should be, if possible be a little lower than the trunk. Remember that speed is essential.

- Kneel at the causalities head and grasp his arms at the wrists then cross them firmly over the lower chest. This movement should force air out of his lungs. Press with the hands crossed on the lower part of the chest and maintain pressure for two seconds.

- Release this pressure and pull out his arms with a sweeping movement upwards and outwards above his head and backwards as far as possible.

- This movement should cause air to be drawn in to his lungs. Retain the arm in this position for three seconds.

- Repeat these movements rhythmically about twelve times a minute checking the mouth frequently for obstructions. Each cycle will thus take give seconds two seconds for chest pressure and three seconds for arm lift.

- With the causality on his back there is danger of aspiration of vomit, mucus or blood reentering the system. This risk can be reduced by keeping his head extended and a little lower than the trunk.

- If an assistant is available, he can press the causality lower jaws so that the chin is jutting out.

- The assistant should also ensure that the mouth is kept open as far as possible and head is tilted to one side.

- When natural breathing begins, your movement should be adapted to correspond to it.

- If burns are present, cover them with a dry sterile dressing

- Handle the causality gentle.

- Do not allow people to crowd around and block fresh airflow.

- Arrange to remove the injured to the care of a doctor as early as possible.

01.05 NATURAL HAZARDS

a) EMERGENCY ACTION PLAN FOR /HIGHWINDS

A. Weather reports will be monitored from broadcast warnings regarding threatening conditions.

B. If the tornado has been sighted or effect is felt, following steps should be taken by plant personnel.

- Persons will be notified over public address system or through siren.

- Emergency services will be alerted for assistance.

- ❖ Plant personnel should be advised to assemble in the administration building basement, staff room, recreation room and restrooms.

- ❖ All safety systems should be kept on alert and all non essential utilities should be put off.

C.After the status is restored, personnel should inspect all the facilities for resource, first aid and damage control activities, damage assessment, and cleanup, restoration and recovery.

b) EMERGENCY ACTION PLAN FOR EARTHQUAKES

- ➢ When first tremors are sensed during an earthquake, all personnel should evacuate buildings and assemble at safe place away from structures, wall sand falling objects. Emergency shutdown should be declared.

- ➢ Emergency services should be contacted for assistance.

- ➢ After the status is restored, personnel should inspect all the facilities for rescue, first aid and damage control activities, damage assessment, cleanup, restoration and recovery.