RISK ASSESSMENT STUDIES

Even in the 21st century, millions of people are working daily in a dusty environment. They are exposed to different types of health hazards such as fume, gases and dust, which are risk factors in developing occupational disease. Cement industry is involved in the development of structure of this advanced and modern world but generates dust during its production. Cement dust affects lungs, stomach and colon. Other studies have shown that cement dust may enter into the systemic circulation and thereby reach all the organs of body and affects the different tissues including heart, liver, spleen, bone, muscles and hairs and ultimately affecting their micro-structure and physiological performance.

The main causes of occupational ill health are;

- Musculoskeletal disorders (MSDs)
- Skin disease, e.g. dermatitis
- Respiratory disease, e.g. occupational asthma

Generally in cement plants, the main causes of accident/ injury are found with reasons due to ;

- Injured while handling, lifting or carrying
- Slipped, tripped or fell on the same level and/or falling from height
- Hit by moving, flying or falling object

Control of Musculoskeletal disorders

Risk assessment can help to identify the workplace hazards and who is at risk, to decide on adequate preventive measures and risk monitoring. Assessment should be based on a holistic approach and the total load on the body should be considered. Normally there is no single factor that causes MSDs — for example, manual handling alone is rarely the cause of back pain, there are many other factors that may contribute to its development, such as stress, vibration, cold and work organisation.

Therefore, it is very important to assess the full range of MSD risks and to address them in a comprehensive way**.** The risk assessment must be completed by a set of appropriate actions targeted to elimination, where possible, or reduction of the risks to

musculoskeletal system. When deciding on preventive actions, a wide range of possible changes should be considered.

- **Workplace** — Layout should be improved to avoid workers performing tasks requiring high force applications in awkward, static working postures.
- **Work equipment** — Tools should be ergonomically designed. Powered tools should be used to reduce the force required for a task.
- **Workers** — they must be trained to increase their awareness of ergonomic factors and to recognise and avoid unsafe working conditions. Furthermore, workers must be convinced why it is important to pay attention to prevention and what happens if this is neglected. They should also be made aware of the benefits of adopting good practices and work methods in terms of reduced suffering and no lost wages.
- **Work task** — one of the most important requirements is to reduce the physical demands of the job by decreasing the levels of force, repetition, awkward postures and/or vibration. This often necessitates the use of new tools or working methods.
- **Work management** — planning the work better and implementing safe systems of work should be adopted. It may be possible to reallocate tasks between workers to reduce repeated motions, forceful hand exertions, and prolonged bending and twisting.
- **At the organizational level** — Practical solutions including developing appropriate work/rest ratios to reduce fatigue, organising breaks and rotating jobs should be adopted. At the corporate level, adoption of a policy to develop a strong safety culture should be promoted to gain higher top-level commitment and involvement in identifying and controlling MSDs risk factors, and to improve safety and surveillance measures.

Control of Skin Diseases

In order to prevent the workers of the industrial unit for any kind of skin disease and prevention of accident, following Personnel Protective Equipments would be provided to them;

Goggles : The workers will be asked to use goggles who work on washing of bottles, filling, cap sealing of bottles for protection of their eyes in case bottles are broken.

Rubber Gumboots : Full suit having hand-gloves, goggles, helmet and aprons will be provided for the workers working in the factory premises.

Face Shield Helmet : The person deputed for welding work will be provided with face shield helmet.

Medical Facilities : The Factory will be provided with the following medical facilities to handle any emergency:

1. Well equipped First Aid Boxes will be provided in each Section of the factory.
2. The First Aid Boxes will be distinctively marked with a Red Cross on green background and contain the following equipment/accessories:
    a) Small sterilized dressings.
    b) Medium size sterilized dressings
    c) Large size sterilized dressings
    d) Large size sterilized burn dressings
    e) Packets sterilized cotton
    f) Snake bite Lancet
    g) Pair of scissors
    h) Bottle of Potassium Permanganate
    i) Bottle containing 2% of alcoholic solution of iodine.
    j) Bottle of Sol. Volatile having the dose and mode of administration indicated on the label
    k) One copy of first aid leaf-let
    l) Bandages
    n) Adhesive plaster
    o) Triangular bandage
    p) Packets of safety pins
    q) Supply of suitable splints
    r) One tournequet

In case of need, factory will be having dispensary to give effective medical facility to workers. In dispensary, sufficient stock of medicines will be available to provide to workers in case of any major emergent situation. A vehicle will be always available to shift the sick/injured person to District Hospital.

DISASTER AND EMERGENCY RESPONSE MANAGEMENT

Disaster, in this context, means a sudden, accidental event that causes many deaths and injuries. Most disasters also result in significant property damage. Common natural causes of disasters include earthquakes, floods, hurricanes and typhoons, and tornadoes. Tsunamis (popularly, but incorrectly, known as tidal waves), volcanic eruptions, wildfires, and landslides and avalanches rank among the other natural forces that sometimes create disasters.

Not all disasters are produced by the forces of nature. The "man-made" disasters can be traced to explosions, fires, uncontrolled release of hazardous substances/chemicals, acts of war and terrorism, etc., unintentionally or intentionally, triggered by humans.

The disaster management approach entails a National Disaster Framework (a roadmap) covering institutional mechanisms, disaster prevention strategy, early warning system, disaster mitigation, preparedness and response, and human resource development.

Major hazards can be generally associated with the potential of fire, flood, or earthquake. Hazard control system is meant to ensure the avoidance of the hazards, or in case of any mis-happening minimum possible impact on residents and surrounding environment. Disaster, in this situation, may include incidences of flood, earthquake, fire, or disruptive incidents of human extremism. While the incidences of natural disaster are remote, these may result in significant loss of life and property.

Disaster, in this situation, may include incidences of flood, earthquake, fire, or disruptive incidents of human extremism. While the incidences of natural disaster are remote, these may result in significant loss of life and property. There is no fire sensitive establishment within or vicinity of the industrial complex. Adequate, fire fighting arrangement at micro level will be provided by the promoter.

Most of the situations are likely to be in the category of *Level 1 Emergency* (a local incident with a likely impact only to immediate surroundings of local site, where the impact radius may not be more than 15 m, such as, local fire, etc.) or *Level 3 Emergency* (an incident with likely impact area extending beyond the boundary limits of the project area, such as, floods, earthquakes, etc.).

On site emergency management will meet the exigency created due to all Level 1

emergencies. Level 3 emergencies need off-site management plan.

The construction specifications adopted by the promoters significantly incorporate fire-retarding properties. Adequate, firefighting arrangement at micro level will be provided by the promoter. In case of mishap, suitable provisions for emergency evacuation will be incorporated.

Regarding earthquakes, the structures of the project will be got designed designed to include earthquake resistant features. These will be appropriately incorporated while erection of the structures.

To contain the retrospective effects, only government authorities and agencies, at local and state level got to be adequately prepared in its mechanism to contain or minimize the losses arising thereof.

Planning for disaster

The management system, at industry level, needs to include;

a) Prevention and control at the onset
b) Setting up an authority, a core group, and control structure
c) Training and capacity building
d) Emergency planning for actions on site
e) Emergency planning for actions off site
f) Preparing a checklist of periodic requirements
g) Resource allocation

Prevention and control

Identification of hazards is the starting point for a system of prevention and control. The causes and sources need to be delineated. The probability and extent (magnitude) of their likelihood will also be estimated.

With this background information, every effort will be made to have a safest possible system, under the given constraints. The identified hazards need to be taken care of by;

a) Incorporating safety and precautionary features at design, execution, and commissioning stages of development

b) Identifying and setting early warning indicators

c) Carrying out preventive measures periodically

d) Identification and regular monitoring of the potentially accident/hazard prone domains

Additionally, selection/design of vessels, machinery, equipments, pipelines, etc., must take care of the following;

a) Strict adherence to applicable standards and codes regarding performance and safety

b) Selection of appropriate MOC

c) Adequate indicators, proper instrumentation and control system with warning and safety triggering mechanisms

Response planning and management

The overall objectives of and emergency plan are;

a) To localise the emergency, and, if possible, eliminate it

b) To minimise the effects of the disaster on people and property

Emergency plans are separate for on-site and off-site matters, but that should be consistent to each other.

On-site emergency plan includes the following issues;

a) Formulation of the plan and of emergency services

b) Alarm and communication mechanisms

c) Appointment of personnel and definition of duties

d) Emergency control centres

e) Voluntary organisations

f) Chemical/material information

g) Action on site

h) Rehearsing emergency procedures

i) Plan appraisal and updating

An off-site emergency plan will include the detailed information on following aspects;

a) Organisation – details of command structure, warning systems, implementation procedures, emergency control centres, details of the key officers.
b) Communications – identification of personnel involved, communication centre, call signs, networks, list of telephone numbers, etc.
c) Specialised emergency equipment
d) Specialised knowledge
e) Meteorological information
f) GIS based database
g) Humanitarian arrangements
h) Public information
i) Assessment

Fire protection system

The following systems of fire protection are proposed to be provided for the cement plant:

a) Fire alarm system
b) Fire containment
c) Hydrant system for the entire plant
d) High velocity water spray (HVWS) system
e) Carbon dioxide flooding system
f) Portable fire extinguishers.

Fire alarm system

A fire alarm system would be installed to provide visual and audible alarm in the power station for fire detection at the incipient stage. This system would comprise manual call points located at strategic locations in areas which are normally manned, and automatic smoke and heat detectors located at important points such as the cable vault, the control room, switchgear room etc., to detect fire at an early stage, and provide visual and audible alarm.

Fire containment

Strategic areas in the plant would be separated by adequately rated firewalls. All

openings for switchgears and cable entry would be sealed by fireproof seals to prevent spread of fire from one area to another.

Reserve water storage for fire demand

Reserve storage of 100 m^3 will be provided in the raw water storage tank with a suitable partition to cater to the water requirements of the fire protection system.

In view of the above, pump house elevation will also be suitably lowered at the location of the fire water pumps as compared to the floor elevation at the location of the raw water pumps.

Hydrant system

The hydrant system will comprise the following:

a) Four pumps, two motor driven and two diesel engine driven, each of 10 m^3/hour, capacity will be provided to keep both the hydrant and HVWS system mains pressurized. These pumps will take the suction from the water storage tank.
b) External as well as internal fire hydrants in all areas of the industry.

High velocity water spray system

The HVWS system is proposed to be provided for the fuel storage area. Since the parameters for the HVWS system will be identical to that of the hydrant system, the diesel engine driven pump described in the hydrant system, can serve as a common standby for both HVWS system and hydrant system.

The HVWS system will consist of a number of high velocity water projectors. Water supply will be through a deluge valve. Smoke and heat detectors will be used strategically.

Portable fire extinguishers

It is proposed to provide an adequate number of wall/column mounted type portable fire extinguishers in various areas of the plant including the control room, administration building, canteen, stores, workshop, etc. These portable fire extinguishers would basically be of carbon dioxide and dry power type.

Lightening protection system

A lightning protection system would be provided as per IS:2309 and Indian Electricity Rules. The protections would consist of roof conductors, air terminals and down-comers, and would be provided for high-rise (of more than 10 m height) structures.

Safety earthing system

A safety earthing system consisting of a buried mild steel conductor earthling grid would be provided for the power plant transformer yard, switchyard and other outlying areas. These would be connected to the earth grids in various buildings. The buried earthling grid would be further connected to earthling grid would be further connected to earthling electrodes buried under ground and located at representative points.

The earth electrodes will be 40 mm diameter and 3000 mm long G.I rods and the main earth conductors will be 75 mm x 12 mm flats. The earth conductors when buried will be of mild steel and galvanized wherever exposed to atmosphere.

Communication system

Adequate provision of inter-communication telephones, public address system, and walkie-talkie sets along with cellular phone based communication will be made to ensure that communication works fail safe during emergency response planning.

Training and information

While technical measures are essential for the safety, the role of people in management of disasters can not be ignored. The people can have a negative as well as a positive influence on the safety.

It is important to train not only the persons directly involved by the virtue of official authority or institutional affiliations (including NGOs), but also the general public by appropriately disseminating information on;

a) Possible disaster prone situations and extent of impact

b) Experience in similar situations elsewhere

c) Expected response and measures

d) Role of various constitutional authorities

OFF-SITE EMERGENCY MANAGEMENT

The Off-Site disaster management plan is as per the requirement of Schedule 12 of MSIHC Rules, 2000. Organizations involved, their responsibilities and liaison arrangements between them are discussed in following paragraphs.

City fire services

It is to combat fire and carry out other emergency operations as per the need. In case of fire, the fire brigade is the best help from outside. Even in a disaster not involving fire, the fire brigade could be of good help, inside the plant and outside, in view of their specialized equipments and expertise in rescue and relief.

Responsibilities;

- To reach the accident spot as soon as possible with all necessary equipments to extinguish the fire
- To provide all other necessary help depending on nature of emergency

Police

Police is required to manage and control the mob, violence, sabotage or outbreak, if any, cordoning of the area and help in fire fighting and other emergency operations. In case of emergency the police department has a number of functions to perform.

Responsibilities;

- Maintain law and order situation around the premises
- To control the traffic to facilitate the victims to reach hospitals as early as possible
- To restrict entry of any unauthorized persons
- To set up communication to assist in disaster management operation
- To take control of surrounding transport facilities and assist in disaster management operation by shifting injured persons and causalities to nearby hospitals
- Shifting injured persons and causalities to nearby hospitals
- To assist in fire fighting and other emergency operations

Hospital

Hospitals are required to provide first aid, treatment, and also to arrange for removal

of victims/casualties. Prompt and efficient medical aid is important in an emergency situation. The first center, inside the industrial premises, cannot cope up with all the treatment requirements. The right approach to this problem is to have arrangements with nearby hospitals so that in case of an emergency, services and facilities available with the nearby hospitals can be utilized.

Responsibilities;

- Depute doctors and nurses to site with ambulance
- To provide immediate medical relief to casualties
- Augmentation of equipments, drugs and doctors
- To provide first aid on the spot to casualties
- To take all out efforts on war-footing to save maximum lives
- To continue treatment to casualties till all of them are attended and properly shifted to medical centers

District administration

Civil administration is meant to provide overall supervision of all off-site emergency operations including order to evacuate off-site population. Local administration means those who are responsible for administration of the geographical area where the industrial facility is located.

Responsibilities;

- To protect the citizens
- To assess the situation for overall control
- To monitor the functioning and need of various agencies in rescue operation at site
- To requisite and make available the services and facilities available in the area like additional fire tenders, hospitals, doctors, transport, police, fire brigade, requisition of army and so on
- To coordinate the activities outside the industrial facility in view of their authority and experience in coordinating rescue and relief operations.

Regional transport office

RTO services may be needed to clear all approach roads to and from accident area for free flow of vehicular traffic, which is engaged in combating the emergency, and demarcate parking area for vehicles to evacuate population.

Controller of Explosives and Factory Inspectorate

These authorities are meant to provide expert advice and help in coordinating emergency operations with government agencies.

The inspector of factories is expected to be friend and a guide to industrial establishments. His involvement is a matter of course since he would be officially connected with inquiries after the disaster.

Responsibilities;

- To coordinate with local government body e.g., civil administration, civil hospital, police department, etc., as well as surrounding voluntary organizations
- To act as off-site emergency controlling authority
- To inform public for precautionary measures

Voluntary organisations

Voluntary organizations should help in relief and humanitarian services to victims in case of any emergency.

Responsibilities;

- To assist in rescue operations and first aid to the victims.
- To arrange transport, refreshment and shelter
- To take necessary assistance from social organizations like Red Cross Society, Scouts, NCC, Rotary, Lions clubs, etc.,

Other industrial installation in the vicinity

Industrial installations present near the site should help to combat the emergency with the available equipment/infrastructure present in their locations.

Responsibilities;

- To provide the strongest possible support and resources to the plant managers so

that the best accident prevention and emergency preparedness procedures are in place in the industrial facility

- To encourage their facility managers to commit themselves fully to the awareness and preparedness for emergencies at local level process
- To monitor the involvement of their facilities in the process