SAFETY, RISK AND DISASTER MANAGEMENT

1 SAFETY

The factory is having its own safety policy, which indicates the sincere commitment of the factory towards safety at work place.

- We have an idea that human life is precious
- We give priority to our production process as a safety, health and pollution free environment
- In our opinion, the accident is an avoidable event
- We are always careful to avoid accidents
- We are committed to covering the safety in the factory carefully
- We have made adequate organization to carry out all the above responsibilities

In 2012, the factory was awarded for best industry in the district for 'Industrial Safety, House-keeping and Environment', by District Industrial Safety Committee.

1.1 Goals/Targets of Safety

- Accident prevention
- Accident control
- Protection of human health/life
- Protection of material and property
- Protection of environment
- All workmen as well as staff of the factory are committed to safe work environment and hence they follow the basic principle of 'safety first'.

The safety department of the factory is responsible for creating safe environment at workplace. They are also responsible for creating and maintaining awareness on safety aspects at factory premises. This is achieved by regular training programmes, display of posters and notices at strategic locations, arranging documentary film shows related to safety, on job training, daily safety round, recommendation for corrective action, etc. The Department has formulated safety procedures and rules, depending upon the nature of work carried out at respective location. These procedures allow the safety personnel to periodically inspect equipments such as safety guards, cranes, lifting tackles, etc. He also inspects the certificates of fitness of the equipment. In addition to this, each year employees has been rewarded for best safety suggestion.

The factory has constituted a safety committee of 24 members (12 staff and 12 workers) headed by five management authorities. The members of the committee take periodical review and identify safety requirements at various locations/places. These requirements are assessed and approved by the management authorities. The members also examine the status of safety equipment and ensure that they are in good working conditions. If some changes/replacement is observed, they propose suitable corrective action. The factory uses safety gears and equipments of standard make (meeting national or international standards). The management ensures provision of adequate funds for safety. Provision for previous financial year was of Rs. 20.25 lakhs.

As a result of excellent housekeeping and safety practices, the factory could able to achieve, zero fetal as well as near miss accidents for last five years and has not lost a single hour due to accidents. However, the factory has well laid procedure for accidents, which is as follows.

1.2 Procedures in case of accident

According to the procedures, when an accident occurs at any place of the factory, respective shift in-charge immediately fills the accident report form. In the next step, this form is sent to respective Head of the Department who signs the form and submits it to Managing Director (MD), who communicate it to the Government Authority/ies. MD also initiates the process of investigation under the supervision of safety officer. Root cause of accident is determined and suitable preventive/corrective action is drawn. MD approves the findings of the investigations and corrective/preventive action plan is submitted to respective Head for implementation.

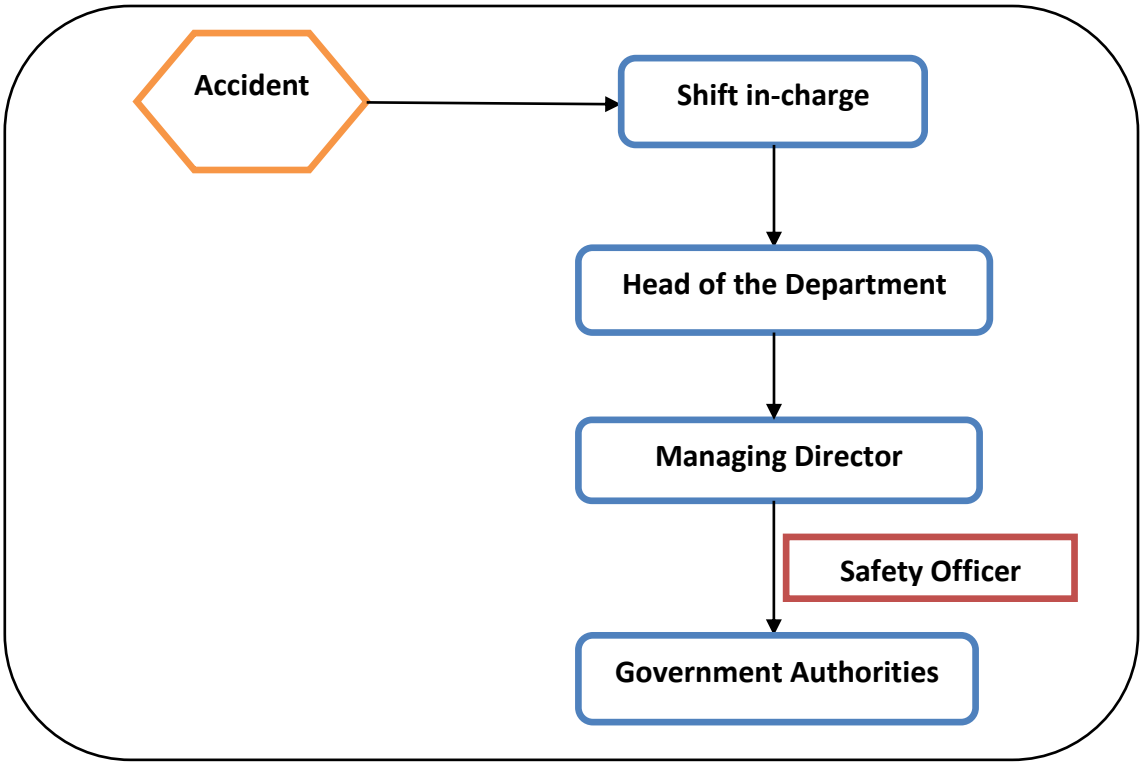


Figure 1: Schematic of procedure in case of accident

NATIONAL SAFETY COUNCIL OF INDIA

SAFETY AWARDS - 2015

Manufacturing Sector

Group-'E': Manufacturing of food products and beverages, textiles, tobacco products, paper & paper products, etc. - Not covered in Group A, B, C and D

CERTIFICATE OF APPRECIATION

This Certificate is awarded to

Krantiagrani Dr. G.D.Bapu Lad Sahakari Sakhar Karkhana Ltd. Kundal, Palus, Sangli, Maharashtra

in recognition of appreciable achievement in Occupational Safety & Health during the Assessment Period of three years - 2012 to 2014

V. B. SANT
DIRECTOR GENERAL

Navi Mumbai: 6 April, 2016

NSC-MC

NATIONAL SAFETY COUNCIL - MAHARASHTRA CHAPTER

MAHARASHTRA SAFETY AWARDS - 2014

This Certificate of MERIT
is presented to
KRANTIAGRANI DR. G.D.BAPU LAD SAHAKARI SAKHAR KARKHANA LTD.
KUNDAL, PALUS, SANGLI
for
MERITORIOUS PERFORMANCE IN INDUSTRIAL SAFETY DURING THE YEAR - 2014
in
PAPERS, SUGAR & PHARMACEUTICALS
Industrial Group
Mumbai, This Nineteenth Day of September, 2015

SHRI P.R. MASURKAR
HON. SECRETARY

SHRI ARVIND R. DOSHI
CHAIRMAN

Figure 2: Awards Received by the Factory for Best Safety Practices

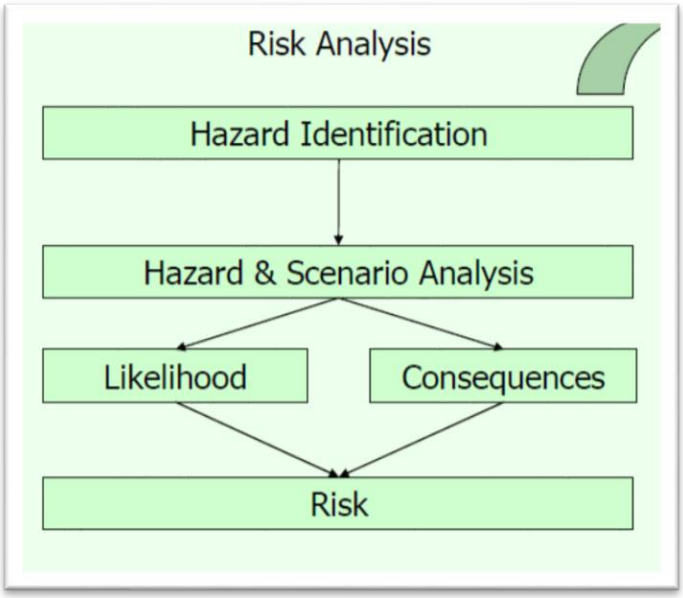
2 RISK ASSESSMENT AND RISK MANAGEMENT

Generally, risk associated with industrial processes can be defined as a measure of probability of harmful event such as death, injury, loss, etc. arising from exposure to chemical or physical agent may occur under the specific conditions of manufacture, use or disposal. Risk is a mathematical product of hazard and exposure. This relationship can, be expressed in the following simple formula.

Risk = Hazard x Exposure x Vulnerability

Multiplying any number by zero results in a product of zero, which means that an extremely hazardous substance can be present with little risk of adverse effect, if handled safely under proper conditions then the 'exposure' component of the risk equation is driven towards zero. Similarly, the hazard component can be reduced to zero even if there is a high probability of exposure, by changing the process design, substituting less hazardous commodity, using a lesser amount of a chemical, etc. and the recognition of vulnerability as a key element in the risk equation has also been accompanied by a growing interest in linking the positive capacities of people to cope, withstand and recover from the impact of hazards. It conveys a sense of the potential for managerial and operational capabilities to reduce the extent of hazards and the degree of vulnerability, which derives the total equation of risk towards zero.

Risk assessment is concerned with determining those factors which are especially dangerous and determining the likelihood of unacceptable toxic exposure. Risk should be assessed against defined limits of exposure, established on the basis of tests under appropriate conditions. Risk Management – a decision-making process to select the optimal steps for reducing a risk to an acceptable level. In the industrial context, it consists of 3 steps: risk assessment (evaluation), emission and exposure control, and risk monitoring.



2.1 HAZARD IDENTIFICATION

2.1.1 Broad categories of hazard

To help with the process of identifying hazards it is useful to categorize hazards in different ways like by topic, for example:

a. Mechanical
b. Electrical
c. Thermal
d. Noise and vibration
e. Material/Substances
f. Fire and explosion

a. Mechanical Hazard

It mainly involves properties of machine parts or work pieces, such as:

a. Faulty design (Shape): It may cause injury to workman
b. Relative location: Confined location during repairs & maintenance
c. Mass and stability: May cause physical injury
d. Inadequacy of mechanical strength
e. Accumulation of energy inside the equipment: steam/ air /water pressure cause injury to workman

f. During commissioning, operation, maintenance and decommissioning of Co-generation plant following hazards are anticipated.

Crushing hazard, shearing hazard, cutting or severing hazard, entangling hazard, friction or abrasion hazard and high pressure fluid injection or ejection hazard.

b. Electrical Hazard

Probable incidences for electrical hazards, could be

a. Contact of persons with live parts (direct contact),
b. Contact of persons with parts which have become live under faulty conditions (indirect contact)
c. Approach to live parts under high voltage
d. Electrostatic phenomena
e. Thermal radiation or other phenomena such as the projection of molten particles and chemical
f. Effect of short circuits, overloads, etc identified during construction, production and maintenance.

c. Thermal Hazard

Probable causes of thermal hazards are -

a. Burns, scalds and other injuries by a possible contact of persons with objects or materials with an extremely high or low temperature, by flames or explosions and also by radiation of heat sources
b. Damage to health by hot or cold working environment
c. Thermodynamic hazard such as overpressure, under pressure, over-temperature, under-temperature need to be avoided by providing system management

d. Hazard generated by noise & vibration

In the proposed project, probable source of noise are – boilers, steam turbine generators and transportation of bagasse on conveyer belts, motors, loading of bagasse, etc. Usually prolong exposure to high noise level, results into

1. hearing loss (deafness), other physiological disorder (e.g., loss of balance, loss of awareness)
2. Interference with speech communication, acoustic signals, etc.

In the proposed project the hazard due to vibrations could be due to -

1. Use of hand-held machines resulting in a variety of neurological and vascular disorders
2. Whole body vibration, particularly when combined with poor postures

e. Hazards generated by materials/substances

1. Hazards from contact with or inhalation of harmful fluids such as: anti rusting chemicals, cleaning agents/acids/organic solvents gases, superheated steam through leaks and bagasse dusts
2. Fire or explosion hazard—dry bagasse
3. Biological or microbiological (viral or bacterial) hazards: -Workplace exposure to dusts from the processing of bagasse can cause the chronic lung condition pulmonary fibrosis.

During work activities following hazards could exist -

i. Slips/falls on the floor level
ii. Falls of persons from heights
iii. Falls of tools, materials, etc. from heights
iv. Inadequate headroom
v. Hazards associated with manual lifting/handling of tools, material, etc
vi. Hazards from plant and machinery associated with assembly, commissioning, operation, maintenance, modification, repair and dismantling
vii. Vehicle hazards, covering both on-site transport and off-site travel by road
viii. Fire and explosion
ix. Violence to staff
x. Substances that may be inhaled
xi. Substances or agents that may damage the eye
xii. Substances that may cause harm by coming into contact with, or being absorbed through the skin
xiii. Substances that may cause harm by being ingested (for example entering the body via mouth)
xiv. Harmful energies (for example, electricity, radiation, noise, vibration, etc.)
xv. Non-compliance of regulation
xvi. Inadequate thermal environment, for example too hot
xvii. Lighting levels
xviii. Inadequate guard rails or hand rails on stairs
xix. Subcontractors' activities.

3 PROBABLE RISK FACTORS (Associate with the Industry)

Following scenarios fall under maximum credible accident scenario

- Fire in fuel storage yard (bagasse yard)
- Fire due to short circuits
- Injury to body and body parts (mechanical unit)

3.1 Fire in fuel (bagasse) storage yard

This is the most common accident known to occur in any plant, while storing and handling fuel. Usually, such incident takes sufficient time to get widespread. Enough response time is available for plant personnel to get away to safer distance. An elaborate fire hydrant network and firefighting system comprising of trained crew and facilities will mitigate the risk of such incidents. In addition, as per requirement fire alarm system and smoke detectors have been installed (in the existing unit).

Figure 3: Firefighting system at existing bagasse yard

Instructions for Vehicles moving in Bagasse yard

Figure 4: Sign board has been displayed for vehicle, insisting fire/ignition arrestor on vehicles

3.2 Mechanical injury to body parts

In a plant, there are several places where workers are likely to be involved with accidents resulting in injury to body parts. The places are workshop, during mechanical repair work in different units, during construction work, road accidents due to vehicular movement, etc.

Workers exposed to mechanical accident-prone areas are using personal protective equipment. The non-respiratory PPE includes tight rubber goggles, safety helmets, welders hand shields and welding helmets, plastic face shields, ear plugs, ear muffs, rubber aprons, rubber gloves, shoes with non-skid soles, gum boots, safety shoe with toe protection. All safety and health codes prescribed by the BIS will be implemented.

4 QUALITATIVE RISK ASSESSMENT

Table 1: Probability of occurrence of hazard

Probability Number	Causes/ Incident
1	Very unlikely once in 10 yrs
2	Remote once in 5 years
3	Occasional once in a year
4	Probable once in a month
5	Frequent / daily or more often

Table 2: Severity - Impact Intensity

1	Minor	Failure results in minor system damage but does not cause injury to personnel, allow any kind of exposure to operational or service personnel or allow any release of chemicals into the environment
2	Major	Failure results in a low level of exposure to personnel, or activates facility alarm system
3	Critical	Failure results in minor injury to personnel exposure to harmful chemicals or radiation, or fire or a release of chemical to the environment
4	Catastrophic	Failure results in major injury or death of personnel

Frequency/ consequence	1 Very unlikely	2 Remote	3 Occasional	4 Probable	5 Frequent
Catastrophic					
Critical					
Major					
Minor					

Acceptable - only ALARP actions considered

Acceptable - use ALARP principle and consider further investigations

Not acceptable - risk reducing measures required

Calculation of Risk assessment and mitigation measures

Risk = Probability x severity

If, there is a probability number of any particular cause/incident is 1 and its severity is minor then,

Risk involved in the hazard is 1x1 = 1

Whereas,

If, there is a probability number of any particular cause/incident is 5 and its severity is catastrophic then,

Risk involved in the hazard is 5x4 = 20

Thus, the Risk of those hazards scoring 20 are defined and considered as 'Non-acceptable Risk'.

Mitigation measures or operational control procedures required for such hazards identified is given below in **Table 3**.

Table 3: Mitigation measures for identified hazards

#	Hazard	Probability	Severity	Mitigation Measure
	Mechanical Hazard			
1.	Physical injury to hand/legs, body parts during process	Frequent Once per month or more often	Minor	Use PPE/PPA
2.	Boiler Explosion	Remote	Catastrophic	Layers of Protection area (LOPA)
3.	Fingers nipping in between moving part. Eg. Belt	Probable Once per year	Major	Fixed /Movable Guards at probable sites
4.	Steam pipe leakages	Frequent Once per month or more often	Major	Proactive Maintenance/PPE
5.	Working on height Impact /falling down	Probable Once per year	Critical	Work permit system Life belts/Helmet
6.	Water feeder pump failure	Occasional Once per 10 years	Critical	Alarming/communication arrangements
	Electrical Hazard			
7.	Contact of persons with parts which have become live under faulty conditions (indirect contact)	Occasional Once per 10 years	Major	PPE/PPA/Permits
8.	Approach to live parts under high voltage	Occasional Once per 10 years	Catastrophic	Guards/ authorization Enter Restriction
9.	Electrostatic phenomena	Remote	Major	Earthling, avoid Dust Explosion
10.	Thermal radiation or other Short circuits, overloads, etc.	Probable Once per year	Major	PPE/Checking /Inspection
	Thermal Hazard			

11.	Burns, scalds and other injuries by steam	Occasional Once per 10 years	Major	Safe working distance /PPA/protective dress code
12.	Damage to health by hot working environment	Frequent Once per month or more often	Critical	Minimum exposure Ventilation/Humidity control
	Hazard generated by Noise			
13.	Belt movement, Pump/Motor, Turbo generator	Frequent	Critical	Confinement of source, Use Ear Muff/Plugs
	Hazard generated by Vibration			
14.	Whole body vibration, during working on feeder platform	Remote	Major	Engineering solutions

Number of Accidents " Reportable " under the Factories Act, 1948 **(including accidents to workers employed by Contractors, Vendors, Transporters and Visitors)**		Assessment Period		
		2016	2015	2014
1	Fatal000	Nil	Nil	Nil
.2	Total Permanent Disability 000	Nil	Nil	Nil
.3	Non-Fatal (excluding item # 5.2) 000	Nil	Nil	Nil
4	Weighted Accident Frequency Rate (WAFR) $= \frac{[\{10(\text{Items \# 5.1 + 5.2}) + \text{Item \# 5.3}\}] \times 10^6}{\text{Number of total man-hours worked (as in Item \# 3.2c)000}}$	Nil	Nil	Nil

5 MITIGATION

5.1 Basic design of the Sugar & Cogeneration plant

While designing the plant, ensure maximum plant load factors. The plant cycle should be optimized to give the best efficiency. The success of the sugar & cogeneration plant depends on this "basic design". Plant layout is a part of the basic design and is very important from the point of view of operability and maintainability of the plant.

The plant and equipment should be so laid out that there is optimum routing of piping, cables and conveyors. New boilers will be designed as per IS standard. Pilot lights will be provided on electrical panel boards. KDGDBLSSKL will provide hand operable firefighting cylinder at strategic location viz.

power house, control panel room, PRDS section etc. The switchyard layout should be such that the transmission lines could be laid without difficulty and hindrance.

5.2 Steam generating System

Some fine tuning is required in the areas of excess air control and un-burnt carbon loss control. Feed water quality control is an area needing attention and this is separately dealt in the detailed project report (technical report).

5.3 Turbo generator System

Problems in maintaining the steam purity in the boilers affect the turbine with deposits on the blades. The major contaminant is silica that gets carried over as vapor as the operating pressure of the boiler increases.

There could be some problems of vibration and failure of bearings. These could be due to-initial problems in the lube oil system, and these could be resolved by having proper pre-commissioning checks. Another problem observed usually in some industries is of exhaust hood spray falling on the blades and causing vibration. This is mainly due to a misdirected spray nozzle in the exhaust hood. Proper designing will resolve such problems.

5.5 Bagasse Handling

During the cane crushing season, the plant receives bagasse directly from the mill, and the surplus bagasse is taken to the yard. The bagasse thus saved will be used for the off-season operation of the cogeneration plant, or could be used to run the cogeneration plant on the cleaning days or when the mill is not running due to some other reasons. Under such circumstances, back feeding of the bagasse from the yard to the boiler has been provided.

5.6 Milling Section

Milling section, where the juice is extracted from the cane, is the most important section of sugar mill. This is where the bagasse is prepared as a fuel, and the moisture in the bagasse controlled to a value of around 50%. If there are problems with this section, the moisture content in the bagasse could go high and the bagasse will not be prepared well for handling and combustion. Other points related to milling section are the use of optimum imbibitions and the use of electric or hydraulic drives for the mills.

5.7 Electrical Systems

As far as the technology for the cogeneration plant and design of the electrical systems is well established. All the electrical equipment required for the sugar & cogeneration plant, as well as its grid paralleling are available indigenously. The only problem faced by the cogeneration plants is the stability of the grid.

There are baseless fears in the minds of the plant operators with regard to the ability of the cogeneration plant to cope up with the tripping of the grid. If the protections are properly chosen and the equipments are properly specified, there is no such probability.

5.8 Controls & Instrumentation

Being the most important subject from the point of view of operation and maintenance of the sugar & cogeneration plant, this subject deserves a lot of attention. Distributed Control System (DCS) is the order of the day. The technology for the planning and designing the complete controls & instrumentation system for the cogeneration plants is available, but what is required is to create awareness among sugar plant people about the importance of instrumentation in the operation and maintenance of the sugar & cogeneration plant.

6 RISK MITIGATION MEASURES: FIRE HAZARD

In view of vulnerability to fire, effective measures have been considered to minimize fire hazard. Fire protection is envisaged through hydrant and sprinkler system, designed as per the recommendation of Tariff Advisory Committee of Insurance Association of India / Loss Prevention Association of India. For detection and protection of the plant against fire hazard, any one or a combination of the following systems will protect susceptible areas:

a. Hydrant system
b. High velocity spray system
c. Portable fire extinguishers
d. Fire alarm system

The existing firefighting system is as per National Code/standards (for Factories), the details of which are as follows.

6.1 Fire Fighting System

While designing, the firefighting system, various vulnerable locations in the Unit, probable causes & chances of occurrence of fire, its class etc. has been considered in-depth.

The sugar factory has developed an excellent set up for firefighting. It is having a dedicated fire fighting vehicle and operating staff in all shifts. This vehicle is supported with a water tank of 6000 L capacity. The factory has made all possible preventive measures for bagasse storage area, which is one of the major vulnerable area of fire. It has developed a water tank of 75 lakh litres and laid down a hydrant line of 2380 feet in this area. This is supported by 40 HP fire pump and 10 fire monitors. It is made

mandatory to install fire arrestor in vehicles visiting bagasse storage area. More upon, the persons working in the area are instructed about the fire preventive work practices.

6.1.1 Fire Extinguisher

6.1.2 Classification of Fire

Class (A): Fire involving combustible materials like wood, paper, cloth and bagasse etc.

Class (B): Fire due to liquid materials like oil, diesel, petroleum products and all inflammables.

Class (C): Fires involving domestic and industrial gases like butane and propane etc.

Class (D): Metal fires, etc.

Class (E): Electrical fires due to short circuiting, etc.

The factory has installed 132 portable fire extinguishers, in the entire premises. Of these, 46 extinguishers are of dry chemical powder type, 24 are of ABC stored pressure, 65 are of CO_2 type, 03 are of water-CO_2 type and 04 are of mechanical foam type. Each extinguisher is properly numbered and placed at required location according to its type. These locations are painted with yellow and white bands, for an easier identification. These extinguishers are checked periodically and sent for refilling immediately after its expiry. In order to know which, type of cylinder to be used in respective fire, boards have been displayed at several locations in the factory. Fire detection, heat detection alarm system have been provided to detect fire/heat/smoke in vulnerable areas of the plant.

Use of Fire Fighting Equipment

Most of the workers have been trained with respect to nature and utility of firefighting equipment, its type and class of fire for which it is to be used. They also perform mock drills to handle disaster situation such as fire.

Fire Evacuation

The factory has provided seven exits to main building for easy and fast evacuation in case of emergency. These exists are properly displayed using glow signs. Fire doors have been provided in the corridors of buildings. Close circuit television (CCTV) cameras have been installed at strategic locations to monitor respective areas. Contact numbers in case of emergency are displayed at various locations. In case of fire, a control room has been provided at ground floor at safe locations. Provision has been made for alternate power supply for pumps, lights and other emergency machineries. As described earlier, a dedicated tank of 75 lakh litres has been provided which is available round the year. Fire alarm, fire extinguishers, hydrant and pumps are properly maintained. Pumps and extinguishers are checked for desired pressure.

The entire factory premises have been declared as 'No smoking zone' and this is strictly implemented. All lobbies, staircases and open spaces are kept free from scrapped material such as packaging boxes, used files, waste papers, broken furniture such as chairs, tables and cupboards as well as similar fire catching material. Office buildings, work places, storage areas as well as parking places have been designed thoughtfully, so as to use natural light and ventilation to maximum extent. The factory follows best housekeeping practices to keep workplace neat and clean.

6.1.5 Procedure for In case of Fire

In case of fire, an alarm is pressed that gives signal to all staff as well as workers. It is advised, not to be panic in such situation and follow the procedure as laid down and for which they have been trained. In brief, the procedure is as follows -

All the machineries located near fire place are shut downed immediately including EOT cranes. The workers are suggested to vacate the area immediately. While vacating the area, it is advised to walk and not to run (specially using staircases) and not to push each other. Vacate the premises through safe exits which are away from fire and assemble at the place defined as 'assembly point'.

6.1.6 Ventilation

Proper ventilation must be provided both in sugar and cogeneration unit. Since, adequate natural ventilation is available at site, the mechanical ventilation is presumed to be minor or less significant. However, if mechanical exhaust ventilation needs to be provided, it should be to the order of 1 cfm/sq.ft. or floor area (0.3 m^3/min.m^2) by fans of adequate capacity having their suction intake located near floor level to ensure a sweep of air across the entire area.

First Aid

A first aid centre with adequate facilities should be provided at the site. It should be maintained round the clock by trained personnel.

Important standards to be followed are -

1. **Fire protection**
   - IS 2189: Standard for automatic fire detection and alarm system
   - IS 2190: Code of practice for selection and maintenance of first aid fire extinguishers
   - IS 3844: Code of practice for installation and maintenance f internal fire hydrants and hose reels

- IS 6382: Carbon dioxide fire extinguishing system – fixed, design and installation

2. **Occupational health and safety**
   - IS 4489: Code of practice for occupational safety and health audit
3. **Electrical Risk**
   - Hazardous area classification based on IS 5572
   - Selection of electrical equipment for hazardous area based on IS 5571
   - Lightning protection system based on IS 2309
   - NFPA 70 B Recommended practice for electrical equipment maintenance
   - NFPA 70 E Standard for electrical safety in employee work places
4. **Process safety management**
   - Hazard and Operability studies (HAZOP)
   - Failure Tree Analysis (FTA)
   - Event Tree Analysis (ETA)
   - Primary Hazard Analysis (PHA)
   - Risk Assessment with risk ranking technique
5. **Electrical Risk Assessment**
   - Review of Hazardous area classification
   - Lightning protection risk assessment
   - Identification and control of electro-static hazards
   - Review of electrical preventive maintenance system
   - Electrical risk assessment (Fire, shock, explosion) using semi-quantitative risk ranking (SQRR) technique
6. **Fire Risk Assessment**

- Identification and assessment of fire risks at receiving station/s, storage, transfer and handling of materials such as raw material, fuel, finished products
- Identification and control of ignition sources in areas where flammable materials are stored/handled/transferred
- Review of fire detection measures adopted in the plant and to suggest suitable improvement measures
- Review of various active (fire hydrant, sprinkler, portable fire extinguishers) and passive fire protection requirements for all work places and suggest improvements as necessary

- Review of contractor safety awareness (fire fighting, emergency communication, knowledge of plant hazards and safety regulations) and to recommend suitable improvement measures to enhance safety
- Review of safety awareness and safety training requirements (training identification and efficacy) of employees with respect to hazards

The consequences, likelihood and exposure of each hazard are arrived using a systematic approach and will help to determine the relative importance of hazard and focus on significant risks.

6.Other measures

- Other mitigation measures include
- Emergency shutdown system
- Pumps of reliable quality will be installed
- Lightening protecting system as per Indian Electricity Rules
- Power cables, control cables, instrumentation cable, thermocouple extension wire will be complying IEEE fire tests as defined in IEEE 422
- Keeping safe distance between fuel storage area and main unit
- Corrosion protection methods for pipelines
- All locations where the above pipelines are close to traffic movement, protection like crash guards should be provided.

Lighting Arrestor
Make- terselesel Type- T Z90
CPRI Tested Range-109 mitre Protection Radioes
Loction - 1. at Boiler Chimany
2. at weight bridge
3. at Sugar House
4. at General office

Figure 4: Lightening arrestors are installed at four locations to prevent fire due to lightening

Figure 5: Workers receive periodical training for operating safety and fire protection equipments

8 DISASTER MANAGEMENT PLAN

8.1 INTRODUCTION

According to the **UN International Strategy for Disaster Reduction, (UNISDR)** "A **Disaster** is a sudden, calamitous event that causes serious disruption of the functioning of a community or a society involving widespread human material economic or environmental losses and impacts which exceeds the ability of the affected community or society to cope using its own resources."

Disaster Management is – "it is action taken to prevent Hazard converting into Disaster". A major disaster in a work is one which has potential to cause serious injury or loss of life. It may cause extensive damage to property and serious disruption both inside and outside the work. Normally, assistance of outside emergency services is required to handle disaster situation effectively. Whatever are the causative factor like plan failure, human error, earthquake, lightning, vehicle crash sabotage etc. they will normally manifest in three basic forms viz. fire, explosion and/or toxic release.

8.2 SCOPE

Disaster: A serious disruption of the functioning of a society, causing widespread human, material or environmental losses which exceed the ability of the affected community to cope up by using its own resources.

Hazard: Hazard is an event or occurrence that has potential for causing injury or loss of life or damage to property or the environment. Following factors are considered to identify Hazard -

- Physiology of the Hazard or and its peculiar characteristics.
- Impact & probability of occurrence
- The elements by affecting, Life / Property or environment, likely to get affected

High power committee on Disaster Management, Government of India has identified 32 types of hazards in India depending on area, probable damage, repentance of occurrence and impact on life, property and environment etc.

Table 4: Various types of hazards

Geological Hazards	1. Earthquake	2. Landslide
	3. Tsunami	4. Dam burst
	5. Volcanic eruption	6. Mine Fire
Water & Climatic Hazards	1. Tropical Cyclone	2. Cloudburst
	3. Tornado and Hurricane	4. Landslide
	5. Floods	6. Heat & Cold wave
	7. Drought	8. Snow Avalanche
	9. Hailstorm	10. Sea erosion
Environmental Hazards	1. Environmental pollutions	2. Desertification
	3. Deforestation	4. Pest Infection
Biological	1. Human / Animal Epidemics	2. Food poisoning
	3. Pest attacks	4. Weapons of Mass Destruction
Accidents related	1. Forest fires	2. Air, Road & Rail accidents
	3. Urban Fires	4. Festival related Disasters
	5. Mine Flooding	6. Electrical Disasters & Fires
	7. Oil Spills	8. Boat Capsizing
	9. Major Building collapses	10. Village fires
	11. Serial Bomb Blasts	

The geographic region of the proposed project may face probable hazards such as earthquake, drought, thunder storms, accidents and environmental hazard such as pollution. So considering these probabilities, following disaster management plan is being recommended.

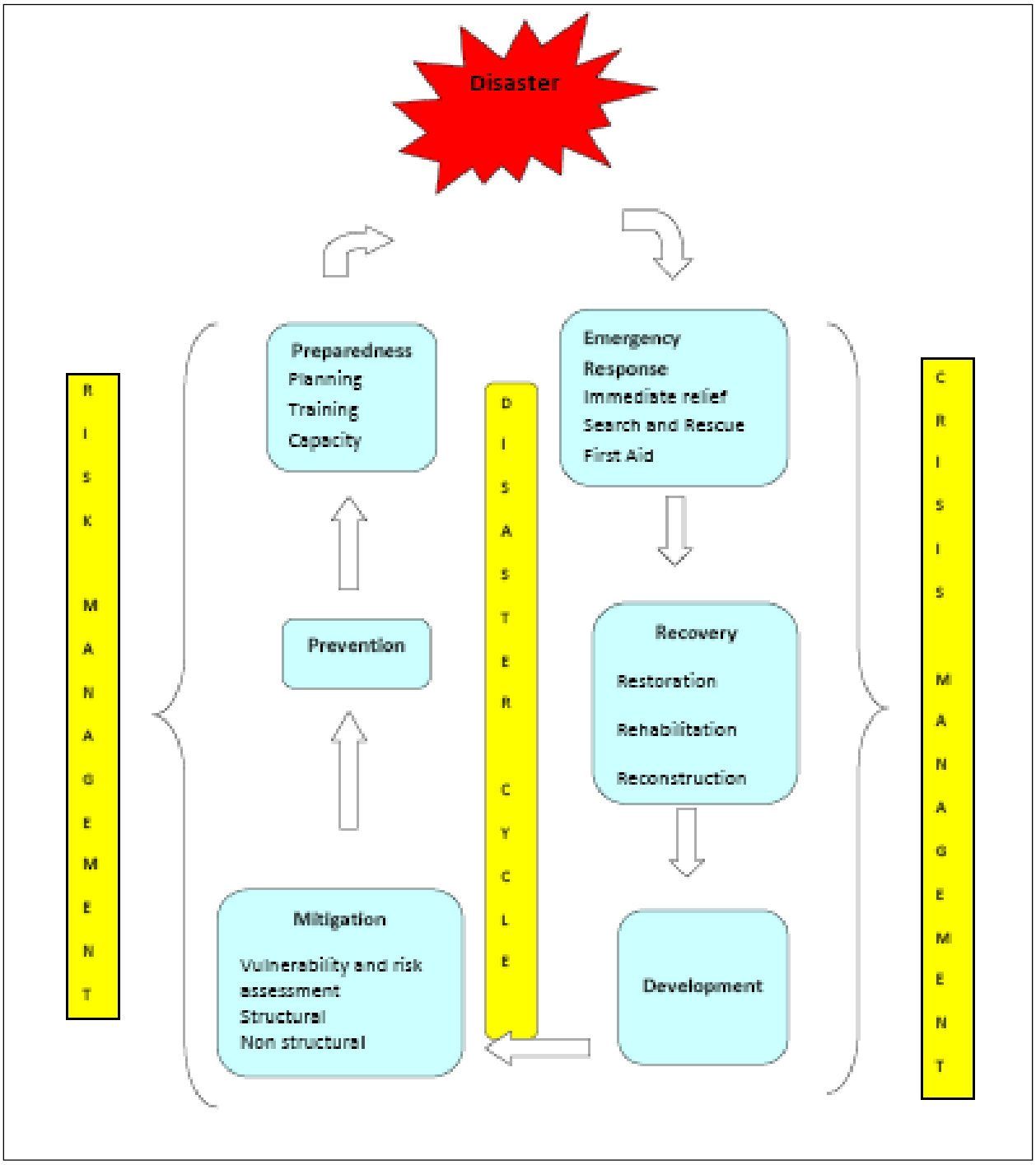


Figure 5: Schematic of Disaster Management Process

9 DISASTER MANAGEMENT PLAN (DMP) CYCLES

Disaster management is a methodology to understand and face disaster and take appropriate measures to minimize the losses of life, property and environment. This can be represented in 3 sections namely – Pre disaster phase, During disaster and Post disaster situations.

1. Pre disaster activities

- Policy development and local level disaster organization formation
- Vulnerability and capacity assessment
- Prevention and mitigation
- Preparedness, planning and training

2. Emergency activities

- Warning (beginning before the actual event)
- Evacuation, search and rescue
- Emergency assistance (relief) – food, water, shelter, medical aid

3. Post disaster activities

- Repair and restoration of life lines (power, telecommunications, water transportation)
- Reconstruction and rehabilitation

9.1 Pre-disaster situation (Preventive measures)

- Earthquake resistant construction as per National Building Code and considering the factory is located in seismic zone III.
- Follow Indian Standard Code for construction of (factory) buildings
- Enforcement of building code in the byelaws
- Strengthening of important buildings, which need to be functional after a disaster. Upgrade level of safety of buildings.
- Reduce possible damages from secondary effects. e.g. identify potential sites and restrict construction in those areas.
- Insurance policies for natural disasters are mandatory and priced specifically on available scientific data of hazards in the region.
- In earthquake prone areas, insurance should be obtained for buildings under construction and those in use

- Preparation of disaster related literature in local languages with do's and don'ts for construction
- Getting communities involved in the process of disaster mitigation through education and awareness
- Networking of local NGOs working in the area of disaster management.

In the preparedness phase, emergency managers develop plans of action carefully to manage and counter probable risks and take action to build the necessary capabilities needed to implement such plans. Common preparedness measures include:

- Communication plans with easily understandable terminology and methods
- Proper maintenance and training of emergency services, including community emergency response teams
- Developing an exercise of emergency population warning methods combined with emergency shelters and evacuation plans
- For evacuation, a disaster supplies kit may be prepared and for sheltering purposes, a stockpile of supplies may be created. The preparation of a survival kit such as a "72-hour kit" is often advocated by authorities. These kits may include food, medicine, flashlights, candles and money. Also, putting valuable items in safe area is also recommended
- Stockpiling, inventory, streamline foods supplies, and maintain other disaster supplies and equipment
- Develop organizations of trained volunteers among civilian populations. Professional emergency workers are rapidly overwhelmed in mass emergencies so trained, organized, responsible volunteers are extremely valuable

It is realized that investment on Preparedness, Prevention and Mitigation is more cost-effective compared to expenditure on relief and rehabilitation. The basic characteristic of disaster management is 'proactive' prevention, preparedness and mitigation rather than the prevalent 're-active' relief and rehabilitation approach. Management of risks as a prelude to crisis management has now gradually gained importance.

Disaster management planning is not a substitute for good operative/maintenance/ design practice. It is an aspect of safety management. Every industry, as mentioned above, should minimize risk by adherence to safe practice and meeting all legislation.

On-site disaster management planning is responsibility of project management (i.e. occupier). The district authorities and the Directorate of Industrial Safety and Health have the responsibilities for off-site Disaster management plan of the district.

The proposed sugar and cogen unit needs to have a round-the-clock team to manage disaster. The team shall include several members. Their functions depend on size of the organization and it shall be headed by a technically qualified as well as a trained individual.

9.2 Response

The response phase includes the mobilization of the necessary emergency services and first responders in the disaster area. This is likely to include a first wave of core emergency services, such as firefighters, police and ambulance crews. In some instances, it is termed **Disaster Relief Operation** (DRO). This may be supported by a number of secondary emergency services, such as specialist rescue teams.

A well rehearsed emergency plan developed as a part of the preparedness phase enables efficient coordination of rescue. Where required, search and rescue efforts commence at an early stage. In this particular section, the response plan is discussed in details.

The response plan of Disaster Management Plan is crucial and it includes the following -

- Controlling the disaster, localizing the disaster and eliminating the hazard, if any
- Minimizing damage to property and environment
- Safeguarding others by timely evacuation
- Welfare of person managing the disaster
- Head count and rescue operations
- Treatment of injured and Informing/assisting their relatives
- Informing and collaborating with statutory authorities as well as media
- Preserving records and organizing investigations
- Resorting normalcy and Ensuring safety of the works before personnel re-enter and resume work

9.2.1 Requirements for Response Phase

- Well-designed Disaster Management Plan (both On-site and Off-site)
- Strong commitment of Management towards safety
- A good Public Address (PA) System in the complex with one or two jeeps with PA system for use in surrounding areas also
- Emergency alarms, and approved emergency control centers and assembly points

- List of key personnel, experts, doctors, village leaders, authorities with their locations and telephone numbers (office, residence as well as cell/mobile phones)
- Written guidelines for the duty team members and well-defined roles of individuals mainly for fire fighting, medical, rescue, engineering support sections/activities.

  Others not needed to take part in emergency handling operations.

- Standby communication system in case the telephone system is affected. e.g. Walkie-talkie, radio telephone, mobile phone etc.
- Division of each factory into 'Safety units' for better safety. Rehearsals of the disaster management plan (disaster control plan) and modifying/ updating the same, if necessary. The timing of events, communication failures etc. should be noted and analyzed for improvement. The plan may therefore, have to be regularly discussed and updated by the Management.
- Availability of emergency 'Install light' (emergency light) to take care of power failures.
- Provision of antidotes, emergency medicines and beds in nearby hospitals (the factory has tie-up with Hospital at village, taluka as well as district level)
- Liaison with outside agencies and civic and government authorities for mitigation of effects of a disaster.
- Round- the- clock availability of trained first-aid personnel at site and volunteers in the nearby areas
- Vulnerable areas of the plant where disasters are likely to originate should be identified and plan measures to deal with the same
- Communication mechanism for raising the alarm as well as that for the interaction within and outside works should be provided
- Check -list for sequence of operations to be followed should be prepared
- Updating Fire and safety manuals (Both common and plant wise); Operating and Maintenance Manuals, Warehouse safety manual
- Strong conviction that "the prevention is better than cure". Therefore, more emphasis should be made to prevent disaster
- Chemical Information Sheets (CIS) or Material Safety Data Sheets (MSDS) or Work Practice Data Sheet (WPDS) for all the hazardous substances handled
- Transport emergency cards (Trem-cards) for the products transported by road.

9.2.2 Situation identification/assessment

In the situation of disaster, (natural or human induced) it is essential to judge the situation timely and correctly. If it is identified as disaster, the emergency is to be declared at the earliest possible. The shift In-charge, who is available in the unit all times, shall identify situation of the hazard or calamity and report immediately the same to the Management. The emergency may be declared in entire unit or part of it, depending upon the situation/nature of disaster. Accordingly, shift in-charge shall also sound the alarm bell to be provided in each of the section.

Under such situation, the shift in-charge or higher authority such as General Manager/Managing Director shall take charge of the situation. He shall initiate all such actions that are essential at each of the sub-unit; which would include-

- Evacuation of all the personnel on the shop floor who are not required for controlling the situation, or hazard
- Immediate grasping of gravity of the problem / hazard and issue or giving of instructions to the concerned teams as laid down to act in a manner required to control the situation
- In case of fire, the help of fire force should be immediately sought and put into action. Simultaneously, the workman trained in the fire fighting procedures shall be called to extinguish the fire.

10 EMERGENCY MANAGEMENT PLAN (ON-SITE)

10.1 Emergency Organization Structure

Team A: The Shift In-charge along with supervisor of the unit or other supervisory staff shall put off the fire or the hazard as the case may be.

Team B: The Shift Operator / In-charge and/or supervisor in the office, Security Officer and labour welfare officer shall be responsible for contacting the fire brigade personnel and arrange for medical assistance, if required.

Team C: The Maintenance In-charge and his staff/team shall form another team and take charge of the safety appliances, tools and implements required to control the situation. They will rush to the spot for taking further instructions from the declarer / controller of emergency.

Team D: The union office bearers shall form another team and should see that none of the workmen crowds around or nobody comes nearer to that place of emergency. This team would also ensure that all the available manual help required by the declarer / controller of emergency, is provided to him.

Team E: The Security Department, the Time Keeper, and Labour Welfare Officer shall form another team. They shall be available at the office and contact for assistance to the declarer/ controller of emergency. It shall be the responsibility of this team to refer, immediately, to the checklist of names, addresses, telephone numbers of the authorities such as Director/Joint Director of Industrial Safety and Health, Boiler Inspector of Factory, Commissioner of Police, Police Station, Fire Brigade, Company Hospital Doctors, Private Doctors and Directors of the Industry and any other appropriate contact for assistance. At all times, one vehicle should be made available at the gate of the factory for the rescue and transportation of personnel. The hooter siren, that is provided, shall be used when a total emergency is to be declared for the entire factory.

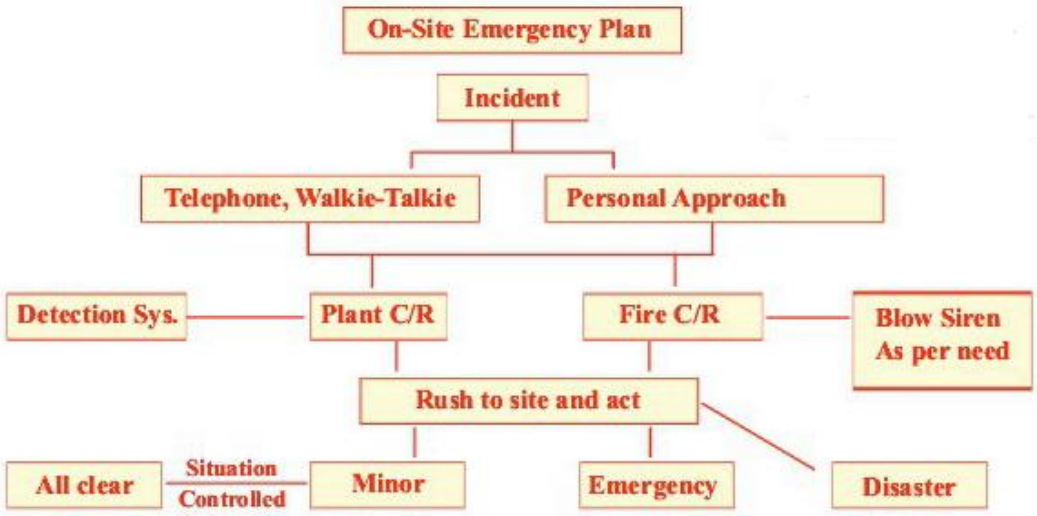


Figure 6: Schematic of On-site Emergency management plan

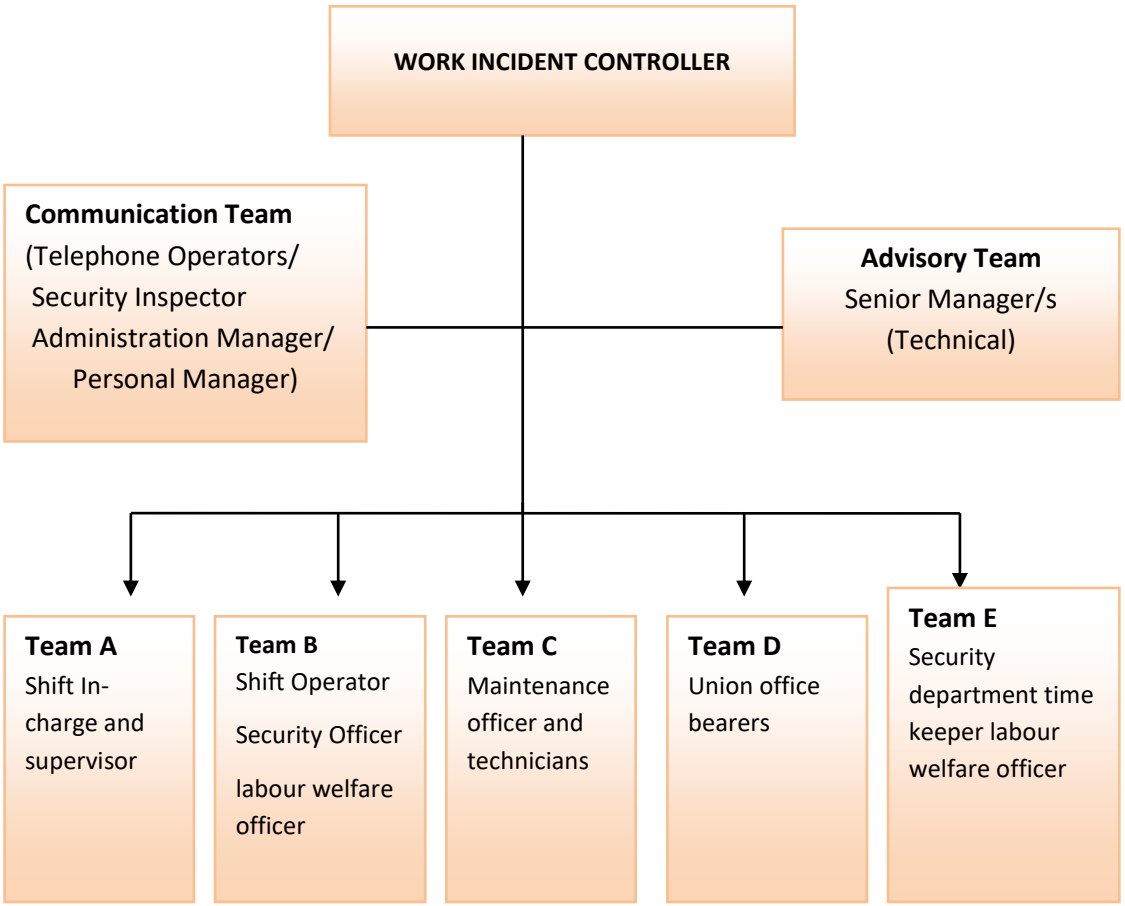


Figure 7: Emergency Organization Structure (proposed after expansion)

10.1.1 Designated persons functions

In addition to the specific responsibilities, assigned to various Team Members, mentioned earlier following are the general functions to be performed by the designated persons-

a. To communicate & report the clear position of a Disaster to Key Persons of the Industry
b. To communicate & co-operate with other departments / aspects like security, safety of victims etc.
c. To minimize the extent of disaster by taking all possible measures which are in control
d. To minimize the exposure of Disaster to human beings
e. To save property and valuable things as far as possible

10.2 Shut downs in emergency

Fire is presumed as the most probable hazard in case of proposed unit. The following steps may be followed in such cases.

- Put off the main supply
- **Boiler section**

  Shut down the boiler section and control the steam supply/movements

- **Control room**

The security office shall function as a control room as the same is ideally situated nearer to the main gate and away from the plant. Thus, there shall be no risk as regard to the fire affecting the security office. However, if there should be a situation where / when the entire premises has to be declared as emergency, the control room will operate from the premises, which is outside the main gate. The declarer/ controller of emergency shall decide, depending on the situation, whether to use generator power or State Electricity Board Power.

In case the entire lighting has to be switched off to meet such an eventuality, the stand by battery operated system need to be provided near the office. It shall be used as per the need and the floodlights shall be used to tackle the situation during the night time.

10.3 Personnel evacuation

When a major accident occurs and if there are cases of workmen or supervisory personnel fainting or losing consciousness or any other type of accident, it shall be the responsibility of Team D to evacuate them and to take them to the nearest dispensary after providing necessary first aid.

There are well-planned roads in and around the plant and within the factory premises and they should choose the safest and shortest route to come out from the unit. The selected route should be kept clear by Team E at all the times.

10.4 Personnel accounting

It shall be the responsibility or the Team E to immediately take stock of the personnel on duty and take a head count. This team shall co-ordinate with Team D to ensure that all the personnel are accounted for. It is also essential for Team E to counter check the security if any visitor or transport workers have entered inside the plant and if so they should also be accounted.

10.5 Controlling disaster

The declarer / controller of Disaster shall take steps to train all the teams and shall draw up an "Action Plan" forthwith.

The Shift In-charge shall be designated as "Work Incident Controller" and he shall act as an in-charge at the site of the disaster to control entire operations.

10.6 Repairs and safety implements

The declarer / controller of disaster along with the work incident controller shall immediately prepare a list of safety gear, tools and other implements required to control the emergency situations in respect of-

- Fire
- Bursting of Boiler
- Short Circuiting

This list shall be submitted to the Managing Director for approval and the material should be brought immediately.

Also, it shall be the responsibility of "Work Incident Controller" to ensure that a separate set of implements, safety gear and tools are placed in a cupboard easily accessible in the workshop/at the work place and these shall be used only when emergency is declared in the plant.

10.7 Medical treatment arrangements

Most of the workers are trained in first aid and fire fighting procedures. The office team shall co-ordinate with these workers, trained in the first aid, and shall get them ready with necessary first aid material so that the injured workers are attended for first aid immediately and then shifted to the nearest dispensary or treated in the factory dispensary as the case may be.

10.8 Training and Rehearsals

It is essential for all the teams to act in uniform and with patience. They are required to be trained to obviate any confusion that might arise due to emergency.

It is responsibility of the declarer/controller of emergency that the teams are given training in their respective areas at least once in two months.

The Government Fire Force will give training for firefighting and The Red Cross Association will train the personnel for first aid procedures.

10.9 Law and order

The declarer / controller of emergency shall inform Police immediately to ensure that law and order situation will be kept under control. The Joint Director/Assistant Director of Industrial Safety and Health as well as Pollution Control Board authorities shall also need to be informed. In case of casualties, information should be sent to the nearest relatives of the affected people. If information is to be given to public or press, the public relation manager of the industry is authorized to do the same.

10.10 All clear signal

Once the disaster is controlled and the normalcy is restored completely and when the declarer/controller of disaster is of the opinion that there is no further hazard involved and the work can go on normally, he shall then declare all clear signal.

All the workers in the plant shall be given proper training to use the signals both at the time of declaring the disaster and at the time of clearing the disaster.

10.11 Equipment and facilities in emergency

An emergency cupboard shall be made available in the plant area. This cupboard should contain certain number of Personal Protective Equipment (PPE), for use in case of disaster. These items kept in the cupboard should be used only during an emergency and not under normal working conditions.

A printed or typed list of items available in the cupboard should be displayed on the front of cupboard. The key of emergency cupboard should be available with the Shift In-charge.

Table 5: Items Recommended for Emergency Cupboard

Sr. no.	Item	Quantity
1	Air line mask set	2 sets
2	Self-containing breathing apparatus	1 set
3	Safety belt with life time	1 set
4	PVC gloves	2 pairs
5	Leather gloves	2 pairs

6	Flextra or asbestos gloves	2 pairs
7	PVC Suit	2 pairs
8	Electrical rubber gloves	2 pairs
9	Safety touch	2 pieces
10	Safety goggle	2 pieces
11	Face- shield	2 pieces
12	Ear-muff	1 set
13	Flexure or asbestos blanket	2 Nos.
14	Manila Rope 100 m long bundle	1No
15	Resuscitator	1No
16	Safety helmet	2 Nos.

This item should be examined once in week by safety observer to ensure that all the items are available and that they are in good condition. Items, if found defective must be replaced immediately.

Important requirements

1. Helmets for the Work Incident Controller and others
2. Megaphone (workable hand-held PA system)
3. Walkie- Talkie/ mobile phones/ pagers
4. Stock of fire fighting material
5. Note books/pads and pens/ pencils
6. Sign boards such as -
    - Assembly point
    - Emergency exit door/Stair case
    - Fire alarms
    - Fire extinguishers
    - Water hydrants
    - Emergency control center
    - Road closed

11 OFF-SITE EMERGENCY MANAGEMENT PLAN

Since the only hazard that expected in the cogeneration is fire and normally contained within the premises. Hence, no specific Off-site emergency plan is required in this case. However, in rare case if the fire hazard spreads out-side the premises Team E shall communicate to the District Magistrate, Commissioner of the Police, Control Room and inform the situation as Off- Site Emergency.

It shall be the responsibility of the Police Personnel to look after the law and order, traffic control, evacuation of workers and other personnel.

They should also advise, through public address system, the localities that are likely to get affected and the steps to be taken.

11.1 Information to local authorities

It shall be the responsibility of declarer/controller of emergency to inform the local P*anchayat* official regarding the likely hazards from the industry and the steps to be taken when there is an off-Site emergency. It is preferable that the local *Panchayat* officials are also trained, on simple protective methods, through demonstrations.