

HAZARD IDENTIFICATION AND RISK ASSESSMENT

1.0 HAZARD IDENTIFICATION AND RISK ASSESSMENT

Risk assessment

Risk assessment is the determination of quantitative or qualitative value of risk related to a concrete situation and a recognized threat. The common terms used in risk assessment are elaborated below:

Risk: Risk is defined as the combination of chance or frequency or probability of occurrence of an accident and its damage consequences to life and property. So risk has two parameters:

- i. Frequency of occurrence of an accident
- ii. Damage consequences to life and property

Risk Analysis:

A systematic approach for describing and/or calculating risk. Consequence analysis determines the damage consequences to life and property from an accident and QRA determines the following: frequency of occurrence, risk of fatality to employees, individual risk-risk of fatality to neighbouring population, acceptability of risk through ALARP-At Least as Low as Reasonable Practical.

Risk analysis involves the identification of undesired events, and the causes and consequences of these events. Risk assessment is a proactive accident prevention technique.

1.1 Scope of the Study

Risk involves occurrence or potential occurrence of some accidents due to an event or sequence of events. The risk assessment study covers the following:

- Identification of potential hazard areas
- Identification of representative failure cases
- Visualization of the resulting scenarios in terms of fire (thermal radiation) and explosion
- Assess the overall damage potential of the identified hazardous events and the impact zones from the accidental scenarios
- Assess the overall suitability of the site from hazard minimization and disaster mitigation point of view
- Furnish specific recommendations on the minimization of the worst accident possibilities
- Preparation of On-site and Off-site Emergency Plan, which includes occupational and health safety plan

There is always possibility of occurrence of incidents in an industry which requires proper risk assessment and proper safety preparedness. Activities requiring assessment of risk due to occurrence of most probable instances of hazard and accident are both onsite and off-site.

1.1.1 On-site

- Exposure to fugitive dust, noise, and other emissions
- Housekeeping practices requiring contact with solid and liquid wastes
- Emission/spillage etc. from storage & handling

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1.1.2 Off-site

Exposure to pollutants released from offsite/ storage/related activities. Contamination due to accidental releases or normal release in combination with natural hazard. Deposition of toxic pollutants in vegetation / other sinks and possible sudden releases due to accidental occurrences.

1.1.3 List of chemicals used or handled

The table below gives the list of various chemicals used in paper mill:

Table: 1

List of Chemicals Used

S. No.	Name of the chemical	Existing requirement	Additional requirement	Total requirement	Use	Storage facility	Storage capacity
1	Caustic soda	36.6	0.92	37.52	For pulp cooking	Tanks	450 Ton
2	Oxygen gas	3.0	0.4	3.4	For pulp bleaching	Vessel	-
3	Hydrogen peroxide	0.903	0.127	1.03	For pulp bleaching	Tanks	28 ton
4	Lime	0.846	0.137	0.983	For making calcium hypochlorite solution	Godown	100 ton
5	AKD	1.54	0.33	1.87	For paper sizing	Tank	25 ton
6	Soap stone	20	9.0	29	As a filler with pulp	Godown	350 ton
7	Chlorine	3	0.6	3.6	For pulp bleaching	Tonnners/cylinders	55 cylinders
8	OBA	0.21	0.045	0.255	Whitening agent	Godown	5 ton
9	Starch	0.70	0.15	0.85	For paper strength	Godown	20 ton
10	DSR	0.49	0.11	0.60	For paper strength	Godown	12 ton
11	PAC	0.49	0.11	0.60	To maintain pH of back water	Tank	12 ton
12	WSR	0.42	0.09	0.51	As a sizing agent for increasing water resistance of paper	Godown	8 ton

1.1.4 Description of process reactions

As such there are no hazardous chemicals used in manufacturing paper. There are no such chemicals used, which may lead to polymerization reaction or may lead to hazardous combination when mixed with any other chemical used in the plant.

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1.1.5 Description of any probable runaway reaction

Chemicals used in the mill do not have runaway reactions. The safety measures for all the chemicals used in the plant are described in MSDS of the chemicals attached.

1.1.6 Hazard Identification

The technique employed for the hazard identification is MCA (Maximum Credible Accident) analysis. MCA is defined as an accident with the maximum damage distance, which is believed to be probable. MCA analysis does not include quantification of the probability of occurrence of an accident. It is judged on the basis of engineering capability and expertise in the field of risk analysis. The rules laid by Government of India are also the methods used in hazard identification.

1.1.7 Hazard assessment & evaluation

Ranking & safety of each unit in hazard prone sections is studied using Preliminary Hazard Analysis (PHA). The PHA consists of formulating a list of hazards related to:

- Plant equipment
- Interface among system components
- Operative environment
- Operations (tests, maintenance etc.)
- Facility
- Safety equipment

Identification of hazards in pulp & paper mill is of prime significance in the analysis, quantification & cost effective control of accidents involving chemical sand process. Estimation of probability of an unexpected event and its severity form the basis of quantification of risk in terms of damage to property, environment or personnel as:

$$\text{Risk} = \text{Probability} \times \text{Severity}$$

Therefore, the type, quantity, location and conditions of release of a toxic or flammable substance have to be identified in order to estimate its damaging effects, the area involved and the possible precautionary measures required to be taken. The following two methods for hazard identification have been employed in the study:

- Identification of major hazardous units based on manufacture, storage and import of hazardous chemical rules, 1989 of Government of India; and
- Identification of hazardous units and segment of plant and storage units based on relative ranking technique, like fire explosion and toxicity index.

1.1.8 Identification of major hazardous units

1.1.8.1 Classification of major hazardous substance

Hazardous substances may be classified into two main classes: Flammable substances and toxic substances. Flammable substances or the vapours arising in some reaction require interaction with air for their hazard to be realized. Toxic substances are those whose exposure may result in

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occupational diseases in the human beings in vicinity. Hazardous characteristics of the major flammable /toxic materials employed in different stages of production are listed in table below.

Table: 2

Properties of storage chemicals used at the pulp & paper mill

Chemical	Codes/Label	TLV	Boiling Point	Melting Point	Hazards associated
			°C		
Sodium Hydroxide	Corrosive , Class 8	2 mg/m³	142-148	12-15	• Causes severe burns • Corrosive action and destruction to tissues • Stinging sensation to nose
Chlorine	Toxic substances ,Class 2	1 ppm	-34.05	-100.98	• Irritation to skin, mucous membrane of eyes • Choking and coughing on inhalation • Respiratory system affected
Hydrogen peroxide	Class 5.1	1 ppm	125	40.3	• Irritation • Discomfort to eyes and nose • Severe stinging sensation

TLV: Threshold Limit Value

Source: Material safety data sheet

1.1.8.2 Visualization of MCA Scenario

1.1.8.2.1 Introduction

A Maximum Credible Accident (MCA) can be characterized as an accident with a maximum damage potential, which is still believed to be probable.

As an initial step in this study, a selection has been made of the process in and around storage units and activities, which are believed to represent the highest level of risk for the surroundings in terms of damage distances. For this selection, the following factors have been taken into account:

- Type of compound(flammable or toxic);
- Quantity of material present in a unit or involved in an activity; and
- Process and storage conditions such as temperature, pressure, flow, mixing and presence of incompatible materials.

1.1.8.2.2 Methodology

The following steps are employed for visualization of MCA scenario:

- Chemical inventory analysis;
- Identification of hazardous processes in individual units;
- Identification of chemical release and accident scenario;
- Analysis of past accidents of similar nature to establish credibility to identified scenario;
- Short listing of MCA scenario.

1.1.8.2.3 Common Causes of Accidents

- Poor housekeeping
- Improper use of tools, equipment and facilities

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- Unsafe or defective equipment facilities
- Lack of proper procedures
- Improvising unsafe procedures
- Failure to follow prescribed procedures
- Jobs not understood
- Lack of awareness of hazards involved
- Lack of proper tools, equipment, facilities
- Lack of guides and safety devices
- Lack of PPEs.

1.1.8.2.4 Failure of Human Systems

An analysis of the past accidents reveals the human factor to have caused for over 60% of the accidents, while the rest are due to other plant component failures. This percentage will increase if only major accidents alone are considered for analysis. Major causes for human failures reported are due to:

- Stress induced by poor equipment design, unfavourable environmental conditions, fatigue etc.
- Lack of training in safety & loss prevention
- Indecision in critical situations
- Inexperienced staff being employed in hazardous situations.

Often, human errors are not analyzed while reporting accidents and accident reports only provide information about equipment failures.

1.1.8.3 Hazard Assessment and Evaluation

Preliminary Hazard Analysis (PHA) is based on the philosophy “Prevention Is Better than Cure”. Safety is relative and implies freedom from danger or injury. But there is always some element of danger or risk in anything we do or build.

The purpose of preliminary hazard analysis is to identify early in the design process the potential hazards associated with, or inherent in, a process design, thus eliminating costly and time consuming delays caused by design changes made later. This also eliminates potential hazard points at design stage itself.

Hence, preliminary hazard analysis is more relevant when a plant is at design/ construction stage. This technique, applied early in the project life cycle, helps eliminating hazard and, thus, to avoid costly design modifications later. This analysis fortifies the process design by incorporating additional safety factors into the design criteria.

1.1.8.4 Preliminary Hazard Analysis (PHA)

A preliminary hazard analysis is carried out initially to identify the major hazards associated with storages and the processes of the plant. This is followed by consequence analysis to quantify these hazards. Finally, the vulnerable zones are plotted, for which risk reducing

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measures are deduced and implemented. The various process activities involved in this pulp and paper mill operations are:

- Raw material handling and preparation
- Chemical Pulping
- Stock Preparation
- Paper Making & Processing

Except for chemical pulping and chemical recovery from black liquor, all the other processes involve purely mechanical operations that are not complex or hazardous. Chemical pulping involves cooking of raw material with sodium hydroxide at temperatures below 175°C. No major hazards are expected from this process. Sodium hydroxide is a mildly hazardous chemical in nature. Hence, no major hazards with the potential for any emergency situation exist in the process plant.

1.1.8.5 Maximum Credible Accident Analysis (MCAA)

Damage Criteria

Unloading at the storage facility may lead to fire. The damage criteria due to an accidental release of any hydrocarbon arise from fire is not toxic and hence no effects of toxicity are expected.

Fire Damage

The fire in the solid raw material can be of point of consideration. The liquid chemicals are non-flammable in nature and the lubricant oils can also be considered in the same context.

Table 3

Preliminary hazard analysis for process and storage areas

Equipment	Process	Potential Hazard	Provision
Power Transformer	--	Fire & Explosion	All electrical fittings and cables are provided as per the specified standards.
Switch Yard Control Room	-	Fire in cable trenches and switches	All electrical fittings and cables are provided as per the specified standards.
Raw Material Yard	Storage of Raw Material	Fire	The yard is encircled with pressurized pipeline fire hydrant system to deal with emergencies.
Caustic	Used in chemical pulping	Leakage	Standby storage tank provided to empty up the leaking tank.

Table 4

Preliminary hazard analysis for the whole plant in general

Major Hazard	Level of Risk	Area of Interest	Recommended Control/Mitigation
Chlorine Gas Leakage	Medium	Bleach Plant (leakage from pipeline/Tonner)	1. Due to corrosive environment the pipeline, structure, supports and tank needs painting at regular intervals

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			2. The electric wire rope hoist used for handling chlorine tonners should be always maintained in very good condition.
	Medium	Chlorine storage area (leakage from Cl ₂ tonner)	1. The chlorine tonner storage area should be isolated and barricaded 2. The tonners should be periodically inspected with Ammonia for chlorine leakage detection. 3. Chlorine tonners should be stored away from the inflammable material. 4. Regular checking of pipeline carrying chlorine 5. Instructions for the safe use and handling of chlorine should be displayed in chlorine handling areas.
Corrosive Spillage	Medium	Acid/Caustic Storage Area	1. Dyke wall of sufficient height should be provided around HCL storage tank of 20 KL capacity. 2. Tanks should be regularly painted. 3. Strict implementation of SOP's to be ensured by Employees/Drivers.
Fire	Low	Oil Tank area	1. Regular maintenance procedure must be in place to reduce likelihood of failure of valves, flanges or pipes. 2. Foam water system must be in place and functions to control escalation of pool fire scenarios in the tank dyke. 3. PPE must be in place to facilitate human operation of the valves in case of emergency. 4. Workers should be trained regularly for all emergency scenarios. 5. A mutual agreement with neighbouring industries to meet out any emergency is made.
Electrical Hazards	Medium	• Compressor House • Electrical Panel Rooms • Transformer Area	1. Proper electrical insulation mats should be maintained. 2. Compliance of work permit system and SOPs must be ensured. 3. Training regarding providing CPBR (Community based participatory research) should be given to all essential persons.
Dust Hazard	Medium	Handling Area	1. Use of dust masks must be ensured. 2. Cleaning with mechanized dust collectors can be explored.

This identification will help to decide the location of the other storage/ process vessel besides the type of protective clothing the workers/ fire fighters need, the duration of time for which they can be in the zone, the fire extinguishers measure needed and the protection methods needed for the nearby storage/ process vessels.

1.1.8.6 Effect due to Toxic Gas (Chlorine) Release

Chlorine is a toxic gas and proper measures have been taken at the plant site to prevent hazards resulting from chlorine leakage. The Company has a commitment regarding usage of chlorine in

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bleaching process where it assures that no extra chlorine will be used other than being used now. In case of hazard occurrence following action plan will be implemented in order to suppress its harmful effects.

1.1.8.7

Action Plan

- Operators will notice the wind direction from wind sock.
- One operator will rush to inform shift I/c in person or through phone.
- He will rush back to attend the leakage.

Shift I/C

- Rush to the site wearing proper personal protective equipment.
- Guide the operators in controlling leakage.
- Will inform to the following :-
 1. WMC (Works Main Controller – Unit Head)
 2. HOD Pulp Mill
 3. Control Room
 4. Safety Fire Officers

HOD Pulp Mill

- Rush to the site wearing proper PPEs.
- Take control over situation.
- Will assess the situation and inform to MIC.
- WMC will direct the control room to sound the Emergency Siren.
- In case leakage from plant will get close the supply of chlorine as per Emergency shutdown procedure.
- In case leakage from Tonner is not controlled, then he will get immediately lifted to Tonner to neutralizing pit.

Safety personnel

- Rush to the site wearing proper PPEs.
- Will help in controlling of leakage.
- Make sure rescue & evacuation to be arranged 900 (Degrees) Left or Right from the up wind direction.
- To call Fire Tender keeping in the wind direction for spring water over chlorine vapour if required.

Compounder

- Will immediate arrange for Ambulance.
- Ambulance to be brought from up wind direction.
- Render First Aid to Victims.

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- Arrange Hospitalization if required.

Security Officer

- Rush to the area wearing proper PPEs.
- Stop all traffic movements.
- Inform Recovery plant, Power Plant, C.D. & Yard if required.
- Start Evacuation of plant employees for Emergency shelter point.
- Direct outside rescue & Emergency services.

1.1.9 Emergencies and Emergency Management

The most common emergencies that arise due to operation in Pulp & Paper mills are fire, rupture of tanks due to pressure and mechanical damages to the human body due to fire, personal accidents & violence.

1.1.9.1 First Aid Measures

In all first aid measures, the speed with which they are taken is of utmost importance. All persons connected with any sphere of activity involving storage or use of caustic should be educated of the urgent necessity of reporting immediately. All accidents however, minor they might be, in their own interest. They should also be suitably trained in imparting appropriate first aid measures.

In case of personal accidents, the victim is immediately rushed to the nearby hospital after providing the first aid on the site.

1.1.10 Emergency Preparedness Plan Relating to Sodium Hydroxide

Protective Clothing

While handling caustic solution, care should be taken to prevent splashing or contact with skin. It is particularly necessary to protect the eyes and the wearing of comfortable goggles or eye shields during discharge from tankers and the subsequent handling and use of the liquor.

Wool is readily attacked by caustic soda, so cotton clothing should be used while handling the caustic. Rubber gloves and gum boots gives good protection to hands and feet.

First Aid Treatment for Caustic Burns

Wherever there is a risk of caustic burns occurring by spillage, splashing, spurting or any other means, a 5% solution of ammonium chloride will be ready available in such quantities that the skin or clothing may immediately be drenched with. If this action be taken without delay, it is unlikely that serious damage will occur. The ammonium chloride solution is stored most effectively in a vessel holding 20 liters. The vessel has a bottom outlet.

If there has been such delay in the application of the solution that some destruction of the epidermis has taken place and there is actually a burn, the part affected should be drenched with ammonium chloride for 10-15 minutes and then washed continuously with running water or saline-boric solution for a period of one hour. The burn should then be dressed with a four- fold pad of lint soaked in Bonny's blue paint.

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This dressing should be left undisturbed until it drops off without aid. When the burns will be found to have healed completely, no infection can possibly take place if the tissues have been thoroughly dyed by blue paint.

If the caustic soda gains access in the eyes or splashed in the eyes, the eyes should be washed immediately with the complete contents of one eyewash bottle of 5% ammonium chloride solution. Such bottles are placed in boxes in the plant so as to be immediately available when needed. This treatment should be carried out on the spot by one of the man's mate. The man should then be removed from works to the nearby hospital for further treatment. If the ammonium chloride solution or saline-boric solution is not available on the spot, the eyes should be thoroughly washed with fresh water of ambient temperature continuously for one hour. This prolonged irrigation is of extreme importance and must be done at once.

An alternative first aid treatment for the eye burns which is less painful than the application of 5% ammonium chloride solution is as follows:

The eyes should be washed out with buffered phosphate solution containing potassium hydrogen ortho-phosphate 27.22 gm, di-sodium hydrogen ortho-phosphate 71.63 gm in one litre of distilled water having 0.01 gm of brilliant green colour as indicator. This treatment should be followed by the prolonged irrigation treatment with saline-boric solution under medical supervision. In order to prevent eye burns, the most satisfactory precaution is to insist on the use of chemical splash proof goggles.

1.2 DISASTER MANAGEMENT PLAN

1.2.1 Disaster

A disaster is a catastrophic situation in which suddenly, people are plunged into helplessness and suffering and, as a result, need protection, clothing, shelter, medical and social care and other necessities of life.

Disaster can be divided into two main groups. In the first are disasters resulting from natural phenomena like earthquakes, volcanic eruptions, storm surges, cyclones, tropical storms, floods, landslides and forest fires. The second group includes disastrous events occasioned by man, or by man's impact upon the environment. Examples are industrial accidents, factory fires, radiation accidents, explosions and release of toxic gases or chemicals, river pollution, structural collapse etc. There can be no set criteria for assessing the gravity of a disaster since this depends to a large extent on the physical, economic and social environment where it occurs.

1.2.2 Objective of Disaster Management Plan

The disaster management plan is aimed to ensure safety of life, protection of environment, protection of installation, restoration of production and the salvage operation in the same order of priorities. For effective implementation of Disaster Management Plan, it should be widely circulated and personnel training through rehearsals/ drills.

To tackle the consequences of major emergencies inside the industry or immediate vicinity of the industry, a Disaster Management Plan has to be formulated and the planned emergency document

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is called “**DISASTER MANAGEMENT PLAN**”.

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

- Effect the rescue and medical treatment of the casualties
- Safeguard other people
- Minimize damage to property & environment
- Initially contain and ultimately bring the incident under control
- Identify any deceased
- Provide for the needs of relatives
- Provide authoritative information to the news media
- Secure the safe rehabilitation of affected area
- Preserve relevant records and equipment for the subsequent enquiry into the cause and circumstances of the emergency

1.2.3 Emergencies

General & Industrial Emergencies

The emergencies that could be envisaged in the plant area follows:

- Slow isolated fires;
- Fast spreading fires;
- Structural failures;
- Natural Calamities;
- Contamination of food/ water; and
- Sabotage/ social disorder.

1.2.4 Specific Emergencies Anticipated in Pulp & Paper Mill

Chemical spills

Chemicals are stored in bounded areas and any spills will be contained in a controlled area. Safety gear and training is provided to all staff who handles chemicals or dangerous goods and the likelihood of injury to person is very low due to training and procedures. The chemicals and dangerous goods are kept away from moving machinery to reduce the risk of fire. The mill has a first aid officer on every shift.

Injury to person

Safety gear and training is provided to all employees. Affected employees are trained in safe handling of chemicals, dangerous goods, machinery (fixed and moving), their surrounding and their work environment. Safety guards, light curtains and other safety measures have been implemented and the likelihood of injury to person is very low due to training and procedures.

Damage to machinery and property

Whilst the likelihood is very low, there is always a small risk of fire. The site is fitted with fire

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sprinklers, has several fire extinguishers, fire hoses and emergency fire warnings. Fire system is linked to the fire brigade and all employees are trained to follow emergency procedures.

Fire & Explosion

Fire consequences can be disastrous, since they involve huge quantities of fuel either stored or in dynamic inventory in open yard. Preliminary Hazard Analysis has provided a basis for consequence estimation. During the study of risk assessment, the nature of damages is worked out and probability of occurrence of such hazards is also drawn up. Therefore the risk assessment report is to be essentially studied in conjunction with the Disaster Management Plan.

Emergency organization

An Emergency Organization is working in the plant. The Vice President of the industry is heading this organization. He is also designated as site controller. The person not below the designation of General Manager and who are working as department heads are designated as incident controllers. Each incident controllers are reporting to the site controller.

Each incident controller, for himself, organized a team responsible for controlling the incidence with the personnel under his control. Shift In charge in each department is the reporting officer, who would bring the incidence to the notice of the incidence controller and site controller.

Emergency coordinators are appointed who would take the responsibilities like fire fighting, rescue and rehabilitation, transport and provide essential & support services. All these personnel are designated as Key Personnel. In case of power or communication failure during any incident, some of the staff members in the office or plant offices would be drafted and their services would be utilized as messengers for quick passing of the communications. All these personnel would be declared as essential personnel. A flow diagram of Emergency Organization is shown in figure below.

Emergency Communication

Whoever notices an emergency situation such as fire, growth of fire, leakage of chemicals etc. would inform his immediate superiors and emergency control centre. The person on duty in the emergency control centre would appraise the Site controller. Site Controller verifies the situation from the Incident controller of that area or the Shift in charge and takes a decision about an impending On-Site Emergency. This would be communicated to all the Incident Controllers and Emergency Coordinators. Simultaneously, the emergency warning system would be activated on the instruction of the Site Controller.

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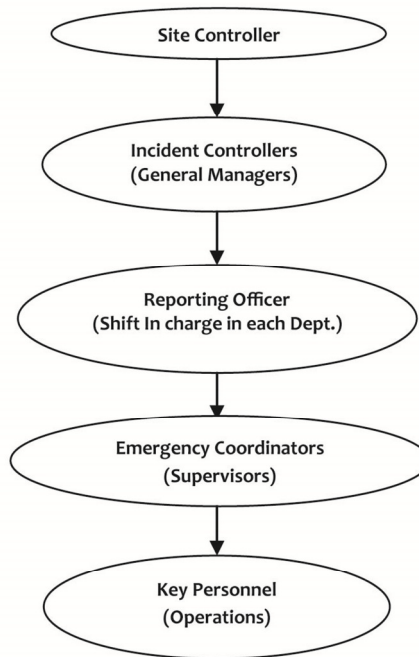


Figure 7.1: Emergency Organization

आकस्मिक दुर्घटना होने पर निम्न नम्बरों पर सम्पर्क करें			
क्र.सं.	नाम	पद	टेलीफोन नं.
(अ) मिल अधिकारी :-			
1-	श्री एम.पी. पवार	तकनीकी निदेशक	270044 (घर)
2-	श्री शमशाद हुसैन	एफ.एम.	279296 (घर)
(ब) डॉक्टर :-			
1-	डा. आर. पी. रस्तोगी	सर्जन	275083 (क्लीनिक)
2-	डा. एस. के. सिंह	हड्डी विशेषज्ञ	276072 (क्लीनिक)
(स) आकस्मिक सेवाएँ :-			275108 (घर)
1-	फायर स्टेशन		101, 275100, 276001
2-	एम्बुलैन्स		278816 (कार्यालय) 275049 (घर)
3-	पुलिस स्टेशन		100, 274015

List of Emergency numbers displayed at main gate

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1.2.5 Emergency Responsibilities

Main incident controller (MIC) [President (Works)/ Vice President (Engineering)]

- Assess the magnitude of the situation and decide whether the evacuation of staff from the plant is needed
- Exercise and direct operational control over areas other than those affected
- Maintain a continuous review of possible development and assess in consultation with Site incident controller and other Key Personnel.
- To take charge of Emergency Control Centre (ECC).
- Declaration of major emergency.
- Liaison with Police, Fire Service, Medical Services, Factory Inspectorate and other Govt. agency.
- Direct the Incident Controller & Department Head in meeting out the Emergency.
- Ensure the victims are evacuated to a safe place.
- If Emergency is prolonged, arrange for the relief of personnel.
- Issue authorized statement to TV & Press Media.

The Works Main Controller will declare the emergency and he will instruct gate office to operate the emergency siren after assessing the gravity of the situation.

Site Incident Controller (HOD Pulp Mill, HOD M/C, HOD Boiler, HOD Electrical)

- He is the next responsible officer after the Works Main Controller. Generally the department head is designated as Site Incident Controller. In case of emergency :
- He will rush to the place of occurrence and take overall charge and report to the Works Main Controller by personal communication system like cell phones or Intercom and inform about the magnitude of emergency.
- He will assess the situation and considering the magnitude of emergency
- He will take decision and inform Communication Officer to communicate the news of emergency to different agencies.
- He will give direction to stop all operations within the affected area.
- He will take the charge of Main Controller till the Main Controller arrives.
- He will order for shutdown and evacuation of workers and staffs from affected area.
- He will inform all Key Personnel and all outside agency for help.
- He will inform security and fire officers and State Fire Services.
- He will ensure that all non-essential workers/staff are evacuated to assembly point and areas searched for casualties.
- He will report all significant development to Communication Officer. Moreover he will advise to preserve evidence of emergency into the cause of emergency.

Security in Charge

- Cordon off the affected area
- Control traffic movement within the plant

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- Report to MIC if instructed by SIC & call emergency and rescue persons from their residence
- To rush to the site in case of fire emergency along with Fire fighting team
- Control the mob

Fire & Safety In charge

- Report to the site under intimation to Site Incident Controller.
- Take charge of the site job for effective emergency control operation.
- Supervise fire fighting operation in most effective way.
- Rescue /Evacuate affected victims.
- Advice Site Incident Controller/Incident Controller for outside help.
- Arrange Fire Fighting Equipment to the site from available sources.
- Keep Site Incident Controller informed about the latest position.

Manager (HR)

- Report to Main Incident Controller.
- Overall responsible for community relation.
- To liaison with security, administrative services for transporting the victims to hospitals.
- To arrange announcement for family of staff who are injured & to avoid panic in the nearby villages.
- To ensure release of Press statements after approval of Main Incident Controller.
- To ensure arrangement for photographs/video filming of the incident.
- To assess & provide food & clothing to all affected in the factory and for fire fighting team as well as mutual aid personnel.
- As a last resort he will prepare for evacuation of nearby villages, if the situation so demands.(As per decision of MIC)
- To make necessary arrangements of buses in case of evacuation.
- At least one vehicle should be kept ready for emergency.
- Arrange more vehicles for evacuation purpose and sending the affected persons to hospitals.

Plant Engineering HOD:

- Report to Site Incident Controller.
- To ensure mobilizing a team of personnel from all discipline of maintenance and provide all engineering services as required by site incident controller.

The plant engineering services include:

- Service
- Workshop
- Mechanical jobs.
- Urgent Fabrication.
- Use of gas cutting for rescue works.
- To provide all engineering help needed by Fire and Safety /WIC/WMC.

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Electrical HOD

- Report to the Main Incident Controller
- To keep the entire communication system alive.
- To ensure un-interrupted water supply and smooth operation of hydrant network.
- To report site incident controller for the requirements if needs from electrical deptt. such as isolation of equipment, provision of temporary lighting, temporary connection etc.
- To arrange power from Hydel if own power fails.
- To maintain a liaison with other coordinators for their communication & power needs.

General Responsibilities of employees during an emergency

During an emergency, it becomes more enhanced and pronounced when an emergency warning is raised, the workers, if they are in charge of process equipment, should adopt safe and emergency shut down and attend to any prescribed duty as an essential employee. If no such responsibility is assigned, he should adopt a safe course to assembly point and await instructions. He should not resort to spreading panic. On the other hand, he must assist emergency personnel towards objective of DMP.

1.2.6 Emergency Facilities

Emergency Control Centre

An office at the administrative block on main gate is working as Emergency Control Centre. The internal and external telephone facilities, fax etc. are available in the block. During an incident, Site Controller and all the Incident Controllers are assembled here. The materials available in the ECC are:

- Internal & External telephone facility
- Hand tools
- Telephone directories
- Plant layout and site plan
- Emergency lamp/ torch light/ batteries
- Plan indicating locations of hazard inventories, plant control room, sources of safety equipment, work road plan, assembly points, rescue location vulnerable zones, escape routes
- Hazard chart
- Emergency shut-down procedures
- Nominal role of employees
- List of key personnel, list of essential employees, list of emergency co-ordinators
- Duties of key personnel
- Address with telephone numbers and key personnel, emergency co-ordinators, essential employees
- Important address and telephone numbers including government agencies, neighbouring industries and sources of help, outside experts, chemical fact sheets,

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population details around the factory

Assembly Point

Number of assembly points depending upon the plant location are identified wherein employees who are not directly connected with the disaster management would be assembled for safety and rescue. Emergency breathing apparatus minimize facilities like water etc. are provided.

In view of the size of plant, different locations are ear marked as assembly points. Depending upon the location of the hazards the assembly points are to be used.

Emergency Power Supply

Water pumps, plant lighting and emergency control centre, administrative building and other auxiliary services are connected to emergency power supply. Also, in case of turbine failure, DG sets are also available to illuminate the area.

There is plan to procure the flame proof emergency lighting system for each of the sections.

Fire Fighting Facilities

First aid fire fighting equipment suitable for emergencies are being maintained in each section in the plant. This would be as per statutory requirements. Also, fire hydrant network is laid in the raw material yard and excise godown. The pressure in the fire hydrant lines is maintained at 6 kg/cm².

Emergency Medical Facilities

First aid facilities are provided at Emergency Control Centre and at main gate of the mill to deal with chemical burns and fire burns etc. Private and government medical hospital's help would be sought in case of emergency.

Apart from first aid facilities, external facilities would be augmented. Names of the medical personnel and details like phone number etc. are displayed at main gate of the mill and the details of facilities available are maintained and updated at main gate of the mill.

1.2.7

Emergency Actions

Emergency Warning

Communication of emergency is familiar to the personnel inside the plant and people outside. An emergency warning system is provided at the main gate.

Emergency Shutdown

Whenever a given method is appropriate depends on that particular case, cessation of the process is the best action in some instances but not in all. Emergency shutdown switches are provided to all those machinery that pose hazard in any condition.

Evacuation of Personnel

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There could be more number of persons in the storage area and other areas in the vicinity. The area has adequate number of exits, stair cases. In the event of an emergency, unconnected personnel have to escape to assembly point. Operators, if needed, have to take emergency shutdown procedure and escape. Based on these requirements, evacuation of the personnel is drafted and emergency exits are provided in the plant. Time office maintains a copy of deployment of employees in each shift. If necessary, persons can be evacuated by rescue teams.

All Clear Signal

Also, at the end of an emergency, after discussing with Incident Controllers and Emergency Co-ordinators, the Site Controller orders an all clear signal. When it becomes essential, the Site Controller communicates to the District Emergency Authority, Police and Fire Service personnel regarding help required or development of the situation into an Off-Site Emergency.

1.2.8

GENERAL

Employees Information

During an emergency, employees would be warned by raising siren in specific pattern. Employees are given training on escape routes, taking shelter, protecting from toxic effects. Employees are provided with information related to fire hazards, and first aid measures. The key personnel and essential employees are given training in responding to emergency (emergency response).

Table 7.5

Official personnel involved with their contact numbers

S. no	Name	Designation	Intercom no.	Mobile no.
1.	Shri M P Panwar	Technical Director	349	9837374379
2.	Shri D K Verma	Vice President	351	9690022189
2	Shri A K Upadhayay	GM QC	352	9690022151
3	Shri Rajeev Kumar	GM Pulp	353	9690022154
4	Shri Ankur Verma	DGM Elect.	360	9837006905
5	Shri Simarprit	DGM Inst.	355	9690022164
6	Shri Sanjay Rohilla	Manager - Mech	351	9690022152
7	Shri Ram Prakash Sharma	Dy. Mgr. Finishing	354	9690022158
8	Shri Piyush Agrawal	AJM Purchase	357	9927990570
9	Shri R P Mathur ra	GM. Boiler	371	9690022161
10	Shri Lalit Mittal	Mgr. Stock	361	9690022157
11	Shri Rajan Singh	Dy. Manager Safety	342	9690022165
12	Shri Sanjeev Ahujha	Mgr. Process	350	9690022156
13	Shri Samsad Husain	Factory Manager	308	9837209275
14	Shri Dipak Jindal	DGM ETP	362	9639006452
15	Dr. S K Gupta	Medical Officer	381	9837402726

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Public information and warning

The industrial disaster effects related to this plant may mostly be confined to the plant area. The detailed risk analysis has indicated that the pool fire effects would not be felt outside. However, as an abundant precaution, the information related to chemicals in use would be furnished to District Emergency Authority for necessary dissemination to general public and for any use during an off-site emergency.

Co-ordination with Local Authorities

Keeping in view the nature of emergency, two levels of co-ordination are proposed. In case of an On-site Emergency, resources within the organization would be mobilized and, in the event of an extreme emergency, local authority's help would be sought.

In the event of an emergency developing into an off-site emergency, local authorities and District Emergency Authority would be appraised and under his supervision, the Off-site Disaster Management Plan would be exercised.

Table 7.6

Emergency contact numbers of authorities outside plant premises

S. No	Authority	Contact. No	Address
1	District Collector	05944-242344 09456592118	Room No-6 Collectorate, Rudrapur
2	Superintendent of police	05944-243907	Police Department
3	S D M Kashipur	05947-2740023	Kashipur
4	Dy S P Kashipur	05947 -275077	Police Department
5	Circle Officer	05947-275077 09411112087	Police Department ,Kashipur
6	Deputy Director of Factory	05946-282849 09557003698	Shram Bhavan, Nainital Road,Haldwani,Uttarakhand
7	Kotavali,Kashipur	05947-274015 09411112087	Police department, Kashipur
8	Fire Station ,Kashipur	101,05947-275100 9410117766	Fire Station, Kashipur
9	Nearest Police Station	100, 05947-221100	Near Surya Choky
10	Medical Aid	121,09927732333	L D Bhatt Hospital ,Kashipur
11	Evacuation Information, Transport	09897894885	Kashipur
12	Emergency Vehicle	108	Kashipur

Mutual Aid

Mutual aid in the form of technical personnel, runners, helpers, special protective equipment, transport vehicles, communication facilities would be sought from neighbouring industrial establishments.

Mock Drills

Emergency preparedness is an important task in planning of Industrial Disaster Management.

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Personnel in the mill are trained suitably and prepared mentally and physically in emergency response through carefully planned, simulated procedures. Similarly, the key personnel and essential employees are trained in the operations.

Important Information

Important information such as names and address of key personnel, essential employees, medical personnel outside the plant etc. are maintained in the mill.

An on-site emergency organization chart for various emergencies is shown in figure below.

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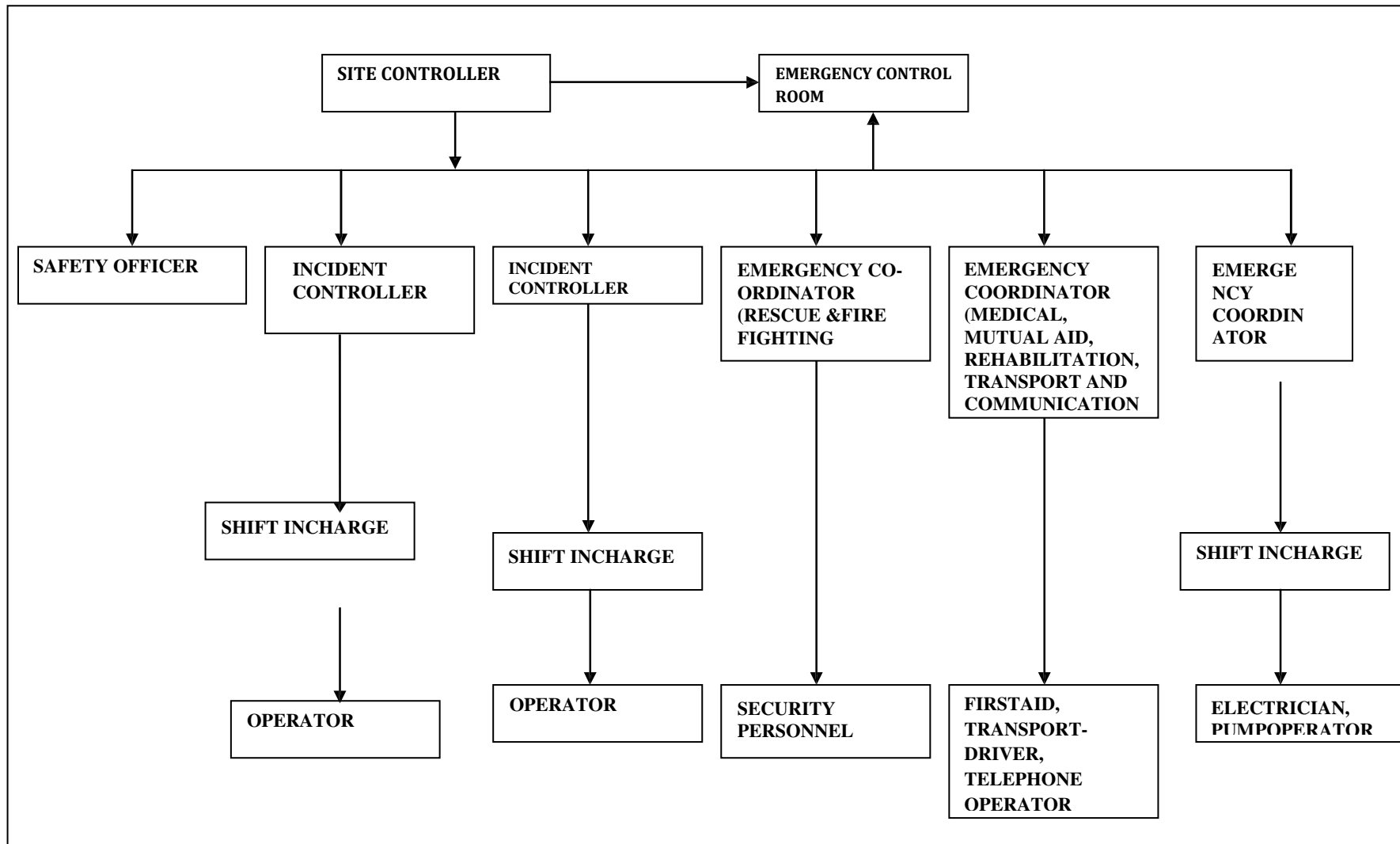


Figure 7.2: On Site Emergency Organization Chart

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1.2.9 Occupational Health and Safety Hazards identification and risk assessment

Following Occupational Health and safety Hazards will be there in pulp & paper plant:

- Dust
- Noise
- Physical hazards
- Electrical Hazards
- Fire and Explosion

(1) Dust

The airborne contaminants can occur in the gaseous form (gases and vapours) or as aerosols, which include airborne dusts, sprays, mists, smokes and fumes. The paper & pulp industry utilizes wheat straw, bagasse, coal, rice husk. The mentioned raw materials releases air borne particles in the air environment during handling and storage activities and gradually it can lead to suspended air contaminants and can harm humans while inhaling.

A) Risks involved

- Occupational lung diseases such as pneumoconiosis
- Systemic intoxications

B) Management Measures

- Water sprinkling in the places where dust dispersion can occur.
- Regular sweeping of roads within plant premises
- Providing dust masks to employees working in handling and storage yards.

(2) Noise

A) Risks involved

- Hearing impairment, hypertension, increase pulse rate
- Annoyance, tinnitus, sleep disturbances

B) Management measures

- Proper maintenance of machineries
- Installation of compressors and turbine in closed buildings
- Regular monitoring of noise level
- Display of noise level with permission level
- Display instruction to use of PPEs at high noise level area
- Periodic health checkup for audiometry for the person working in high noise area

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(3) Heat stress

A) Risks involved

- Increase in core body temperature which leads to dehydration
- Increase in heart rate and muscle cramps
- Heat exhaustion

B) Management measures

- Monitor workers who are at risk of heat stress
- Provide rest periods with water breaks
- Use of personal protective equipment

(4) Electrical hazards

A) Risks involved

- Electric shock, electric burns, fires and explosions

B) Causes of hazards

- Insulation failure, equipment failure, poor maintenance.
- Wrong work methods, substandard material and workmanship
- Unauthorized personal & lack of training and knowledge, etc.

C) Management measures

Following protection measures will be taken:

- Proper earthing is being/will be done as per IS 3043
- Low voltage supply will be ensured
- Isolating transformers
- Double insulated tools
- Over load protection
- Protection against leakages (G.F.C.I.)
- Flame- proof equipment
- Lightning protection
- Protection against static electricity and safe use of ladders and scaffolds

(5) Fire and Explosion

A) Risks involved

Following risks are involved:

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Fire catching in store, godown, conveyors, cable tunnel, oil storage area, transformers and HT/LT substation etc.

B) *Management measures*

- Suitable fire extinguisher, fire hydrant system and fire buckets. Dry power type in oil and fire buckets are kept near transformer, cable, general store and office area. Fire tender is kept ready at plant main gate
- Oil and flammable gases storage area fenced and declared as fire hazardous area-No Smoking Area”
- Predictive interlock in transformers to give alarm and trip the system
- Adequate height of brick walls for separation of all transformers, soak pits for storage of oil leakages from transformers

1.2.9.1 **Occupational Health Surveillance**

In paper plant, the occupational health surveillance of the employee is/will be done on a regular basis and records of the same are/will be maintained as per the Factories Act. The occupational health surveillance program include lung function; sputum analysis and audiometric analysis on regular basis to observe any contraction due to exposure to dust and noise and corrective measures are/will be taken accordingly.

Vocational training programmes are/will also be conducted. Under vocational training the workers are/will be given training related to all safety and health aspects pertaining to their vocation and thereafter every quarter special training courses/ Awareness programme for Malaria eradication, HIV and health effects on exposure to dust, heat, noise, chemicals are/will be organized for employed person.

Periodical medical camps with specialized doctors of various disciplines also provide the specialized medical assistance to employees as well as neighbouring communities.

A. List of Equipment for Occupational Health Monitoring

ECG	Audiometric device
Glucometer	Chest X Ray
Laryngoscope	Complete Medical Laboratory Set up
Suction Machine	D.C. Shock and Cardiac Monitor
Autoclave	Endoscopic Ear & Throat
Sterilizer	Urine Analyzer
Spirometer	TMT

Pre Placement and Periodical Health Status

Pre /post-employment checkup will be carried out and following tests will be conducted:

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Chest x rays	SGOT and SGPT
Vision testing (Far and Near vision, color vision and any other ocular defect)	Urine (Routine and Microscopic)
ECG	Complete physical examination
Haemogram (examination of the blood)	Post employment occupational health check up such as lung function, audiometry, spirometry, CBC, Blood Sugar, Lipid Profile etc.
Blood Sugar Fasting	Medical records of each employee will be maintained separately and will be updated as per finding during monitoring
Serum Cholesterol	Serum Creatinine

A. Frequency of Medical Examination

- Yearly

B. Personal Protective Devices and Measures

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

C. Details of Test conducted

Details of various test conducted is given below:

Spirometry							
Name of Dept.	Total Employees	FVC (litres)	FEV 1	FEV 1/ FVC %	PEFR	MVV (litres/min)	Conclusion
					(litres/sec)		
Plant	330	WNL	WNL	WNL	WNL	WNL	WNL
Total No. of employees	330	Normal	Normal	Normal	Normal	Normal	100 % Normal

Biochemical Parameter (Blood)

Name of Dept.	Total	CBC	Lipid	Renal	Liver	Blood Sugar
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	Employees		Profile	Profile	Function Test	
Civil	5	WNL	WNL	WNL	WNL	WNL
Commercial	13	WNL	WNL	WNL	WNL	WNL
Process	130	WNL	WNL	WNL	WNL	WNL
Drawing & Design	08	WNL	WNL	WNL	WNL	WNL
Electrical	38	WNL	WNL	WNL	WNL	WNL
Lab and QC	28	WNL	WNL	WNL	WNL	WNL
Medical	1	WNL	WNL	WNL	WNL	WNL
Instrumentation	26	WNL	WNL	WNL	WNL	WNL
Mechanical	80	WNL	WNL	WNL	WNL	WNL
P & A	1	WNL	WNL	WNL	WNL	WNL
Total No. of employees	330	Normal	Normal	Normal	Normal	Normal

Circulatory System Vision

Name of Dept.	Total Employees	Pulse	ECG	BP	Right Eye	Left Eye	Color Blindness	Squint
Civil	5	Normal	WNL	Normal	Normal	Normal	Nil	Normal
Commercial	13	Normal	WNL	Normal	Normal	Normal	Nil	Normal
Process	130	Normal	WNL	Normal	Normal	Normal	Nil	Normal
Drawing & Design	08	Normal	WNL	Normal	Normal	Normal	Nil	Normal
Electrical	38	Normal	WNL	Normal	Normal	Normal	Nil	Normal
Lab and QC	28	Normal	WNL	Normal	Normal	Normal	Nil	Normal
Medical	1	Normal	WNL	Normal	Normal	Normal	Nil	Normal
Instrumentation	26	Normal	WNL	Normal	Normal	Normal	Nil	Normal
Mechanical	80	Normal	WNL	Normal	Normal	Normal	Nil	Normal
P & A	1	Normal	WNL	Normal	Normal	Normal	Nil	Normal
Total No. of employees	330	Normal	WNL	Normal	Normal	Normal	Nil	Normal

According to permissible exposure levels of harmful chemicals, chlorine and sodium hydroxide details are given below:

S. No.	Harmful Chemicals	Permissible exposure levels	Concentration in working area	Safety measures adopted inside plant premises
1.	Chlorine	0.5 ppm	<0.5 ppm	- Procedure pertaining to safe handling and usage is followed. - Chlorine detectors are installed at places prone to dangers of leakage. - Proper personal protective equipment is provided to workers exposed to handling and

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				usage of chlorine.
2.	Sodium hydroxide	2 mg/m ³	<2 mg/m ³	Proper PPEs are provided to workers.

1.2.9.2 Implementation of OHS standards as per OSHAS/USEPA

The overall objective of the company is to provide a system that is capable of delivering healthy and safe workplace. Following measures have been adopted for implementation of OHS standards.

- Availability of trained safety personnel round-the-clock.
- Dedicated hydrant network.
- Effective chlorine handling system & equipment.
- Continuous training for fire fighting, chlorine handling and leakage prevention.
- Mock drill programs.
- Well-equipped Occupational Health Centre with adequate paramedical staff
- Routine and special investigation related to occupational health
- Health surveillance & maintenance of health record
- Rules and procedure for effective implementation of Safety, Health and Environment policy and made to know all employees
- Round the clock Ambulance facility
- Sufficient number of First aid boxes
- Implementation of OHSAS 18001 for Occupational, Health and Safety Management System
- Implementation of ISO 14001 for Environment Management System
- Formulation of OHS implementation team/ cell
- Risk assessment of each and every activity
- Implementation of OHS management program
- Displaying the safety and health policy and instructions at various locations
- Display of safe operating procedure (SOP) at various locations
- Job safety analysis
- Carry out daily plant safety inspection by internal safety department
- Investigation of fatal, serious accidents and near miss accident
- Investigation of reports of occupational diseases
- Monthly safety meeting of all employees and workers to discuss last month accident if any, reason and corrective measures taken.
- Organize campaigns, competitions, contests etc. to promote safety
- Organize safety training, seminars for safe working and safe vehicle and traffic movement within the plant premises and regular training for safe driving outside the plant premises

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- Prepare annual reports of accidents and occupational diseases. Preparation and updating of Onsite Emergency Plan and liaison with external agencies and authorities
- Ensure use of PPEs according to the job like helmet, safety shoes, goggle, dust mask, ear plug and hand gloves etc.
- Establishment of Occupational Health Centre for pre and periodic medical examination of workers and staff to detect any onset of occupational disease and corrective manures
- Display Material Safety Data Sheets (MSDS) for use of every hazardous substance
- Implement the recommendations of HAZOP (A hazard and operability study) for examination of problems in existing process / operation that may represent risks to personnel or equipment
- Periodic Safety Audits both internal and external, review and implementation of recommendations

1.2.9.3 Safety Committee

A safety committee is / will be formed and manned by equal participation from management and workers with the following functions:

- a) Accident prevention and control including ensuring the use of safety appliances
- b) Publicity, propaganda, education and training
- c) Assisting and cooperating with the management in achieving the aims and objectives outlined in the “Health and Safety Policy” of the occupier
- d) Carrying out health and safety surveys for identifying unsafe working condition/practices, which causes accident

1.2.9.4 Medical Facilities

NTL is /will be provided with occupational health centre functioning round the clock. Qualified doctor are available for 24 Hrs, availability of pharmacist and ambulance is/will be there at site to render the medical assistance. Tie up arrangements are/will be there with nearest hospital and nursing home for the plant. First aid boxes are/will be kept in 15 identified locations for emergency.

Apart from these, specialists will visit NTL Plant to render consultation. Camps for immunization, family planning, blood donation and free medical checkup programs are/will be organized on regular basis for employees as well as neighboring communities.

First Aid Boxes

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First aid boxes are/will be kept in every department for emergency. First aid training are/will be organized for the employees.

First aid boxes are/will be provided at prominent places with following items:

Small size sterilized dressing	Mercurochrome solution (in 2% water)
Medium size sterilized dressing	Scissors
Large size sterilized dressing	Adhesive plaster (2cm x 1 m)
Burnol ointment	Sterilized eye pads in separate sealed packets
Packets of sterilized cotton wool	Aspirin tablets
Bottle (120 ml) of cetramide solution (1%) of suitable antiseptic solution	Potassium Permanganate crystals

1.2.9.5 Plan and Fund allocation for Occupational and Safety Hazards

Plan and fund allocation to ensure the occupational health and safety of all contracts and sub-contract workers is given in Table below.

Table – 7.7

Fund allocation for Occupational and Safety Hazards

Particular	Amount(Lakhs)
Estimated Expenses on employee's health check-up	5 lakhs
Doctor fees, medicines, ambulance	5 lakhs
Total safety Budget	10 lakhs

1.3 Conclusion

The hazard identification and risk assessment procedure has analyzed the possible hazards and mitigation measures pertaining to emergency situations and disaster. The Company has well designed plan regarding safety procedures and it has the capability to deal with any kind of emergency situation as per the need. The Occupational and Safety hazards are also dealt well as the company believes in safety of employees first.