	Environmental Impact Assessment for the Proposed Captive Resin Plant of 100000 TPA Production Capacity at Routhusuramala Village, Thottambedu Mandal, Chittoor District, Andhra Pradesh
	Risk Assessment

7.1 Risk Assessment

Risk assessment ensures that all the relevant hazards are addressed, with the aim of identifying significant risks in the workplace. The risks identified are indicative in nature only.

M/s. Greenply Industries Ltd., for its upcoming new resin unit in MDF plant at Routhusuramala village shall handle chemicals, some of which are hazardous in nature by virtue of their intrinsic chemical properties or their operating temperatures or pressures or a combination of them. Fire, toxic release or combinations of them are the hazards associated with industrial plants using hazardous chemicals. More comprehensive, systematic and sophisticated methods of safety engineering, such as, hazard analysis have been developed to improve upon the integrity, reliability and safety of industrial plants, the same has been discussed below.

7.2 Approach to the Study

Risk involves the occurrence or potential occurrence of some accidents consisting of 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; and
- Preparation of broad Disaster Management Plan (DMP), on-site and off-site emergency plan which includes occupational and health safety plan.

7.3 Objectives of Risk Assessment

Risk analysis follows an extensive hazard analysis. It involves the identification and assessment of risks the neighboring populations are exposed to as a result of hazards present. This requires a thorough knowledge of failure probability, credible accident scenario, vulnerability of population etc. Much of this information is difficult to get or generate. Consequently, the risk analysis is often confined to maximum credible accident studies. The layout plan of the resin plant demarcating the storage facilities is shown in Figure-7.1.

7.3.1 Storage Details of Raw Materials with Exposure Control

The storage details of raw materials with proposed protection measures are given in Table-7.1.

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7.4.2 Hazardous Characteristics & Toxicity of Raw Materials/ Chemicals

- Immediate Dangerous to Life and Health (IDLH) limits are used when no public exposure guidelines are defined for a given chemical. An IDLH limit is a workplace exposure limit that is used primarily for making decisions regarding respirator use.
- Lower Explosive Limit (LEL): The lowest concentration (percentage) of a gas or a vapor in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat). The term is considered by many safety professionals to be the same as the lower flammable limit (LFL).
- Upper Explosive Limit (UEL): Highest concentration (percentage) of a gas or vapor in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat). Concentrations higher than UEL are 'too rich' to burn. Also called upper flammable limit (UFL).
- Flash Point: The flash point of a volatile material is the lowest temperature at which vapours of the material will ignite, when given an ignition source. The flash point may sometimes be confused with the autoignition temperature, which is the temperature at which the vapor ignites spontaneously without an ignition source. The fire point is the lowest temperature at which the vapor will keep burning after being ignited and the ignition source removed.
- Short Term Exposure Limit (STEL): A short-term exposure limit (STEL) is the acceptable average exposure over a short period of time, usually 15 minutes as long as the time-weighted average is not exceeded. STEL is a term used in occupational health, industrial hygiene and toxicology.
- Threshold Limit Value (TLV/ TWA): The threshold limit value (TLV) of a chemical substance is a level to which it is believed a worker can be exposed day after day for a working lifetime without adverse effects.
- Lethal dose levels (LD₅₀, LC₅₀): LD stands for "Lethal Dose". LD₅₀ is the amount of a material, given all at once, which causes the death of 50% (one half) of a group of test animals. The LD₅₀ is one way to measure the short-term poisoning potential (acute toxicity) of a material.
- LC stands for "Lethal Concentration". LC values usually refer to the concentration of a chemical in air but in environmental studies it can also mean the concentration of a chemical in water. The concentrations of the chemical in air that kills 50% of the test animals during the observation period is the LC₅₀ value. Other durations of exposure (versus the traditional 4 hours) may apply depending on specific laws. The hazardous and toxicity characteristics of raw materials are given in Table-7.2.

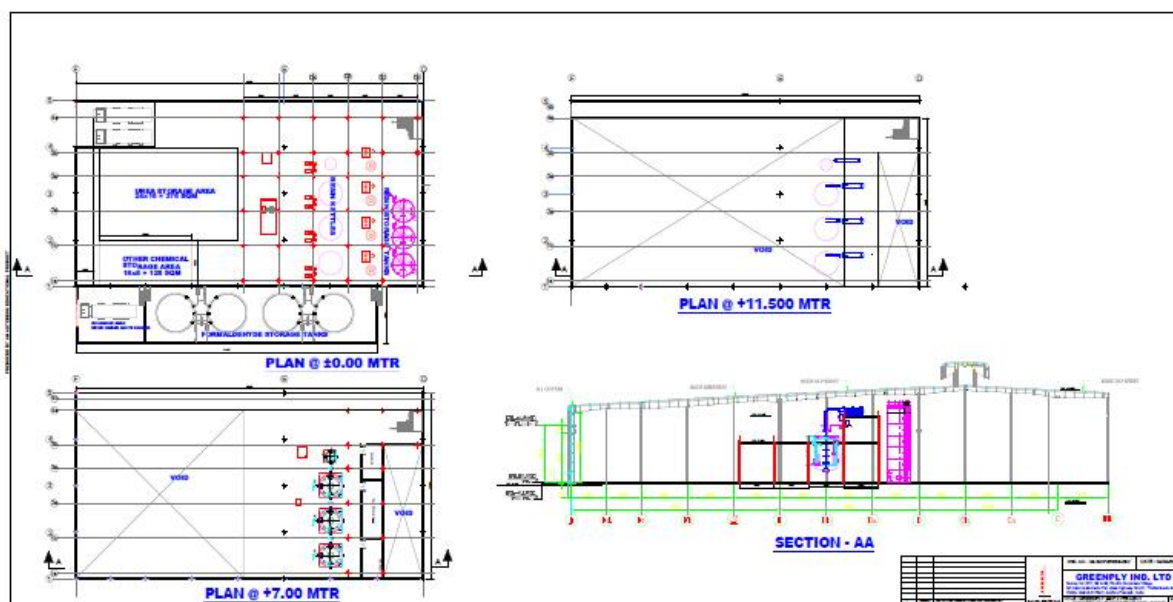


FIGURE-7.1
LAYOUT PLAN OF THE RESIN PLANT DEMARCATING STORAGE
FACILITIES OF RAW MATERIAL



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TABLE-7.1
STORAGE DETAILS OF RAW MATERIALS WITH PROTECTION MEASURES

Sr. No	Name of the Raw Materials	Total Quantity (TPA)	Storage Capacity (MT)	Mode of Storage	Material of Construction	Possible Type of Hazards	Exposure Control/ Proposed Protection Measures
1	Formaldehyde	62,500	1000	Vertical storage tank	M.S.R.L	Toxic & Flammable	PPEs like chemical safety goggles, protective gloves and clothing, respirator, etc., shall be used to prevent skin exposure. Self containing breathing apparatus Sufficient capacity i.e. 10% extra than storage tank capacity will be provided.
2	Urea	33,100	1000	Bags	HDPE	Material will not burn	A NIOSH approved air purifying respirator with a particulate filter may be used under conditions where airborne concentrations are expected to exceed exposure limits
3	Melamine	4,400	300	Bags	Paper	May be combustible at high temperature	Using process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit
4	Caustic soda	33	1	Bags	HDPE	Irritation	PPEs like protective gloves/protective clothing/eye protection/face protection shall be worn. Care shall be taken, when removing gloves

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Sr. No	Name of the Raw Materials	Total Quantity (TPA)	Storage Capacity (MT)	Mode of Storage	Material of Construction	Possible Type of Hazards	Exposure Control/ Proposed Protection Measures
							and other PPEs, to avoid all possible skin contact.
5	Acetic acid	20	1	Jars /drum	HDPE	Flammable	PPEs like splash goggles, full suit, vapor respirator, boots, gloves.
6	Rodhamine dye	26	1	Jar	HDPE	Causes irritation	Safety goggles, uniform, apron, rubber gloves are recommended.



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TABLE-7.2
HAZARDOUS & TOXICITY CHARACTERISTICS OF RAW MATERIALS/ CHEMICALS

Sr. No	Chemical	Physical State	Flash Point	Boiling Point	Lower Explosive Limit (LEL)	Upper Exposure Limit (UEL)	LD ₅₀ Oral	IDLH Value by NIOSH	Short Term Exposure Limit (STEL)	Threshold Limit Value (TLV/ TWA)
1	Formaldehyde	Liquid	59°C	96°C	7.0 %	73.0 %	100(mg/kg) (Rat)	20 ppm	2 ppm	0.3 ppm
2	Urea	Solid/ granules	NA	Decomposes at 135°C	NA	NA	8.5 g/kg(Rat)	-	-	Not established
3	Melamine	Powder	NA	NA	NA	NA	3850 mg/kg (Rat)	-	-	-
4	Caustic soda	Solid flakes	NA	1388°C	Product is not flammable	Product is not flammable	2000 mg/kg (Rat)	10 mg/m ³	-	-
5	Acetic acid	Liquid	39 °C	118.1°C	4.0%	19.9%	3310 mg/kg, oral (Rat)	50 ppm	15 ppm	10 ppm
6	Rhodamine dye	Powder	NA	NA	NA	NA	112 mg/kg	-	Not established	Not established

**Note:

- Formaldehyde 37% solution in water is a aqueous solution. Hence it is not a fire hazard. To prevent the toxic release of formaldehyde, vent from storage tank is connected to condenser to minimize the formaldehyde vapor in the atmosphere.
- Acetic acid quantities is handled in small size drums. Hence the possibility of fire and toxic release is not significant. However for acetic acid consequence analysis is considered.

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7.4.3 Consequence Analysis for Acetic Acid

The properties of hazardous material of acetic acid are given in Table-7.3. The results of consequence analysis are given in Table-7.4. The legend for figures is shown in Figure-7.2. The pool fire radiation intensity is given in Figure-7.3. The toxic gas dispersion footprint is given in Figure-7.4.







TABLE-7.3
PROPERTIES OF ACETIC ACID

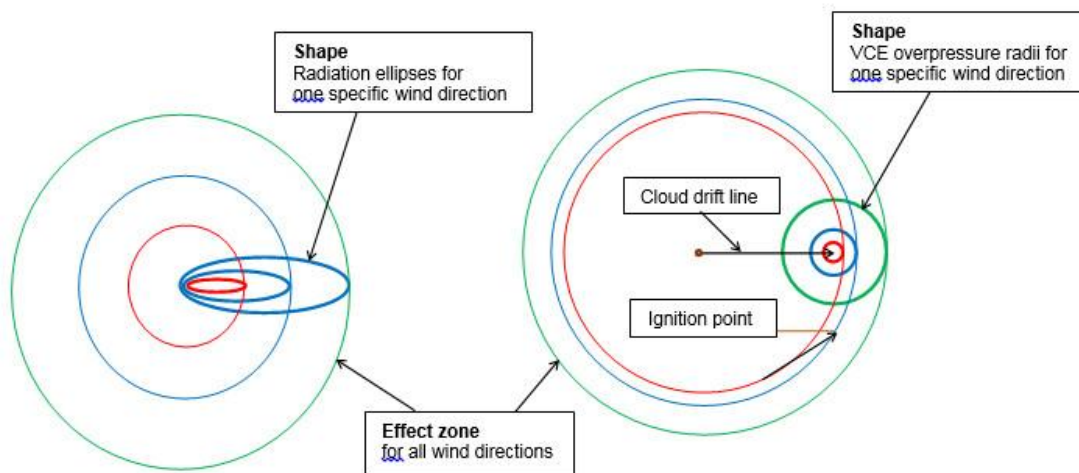
Sr. No.	Chemical	Normal Boiling Point (°C)	Flammable Properties			Toxic Properties		
			Flash Point (°C)	LFL (%)	UFL (%)	IDLH (ppm)	ERPG-2 (ppm)	ERPG-3 (ppm)
1	Acetic acid	118.1	39	4.4	19.9	50	35	250

Case: Spillage of Acetic Acid from Drum (50 kg)

TABLE-7.4
RESULTS OF CONSEQUENCE ANALYSIS

Sr. No.	Description	Parameter	Down Wind Distance (m)	
		Weather	D; 3 m/s	D; 5 m/s
1	Acetic acid drum - spill			
	Pool fire	Radiation intensity		
		4 kW/m ²	7.1	7.0
		12.5 kW/m ²	4.7	4.8
		37.5 kW/m ²	2.7	3.0
	Toxic vapour dispersion	Acetic acid concentration in air		
		50 ppm (IDLH)	13.5	13.8
		250 ppm (ERPG-3)	8.2	8.4

Fire radiation intensity ellipse		VCE overpressure radii	
4 kW/m ²		0.021 bar (0.3 psi)	
12.5 kW/m ²		0.069 bar (1.0 psi)	
37.5 kW/m ²		0.207 bar (3 psi)	



Toxic gas dispersion footprint (Acetic acid)
 50 ppm (IDLH)
 250 ppm (ERPG-3)

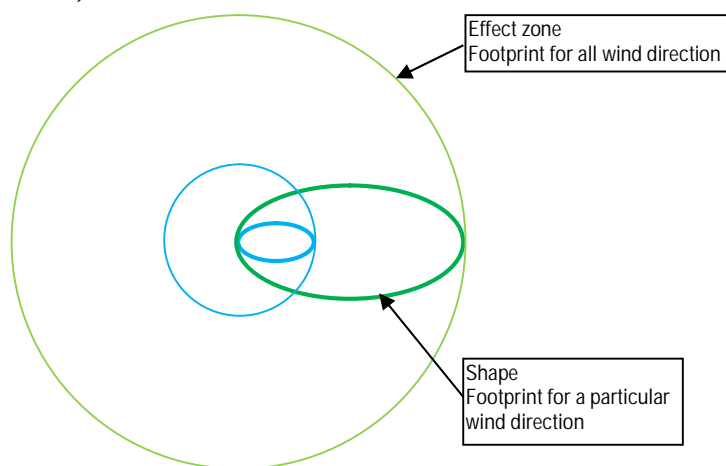


FIGURE-7.2
LEGEND FOR FIGURES

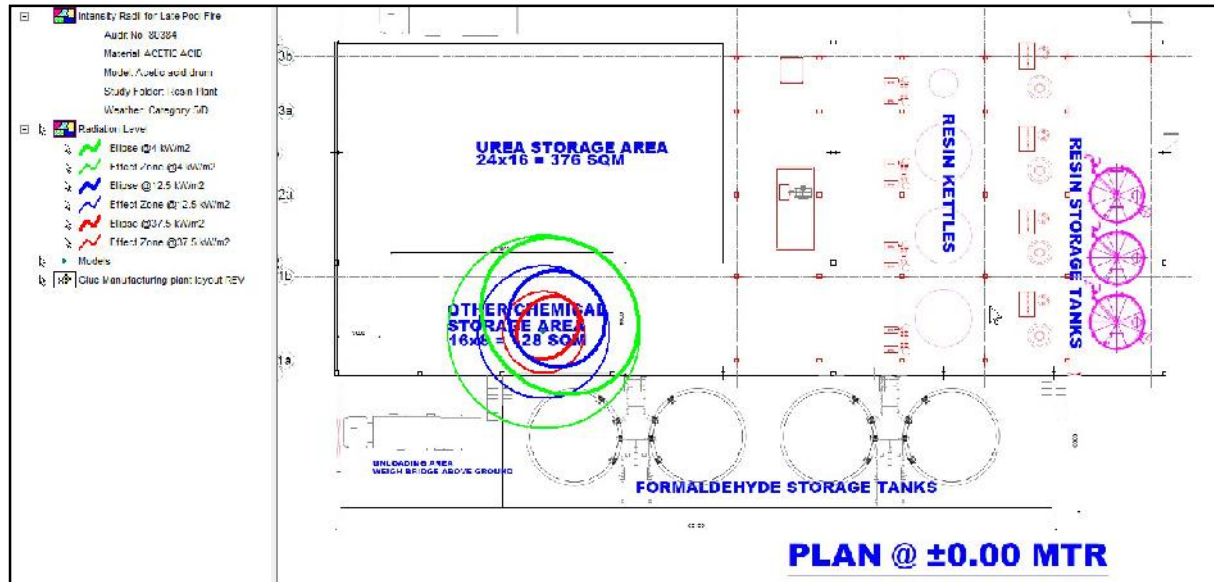


FIGURE-7.3
POOL FIRE RADIATION INTENSITY

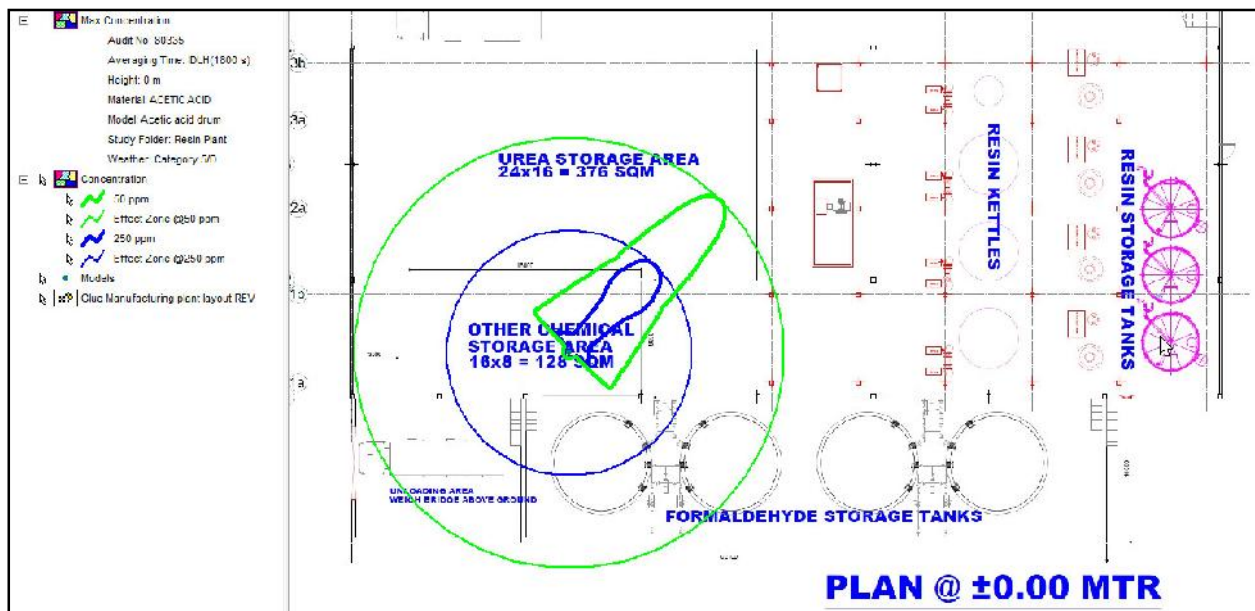



FIGURE-7.4
TOXIC GAS DISPERSION FOOTPRINT

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7.4.4 Storage and Handling of Toxic Chemicals (like formaldehyde, etc.)

The storage and handling of toxic chemicals is given in Table-7.5.

TABLE-7.5
STORAGE AND HANDLING OF TOXIC CHEMICALS


Sr. No	Process or Activity	Associated Hazards	Health & Safety Impact	Recommendations
1	Chemical handling /loading & unloading	Exposure to fumes (due to leakage from joints, corroded lines failure etc.)	Skin burn. Eye irritation and respiratory disorder.	Dyke will be provided. Shall be stored in well ventilated area. Eye wash station or safety Shower shall be installed in nearby location. Maintenance shall be carried as per schedule. Employee will be provided with impervious clothes, gloves, face shield dust and splash proof safety goggles, chemically resistant safety shoes, etc
2	Working in storage area	Exposure to fumes due to spillage.	Severe irritation to eyes, skin etc. Internal body burns.	Spill kit or suitable absorbent shall be kept available. PPEs like face mask, gloves, goggles, etc. shall be worn by concerned person. Eye wash station or safety Shower shall be installed in storage area.
3	Tank overflow	Chemical exposure	Eyes and skin irritation.	Level indicator shall be installed and the same shall be checked for its proper operation. Dyke wall shall be available to contain the spill.

7.4.5 Storage and Handling of Solid Chemicals

The storage and handling of solid chemicals is given in Table-7.6.

TABLE-7.6
STORAGE AND HANDLING OF SOLID CHEMICALS

Sr. No	Process or Activity	Associated Hazards	Health & Safety Impact	Recommendations
1	Handling chemical bags	Chemical exposure	Skin/eye irritation.	Chemicals shall be stored in an isolated storage rooms having provision for natural & forced ventilation.

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Sr. No	Process or Activity	Associated Hazards	Health & Safety Impact	Recommendations
				Certified dust respirator shall be used. Suitable protective clothing and other PPEs shall be used
2	Cleaning of chemical spillage.	Fumes inhalation. Dust exposure	Severe irritation to eyes, skin. inhalation.	Certified dust respirator will be used. Suitable protective clothing, gloves, boots shall be used. Spillage shall be cleaned or neutralized with suitable media. Chemicals shall be stored in isolated storage rooms having provision for natural & forced ventilation. Care shall be taken, when removing gloves and other PPEs, to avoid all possible skin contact.

7.4.6 Other Safety Precautions / Recommendations

Following mitigation measures will be followed /practiced during transportation, unloading and handling of flammable & toxic chemicals, in order to ensure health & safety of workers involved in handling hazardous chemicals and avoid the human health impacts. The proposed safety details or proposed safety control measures to reduce the risk of fire, explosion and toxic release is given in Table-7.7.

TABLE-7.7
PROPOSED SAFETY DETAILS OR PROPOSED SAFETY/CONTROL MEASURES TO REDUCE THE RISK OF FIRE, EXPLOSION AND TOXIC RELEASE


Sr. No	Activity	Safety Precautions
1	Transportation of chemicals by road tanker	<ul style="list-style-type: none"> • Training will be provided to driver and cleaner regarding the safe driving, hazards of chemicals, emergency handling. • Fire extinguishers will be kept with TL. • Flame arrestor will be provided to TL exhaust. • Instructions will be given not to stop road tanker in populated area. • Hazard identification symbol and emergency telephone number will be displayed as per HAZCHEM code. • Appropriate PPEs will be kept with TL. <p>In case of leak or spill:</p> <ul style="list-style-type: none"> • Area will be isolated. • Container shall be isolated. • Source of leakage will be checked. • Damaged containers or spilled material shall not be attended without wearing appropriate protective clothing. • Leak will be stopped, if possible to do so without risk. • Water spray shall be used to reduce vapors (but

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Sr. No	Activity	Safety Precautions
		do not put water directly on leak, spill area or inside container). <ul style="list-style-type: none"> Combustibles (wood, paper, oil, etc.) shall be kept away from spilled material.
2	Unloading of chemicals from tanker	<ul style="list-style-type: none"> Priority will be given to tanker to immediately enter the storage premises at site and will not be kept waiting near the gate or the main road. Security person will check license, fire extinguisher condition, SCBA set condition, antidote kit, required PPEs as per SOP laid down. Store officer will take sample as per sampling SOP from sampling point.
3	Chemicals storage tank safety	<ul style="list-style-type: none"> Pipes and equipment shall be inspected at regular intervals. All storage areas shall be isolated from all sources of open flame and well posted with 'NO SMOKING' signs and will be provided with adequate fire fighting/extinguishing system. Entry of unauthorized persons shall be prohibited. Spark-resistant tools will be used, wherever required. Water spray shall be used to reduce vapors (but do not put water directly on leak, spill area or inside container). Combustibles (wood, paper, oil, etc.) shall be kept away from spilled chemicals. Storage areas will be inspected on regular basis. For solid storage, adequate ventilation & illumination shall be provided. At strategic point of the plants, online toxic gas detectors shall be provided for detection of such emissions. Lines of hazardous chemicals will be tested periodically and such tests will be recorded.
4	Chemicals transfer from storage tank to process plant.	<ul style="list-style-type: none"> Double mechanical seal type FLP type pump shall be provided, if required. FLP type pump & electrical fittings will be provided, if required. Double on / off switch shall be provided at tank farm and process area near day tank. Pump auto cut off with day tank high level shall be provided. Flame arrestor shall be provided on day tank vent, if required. Over flow tank shall be provided for additional safety and it shall be connected to main storage tank. Color coding will be provided for solvents handling pipelines.

Recommendations to Reduce Fugitive Emissions

- Regular monitoring of plant area shall be conducted and records will be maintained. At strategic point of the plants, online detectors will be provided for detection of such emissions;
- Lines of such hazardous chemicals will be tested periodically and such tests may be recorded;

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- All lines carrying toxic liquid shall be continuous welded and shall be provided with proper slopes and special tongue and groove joints to avoid liquid stagnation and leakage;
- Spill containment kit shall be made available;
- Dyke wall will be provided & PPEs will be given to concerned personnel; and
- Only trained personnel will be allowed to carry out work in this area.

Fire Control Plan

M/s. Greenply Industries Ltd., has considered fire prevention measures at the project planning stage for its upcoming new facility to avoid any outbreak of fire. The company has planned to keep the following types of fire extinguishers at various conspicuous locations. Following fire protection facilities have been envisaged for the proposed plant which is given in below Table-7.8.

TABLE-7.8
TYPE OF FIRE FIGHTING FACILITIES

Sr. No	Type	Total Nos.
1	Dry chemical powder	197
2	Carbon dioxide type Extinguishers	87
3	Water type extinguishers	92
4	Foam type extinguishers	100
	Total	476

7.5 Risk Assessment Summary


The preliminary risk assessment for the proposed plant and associated facilities and the broad conclusions are as follows:

- There will be no significant adverse community impacts or environmental damage consequences; and
- The hazardous event scenarios and risks in general at this facility can be adequately managed to acceptable levels by performing the recommended safety studies as part of detailed design, applying recommended control strategies and implementing a safety management system.

7.5.1 Risk Reduction Opportunities

The following opportunities will be considered as a potential means of reducing identified risks during the detailed design phase:

- Buildings and plant structures designed for cyclone and seismic events (where appropriate), to prevent structural collapse and integrity of weather (water) proofing for storage of dangerous goods;
- Provision for adequate water capacity to supply fire protection systems and critical process water;

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- Isolate people from load carrying/mechanical handling systems, vehicle traffic and storage and stacking locations;
- Installation of fit-for-purpose access ways and fall protection systems to facilitate safe access to fixed and mobile plant;
- Provision and integrity of process tanks, waste holding tanks and bunded areas as per relevant standards;
- Containment of hazardous materials;
- Security of facility to prevent unauthorized access to plant, introduction of prohibited items, and control of onsite traffic; and
- Development of emergency response management systems commensurate with site specific hazards and risks (fire, explosion, rescue and first aid).

7.6 Disaster Management Plan


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

Disasters can be divided into two main groups. In the first, disasters resulting from natural phenomena like earthquakes, volcanic eruptions, storm surges, cyclones, tropical storms, floods, avalanches, landslides, forest fires etc. The second group includes disastrous events occasioned by man, or man's impact upon the environment. Examples are armed conflict, industrial accidents, radiation accidents, factory fires, explosions and escape of toxic gases or chemical substances, river pollution, mining or other structural collapses, air, sea, rail and road transport accidents and can reach catastrophic dimensions in terms of human loss.

There can be no set criteria for assessing the gravity of a disaster in the abstract since this depends to a large extent on the physical, economic and social environment in which it occurs. What would be considered a major disaster in a developing country, well equipped to cope with the problems involved, may not mean more than a temporary emergency elsewhere. However, all disasters bring in their wake similar consequences that call for immediate action, whether at the local, national or international level, for the rescue and relief of the victims. This includes the search for the dead and injured and removal of debris and social care, the provision of temporary shelter to the homeless food, clothing and medical supplies, and the rapid re-establishment of essential services. The disaster management plan for existing hot metal is given below and the same will be extended for HPPI and iron, alloy powder plant.

7.6.1 Objectives of Disaster Management Plan (DMP)

The disaster management plan is aimed to ensure safety of life, protection of environment, protection of installation, restoration of production and salvage operations in this same order of priorities. For effective implementation of the

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disaster management plan, it will be widely circulated and personnel training given through rehearsals/drills.

The disaster management plan would reflect the probable, consequential severalties of the undesired event due to deteriorating conditions or through 'Knock on' effects. Further, the management should be able to demonstrate that their assessment of the consequences uses good supporting evidence and is based on currently available and reliable information, incident data from internal and external sources and if necessary the reports of outside agencies.

To tackle the consequences of a major emergency inside the factory or immediate vicinity of the factory, a disaster management plan has to be formulated and this planned emergency document 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 casualties;
- Safeguard other people;
- Minimize damage to property and the environment;
- Initially contain and ultimately bring the incident under control;
- Identify any dead;
- Provide for needs of relatives;
- Provide authoritative information to the news media;
- Secure the safe rehabilitation of affected area; and
- Preserve relevant records and equipment for the subsequent inquiry into the cause and circumstances of the emergency.

In effect, it is to optimize operational efficiency to rescue rehabilitation and render medical help and to restore normalcy.


7.7 Planning for Hazard Identification Risk Assessment and Risk Control

7.7.1 Identification of Hazards

Identification of hazards with respect to the departmental activities including those performed by sub-contractors shall be done by the Dept. Head in consultation with his/her sub-ordinates. Dept. Head shall ensure due consideration is given to temporary, new/planned activities and change in organizational structure (Change in people or change in their responsibility) while identifying the hazards associated with departmental activities.

The process of hazard identification takes into account the following:

- Human behavior, capabilities and other human factors;
- Identified hazards originating outside the workplace capable of adversely affecting the health and safety of persons under the control of Greenply Industries Limited within the workplace;

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- Hazards created in the vicinity of the workplace by work-related activities under the control of the Greenply Industries Limited;
- Infrastructure, equipment and materials at the workplace, whether provided by Greenply Industries Limited or others;
- Any modifications, including temporary changes and their health & safety impacts on operations, processes and activities;
- Any applicable legal requirements relating to risk assessment and implementation of necessary controls ; and
- The design of work areas, processes, installations, machinery/equipment, operating procedures and work organization including their adaptation to human capabilities.

7.8 Emergency Preparedness & Response (On-site Emergency Plan)

M/s. Greenply Industries Ltd will prepare the proposed On-Site / Off-Site Emergency Plan which shall be followed from the project construction & erection phase. The purpose of this plan is to effectively utilize all the resources at its disposal for the protection of life, environment and property. The details of the same are discussed in the following sections:

Level of Emergency

Level - 1

The leakage or emergency, which is confinable within the plant/ area. It may be due to:

- a) Small pipe/valve rupture or similar leakages that do not affect outside premises;
- b) Release of toxic chemicals for short duration; and
- c) Small fire in the plant.

Level - 2


The emergency, which is confinable within the factory premises. It may arise due to:

- a) Leakage of toxic chemicals for long duration;
- b) Medium scale explosion confined to the factory premises; and
- c) Medium scale fire inside the factory premises.

Level – 3

The emergency, which is not confinable within the factory premises and general public in the vicinity are likely to be affected. It may arise due to:

- a) Heavy / Profuse leakage of toxic / flammable gases for a long duration.
- b) Explosion of high magnitude affecting the adjacent area.
- c) Major fire inside the factory premises.

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Objectives of Emergency Management System

The objectives of the emergency management system are summarized as under:

- To identify and assess types of emergencies due to different types of hazards;
- To work out plan with all provisions to handle emergencies and safeguard employees and people in the vicinity of the factory;
- To provide for emergency preparedness and the periodical rehearsal of the plan;
- To plan mode of proper communication and actions to be followed in the event of emergency;
- To keep all necessary information with respect to hazard/accident control and emergency contacts in one document for easy and speedy reference;
- To inform employees, general public and the authorities about the hazards/risk if any and the role to be played by them in the event of emergency;
- To control and contain the accident;
- To effect rescue and treatment of casualties;
- To inform and help relatives of casualties;
- To secure rehabilitation of affected area and restore normalcy;
- To provide information to media and government agencies;
- To preserve record, equipment etc. for investigating cause of emergency; and
- To be ready for "mutual aid" if need arises to help neighboring units.

Structure of Emergency Management System

M/s. Greenply Industries Ltd, shall develop an emergency management team. The management structure shall include the following personnel's;


- Site main controllers;
- Incident controllers and Deputy incident controllers;
- Key personnel's; and
- Essential workers;

The other elements of emergency plan shall be:

- Assembly points;
- Emergency control center;
- Fire control arrangements;
- Medical arrangements; and
- Other arrangements.

Site Main Controller (SMC)


Senior most Executives (i.e. Director & Supervisor) of the company shall be nominated as SMC. His task will be to co-ordinate all internal and external activities from the Emergency Control Centre at Main Security Gate, from where all operations will be directed. He shall:

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- Immediately on being informed of the emergency and its location, will arrive at the site, review the situation and control further actions;
- Direct all emergency operations within the approved area with the following priorities:
 - a. Personnel safety;
 - b. Plant, property and environment safety; and
 - c. Minimum loss of production.
- Co-ordinate to avail services from external agencies like fire brigade, hospitals etc, if called for, following the declaration of major emergency. If necessary, major installations in the vicinity may also be informed of the situation;
- Exercise direct operational control of the unaffected section of the plant;
- In consultation with the advisory team, expedite the shutting down of loading / unloading operations of tankers and if necessary, instruct the supervisor / security personnel to evacuate tankers;
- Ensure that all employees are evacuated from the affected area and the casualties, if any, are given necessary medical attention. Instruct assistant / security for rushing casualties to hospitals if required;
- Liaise with fire and police officials, pollution control board officials and other statutory bodies and advise them of all possible consequence effects outside the premises;
- Arrange for relief of personnel when emergency is prolonged;
- Issue authorized statement or press release to the news – media;
- Ensure preservation of evidence for enquiries to be conducted by statutory authorities;
- Authorize the sounding of “All Clear” and “Evacuation Siren”;
- Arrange for obtaining the head – count of all personnel within the premises and crosschecking with the data from records available for no. of persons within the premises; and
- Nominate a person from advisory team, to maintain chronological log of event during the entire period of emergency.

Role of Incident Controller and Deputy Incident Controller:

His primary duties shall be to take charge at the scene of the incident. In the initial stage he may be required to take decisions involving the operation of the other plants or to stop or continue any process and to take technical decisions to control the incident. The deputy incident controller will take the charge of incident


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controller, if he is not available due to any reason. They will be always available in each shift and can take charge of the incident.

Responsibilities/Duties of Incident Controller and Deputy Incident Controller:

Managers connected with plants/the respective plant-in-charge from each shift have been designated as I.C.

- Two production officers in each shift will be identified as Deputy incident controllers;
- He shall take charge at the scene of incident;
- He shall immediately assess the gravity of risk and alert panel and field operators to start controlling their respective section;
- He will work under the direction of the SMC, but till his arrival he may have to execute following responsibilities;
- He will ensure that all the key personnel are called;
- Direct for evacuation of plant and areas likely to be affected by the emergency;
- He shall communicate to the SMC the type of outside help needed;
- He shall direct all emergency operations within the affected area with the following priorities;
- Personnel safety, including of surrounding community;
- Minimum damage to plant, property and environment;
- Appropriate actions to minimize loss of production and material;
- Give information to the head of fire fighting and rescue team and other emergency services;
- Depending on the incident, instruct partial or total shut down, isolations, depressurization, firefighting, rescue operations;
- Instruct upstream/downstream units to take emergency shutdown /cutting off supply and other appropriate actions and emergency evacuation help etc;
- Direct for search of casualties;
- Evacuate non-essential workers/visitors/contractors to safe assembly points; and
- Brief site main controller and keep him informed about the developments.

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Key Personnels

Senior officers of various departments like fire, security, safety, administration, engineering, project, production, transport, pollution control, technical services and stores shall be nominated as key personnel in their respective fields. As necessary, they shall decide the actions needed to shutdown plants, evacuate personnel, carryout emergency engineering work, arrange for supplies of equipments, utilities, carryout environment monitoring, provide catering facilities, liaise with police, fire brigade and other local authorities, relative of casualties, hospital, press & neighboring industries, action at assembly points, outside shelters and mutual aid center under the direction of the SMC. All the key personnel and other called in so to assist, shall report to the ECC. They shall be available at any time on duty or on call or on holidays.

Essential Workers

Essential Workers shall be those who shall be trained in firefighting and first aid. One Supervisor and two helpers from each shift will be identified as E.W.'s & shall supposed to report at emergency site to take instructions from I.C. or Dy. I.C. Such work instructions will include:

- Fire fighting and spill control till a fire brigade takes the charge;
- To help the fire brigade and mutual aid teams, if it is required;
- Shutting down plant and making it safe;
- Emergency engineering work e.g. isolating equipment, material process, providing temporary by-pass lines, safe transfer of materials, urgent repairing or replacement, electrical work, etc;
- Provision of emergency power, water, lighting, instruments, equipments, materials etc;
- Movement of equipment, special vehicle and transport to or from the scene of the accident;
- Search, evacuation, rescue and welfare;
- The injured will be given first aid;
- Moving tankers or other vehicles from area of risk;
- Carrying out atmospheric test and pollution control;
- Manning of assembly points to record the arrival of evacuated personnel. Manning for outside shelters and welfare of evacuated persons there;
- Assistance at casualties reception areas to record details of casualties;

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- Assistance at communication centers to handle out going and incoming calls and to act as messengers if necessary;
- Manning of works entrances in liaison with the police to direct emergency vehicles;
- Entering the work, to control traffic leaving the works and to turn away or make alternative safe arrangements for visitors, contractors and other traffic arriving at the works;
- Informing surrounding factories and the public as well as directed by the site main controller; and
- Any special help required.

Assembly Point

Inaffected & vulnerable plants, all nonessential workers (who are not assigned any emergency duty) will be evacuated from the area & they shall report to specified assembly points. Minimum 2 nos. of assembly points shall be marked at a safe place well away from area of risk and least affected by the down wind direction.


To ensure that workers do not have to approach the affected area to reach the assembly point, proper location and number shall be marked at assembly points. Each assembly point shall be manned by a nominated person to record the names and dept. At each assembly point, duties of assembly point in-charge shall be displayed in brief. Before reaching an assembly point or subsequently, if it is required to pass through an affected area or due to presence of toxic substances, suitable PPE's including respirators, helmet etc., shall be issued & made available with workers.

Emergency Control Center

The emergency control center is the place or room from where the operations to handle the emergency are directed and coordinated. A safe room near security gate shall be earmarked/ identified as the emergency control room.

Telephone and other facilities required with necessary documents shall be displayed in ECC for ready reference. Designated trained personnel shall operate ECC. In case of major emergency, the site main controller will operate from ECC. The ECC center shall be equipped with the following facilities.

- Internal and external telephone including STD facility;
- Telephone directory/ telephone nos. of mutual aid centers;
- First aid;
- Muster roll of workers;
- Identity card register;
- Layout plan of the factory showing the location of hazardous materials, assembly point, first aid centres etc;

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- Map of surrounding area with fire extinguishers location;
- M.S.D.S;
- Copy of onsite off site plan;
- Stationeries like- note book, pen, pencils etc;
- S.B. apparatus;
- List of Government agencies /local press agencies with phone no;
- Sand buckets & hydrant network; and
- Adequate numbers of PPE's.

Fire Control Arrangements (Fire Fighting, Gas Leak Control and Rescue Operation)

- Incident controller shall direct the fire fighting and emergency operation. His duties include
 - Keep the constant touch with the SMC/Incharge - EHS.
 - Direct the crew members to the scene of emergency and arrange replenishment of manpower / equipment / extinguishing media etc.

Role of EHS Representative


- On being notified about the location of fire/ gas leakage, he shall immediately proceeds to the help;
- Decides his line of action in consultation with incident controller and takes appropriate measures to handle the emergency;
- Shall assess the severity of the incident& shall immediately report to emergency controller about the gravity of the situation; and
- He shall also assess the extra requirement required if any, from the neighboring industry.

Fire Crew Members

- On hearing fire alarm & emergency siren, they shall immediately reports to control room and proceed to the scene of emergency and work under the direction of IC/ Dy IC;
- The personnel availability at the scene of incident shall be made optimize.

Emergency Squad Members

- On hearing Emergency Siren, they shall immediately reports to site main controller, safety in charge or incident controller;
- They shall combat the emergency situation as per the direction of site main controller, safety in charge or incident controller.
- They will help for safe evacuation.

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Medical Services

The roles of Medical officers are as follows:


- (a) He will report immediately to the SMC/IC;
- (b) He will render necessary treatment, at occupational health center;
- (c) He will arrange for hospitalization and treatment at outside hospitals, if required;
- (d) He will mobilize in getting the services of external medical agencies, other para –medical services etc. and transportation services etc;
- (e) He will arrange for extra medical assistance/antidotes, from out, if required;
- (f) He will arrange for first-aid trained volunteers for necessary help;
- (g) He will liaise with the Government health authorities for treatment of the affected persons nearby.

Role of Security In-Charge (Security Officer)

- On hearing the emergency siren, he shall find out the location of the incident (fire / gas leak / spill / explosion) and inform the location of the same to the key personnel coming to the plant;
- He will depute the security guards for managing gates and traffic control at the incident site & send remaining guards to the site of incident;
- He will prevent unauthorized entry in to the site;
- He will render assistance as demanded by the safety in-charge;
- He will mobilize additional security force for help, if required;
- He will direct ambulance(s) and emergency vehicle(s) to the scene of incident;
- He will help evacuate persons within the scene of incident; and
- As directed by the site main controller, he may be required to address the public of surrounding villages for warning / evacuation.

Standard Operating Procedure (shall be followed during emergency)

- As soon as emergency alarm is heard, all essential workers shall report to IC or SMC;
- They shall carefully listen to the instructions given by IC or SMC;

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- According to the type of emergency/accident, they shall get equipped with PPE/firefighting equipment and devices;
- The runner among the workers shall inform SMC/IC and key personnel if they are not at site;
- The messenger amongst the workers shall deliver messages to nearby units as per the instructions of SMC/IC;
- The in-charge of medical arrangements shall prepare first-aid and other required facilities for the injured;
- The other essential workers shall try to control the emergency as per the instructions given to IC;
- IC would keep SMC informed about the status of control measures being taken at the site and ask for other requirements eg. Mutual aid, equipment etc. if he find necessary; and
- SMC would co-ordinate with outside agencies regarding control measures being taken, need for external help, evacuation, medical treatment etc.

Communication System

Communication system is a crucial factor while handling emergency. Company has quick & effective communication system through which, any situation, which can lead to emergency, can be informed or known to


- All persons working inside the plant;
- Key Personnel outside during normal working hours & during off-duty hours;
- Outside emergency services, Statutory and Local Authorities; and
- Neighboring facilities and public leaving in vicinity.

Each and every section, plant & department of the factory will be connected by internal telephones with SMC, supervisor or IC's. External phone at office and residence and mobile shall also be made available with key personnel and top executive of the factory. The communication system shall begins with raising the alarm declaring the emergency, telephone messages and procedure to communicate the emergency to other persons & general public.

Raising the Alarm

As soon as incident takes place inside the factory and is noticed by someone, the first step shall be to raise the nearest manual emergency bell to alert the nearby people. Next, he/she shall informs the security persons to raise the emergency siren located at the factory gate.

The security personnel sound the siren. The alarm sound informs the I.C and the S.M.C that an emergency has been created and emergency organization plan to be activated. The I.C. rushes to the site and shall takes charge of the scene.

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Declaring the Major Emergency

Major emergency is declared after sufficient and thorough check because the declaration of major emergency puts many agencies on action and it may disturb the running system, which may be costly at, time or its consequence may be serious. Therefore, major emergency must not be decided on whims or immature judgment or without proper thought.

Looking to all the above, the nominated persons (SMC: Director & Incident Controllers) who can declare the emergency. These persons will be technically qualified and experienced. The decision about major emergency shall be taken as early as possible and without wasting time so that control action can be started immediately.

Communication of Emergency & Statutory Information

Communication of Emergency

An effective system to communicate emergency shall be made to communicate about the emergency situation as mentioned below:

- Inside the factory i.e. workers including key personnel and essential workers, on duty & inside during normal working hours;
- To key personnel and essential workers not on duty and outside during normal working hours;
- To the outside emergency services and the Government authorities; and
- To the neighboring factory & the General Public in the vicinity.

Statutory Information

a) Information to workers


Set of statutory information regarding types of hazards and their prevention and control as directed in the Factories Act shall be prepared by the unit. This information shall be printed in the local language and will be given in the form of booklet to all workers including contract workers.

b) To the outside emergency services and authorities

Statutory information in the form of booklet will be given to outside emergency services and authorities, if required.

c) To neighboring firms and the general public

Statutory information in the form of booklet will be given to neighbouring units and the general public of the villages in the vicinity of the unit, if required.

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Emergency Time Activities

The probable emergency situation that can arise in the unit and the corresponding control actions as described below shall be followed:

1. Flammable Releases


Source/incident – fire involving spilled combustible material near or in flammable storage areas. Following control actions shall be taken:

- Any one who notices fire shall sound emergency alarm;
- SMC/IC who is at site, shall immediately rush to the scene and assess the situation;
- For fire due to spillage of combustible material, he activates the on-site plan as –
 - He cuts off electric supply to that area and evacuates all the persons to safe assembly points;
 - He calls in DIC (if DIC is not present there) and asks essential workers to fight fire with dry chemical / CO₂ fire extinguisher or sand;
 - He inform fire brigade telling them in briefly about kind of fire and type of extinguishers required;
 - He informs mutual aid teams and asks for necessary help;
 - He arranges first-aid / hospitalization for the affected persons;
 - Fire officer on reaching the site, takes charge of the fire-fighting operations;
 - Mutual aid teams are asked for help in the form of first-aid, transport etc;
 - If fire is growing, fire officer shall inform IC who shall alert neighbouring units and through SMC gets more fire-fighting help;
 - Fire fighting shall be continued till fire is fully overcome;
 - After extinguishing fire, fire officer cools the entire area with water spray and checks that no re-ignition is likely to occur. After that, he declares the area safe;
 - IC tells essential workers to sound all clear;
 - The incident shall be recorded;
 - SMC arranges to inform families / relatives of injured / dead;
 - SMC issues authorized statement to press / media; and
 - SMC informs factories inspector about the incident and related information

2. Toxic Releases

Source / incident – pressure release due to failure of

- Stuffing box gland packing;
- Pressure release valve; and
- Vessel / pipeline failure.

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Following control actions will be taken:

- Any one who notices the release shall sound emergency alarm;
- SMC/IC who is at site, shall immediately rush to the scene and assess the situation;
- For toxic release from a reactor, he activates the on-site plan as –
 - He evacuates all the persons to safe assembly point;
 - He calls in DIC (if DIC is not present there) and asks essential workers to wear self breathing apparatus and if the reaction is exothermic, start cooling water flow in the reactor jacket and cool the reactor as soon as possible;
 - The essential workers stop all the charging pumps of that reactor and the nearby reactors;
 - He informs mutual aid teams and asks for necessary help;
 - He arranges first-aid / hospitalization for the affected persons;
 - Mutual aid teams shall be asked for help in the form of first-aid, transport etc;
 - When the leak stops and the air shall clear of toxic release, IC tells essential workers to sound all clear;
 - The vessel / rupture disc/gland packing will be attended by maintenance department;
 - The incident shall be recorded;
 - SMC arranges to inform families / relatives of injured / dead;
 - SMC issues authorized statement to press / media; and
 - SMC informs Factories Inspector about the incident and related information.

3. Chemical Spill


Most of the storage tanks shall be located in storage tank yards. Dyke walls shall be constructed around the tank yard. Neutralizing material shall be kept available. For dilution, water connection will be provided on all sides of tank farms. Sand buckets shall be available for covering spillage of flammable/corrosive materials.

7.9 Occupational Health and Safety

The details of possible occupational health hazards and impacts are given in Table-7.9.

TABLE-7.9
DETAILS OF OCCUPATIONAL HEALTH IMPACTS AND SAFETY HAZARDS


Possibilities of Occupational Health Hazards	Occupational Health Impacts
Exposure to toxic chemicals	Toxication, irritation
Exposure to fire chemicals	Fall injury, electrocution,
Exposure to chemical dust	Body injury, burns, skin sensitization
Slip/trip, fall, electric shock, etc.	Severe irritation to eyes & skin
Spillage/leakage,	Respiratory disorder
Overflow	Damage to nearby equipments
Exposure to corrosive chemicals.	Fatality etc.

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Personal protective equipment (IS approved) like safety helmet, safety shoes/ gumboots hand gloves, gas mask/ nose mask, PVC apron, SCBA Set, PVC pressure suit, goggles, hood, etc. will also be provided to the required personnel.

In regards to safety management and measures taken to maintain safe working atmosphere in the factory. Following programme is under taken.

- Safety committee is formed: Safety committee meeting is being held once in the quarter.
- Operation Safety committee: This committee is consists of members of other departments such as production, store, electrical and mechanical, security, and logistics. Meeting of this committee is conducted once in a month. Minutes of meeting are about.
 - Identifying hazards;
 - Safety measures to remove hazards and use of safety measures to handle those hazards;
 - Training programme to create awareness about safety to work in safe condition; and
 - Use of personal protection equipment's:- Safety shoes, goggle, welding glasses, safety belt, helmets, masks, gloves.
- Without safety permit, no maintenance work or fabrication work is permitted hot permit are issued;
- Safety posters are displayed at vital places of work;
- Safety slogans are conveyed on day to day basis by displaying on notice board;
- Housekeeping is maintained on top priority;
- Training programmes are conducted to create awareness about safety among staff/workers;
- Lifts, cranes, forklift are being examined in every six months by authorised agency;
- Fire fighting system is updated and maintained to meet any emergency at any time fire hydrant system and fire equipment are kept in serviceable condition. Fire fighting training is conducted weekly and mock fire drill is conducted monthly;
- Safety of building and machinery is taken care of on top priority by concerned maintenance authority; and
- Round o'clock security is deployed at unit security guards at vital post, patrolling and surprise checks are carried out frequently and security light is also maintained.

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In respect to health measures, following measures are being taken in the factory:

- Housekeeping is carried out and maintained. Accumulation of dirt and refuse are being removed, flooring is kept clean, and waste is disposed;
- First aid boxes are kept and maintained at required places;
- Ambulances are kept in ready position to meet any case of emergency;
- As per the provisions of factory Act'1948 and in exercise of powers conferred by section (40B), whole time medical officer assisted by one qualified subordinate;
- First aid training programme are conducted forth nightly;
- Surrounding areas, drainages are kept clean;
- Adequate ventilation is provided at every work place;
- Sufficient lighting is provided at every work place;
- Drinking water facilities are provided for workers in the factory;
- Latrines, urinals and spittoons are provided for workers; and
- Workers and staff are medically examined monthly.

Work Zone Monitoring Arrangements for Workers


Work zone monitoring will be carried out by third party. Location for samplings shall be identified. Ambient air & noise monitoring shall be done as per requirements. Following information will be incorporated in the format for maintaining records of work zone monitoring:

- Location/operation monitored;
- Identified contaminant;
- Sampling instrument used;
- Number of samples;
- Range of contaminant concentration as measured in sample;
- Average concentration;
- TWA concentration of contaminant;
- Reference method used for analysis;
- Number of workers exposed at the location being monitored; and
- Signature of the person taking samples.

Monitoring of the Occupational Injury & it's Impact on Workers

Following action plan will be prepared & followed to monitor the occupational injury to workers:

- Each workplace will be evaluated for the existing work conditions;
- Unsafe act & unsafe practices will be identified;
- Unsafe equipment's, unsafe areas, etc., will be identified;
- Area will be checked for proper ventilation and illumination;

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- Air-borne concentration of toxic chemicals will be measured and records will be kept;
- Evaluation of training & on the job work; and
- Impact of the above mentioned unsafe conditions on workers will be studied and remedial measures for the same will be adopted.

Provision of Industrial Hygienist & Health Evaluation of Workers:

- It is proposed that management will device a plan to check and evaluate the exposure specific health status evaluation of workers;
- Workers will be checked for physical fitness with special reference to the possible health hazards likely to be present, where he/she is being expected to work before being employed for that purpose. Complete medical examinations including PFT, urine and blood examination, liver function tests, chest X-ray, audiometry, spirometry vision testing, ECG, etc. shall be carried out. However, the parameters and frequency of such examination will be decided in consultation with factory medical officer and industrial hygienists.
- While in work also, all the workers will be periodically examined for the health with specific reference to the hazards which they are likely to be exposed to during work. Again, the parameters and frequency of such examination will be decided in consultation with factory medical officer and industrial hygienists. Plan of monthly and yearly report of the health status of workers with special reference to occupational health and safety, will be maintained.

Safety Trainings & Mock Drills

Safety trainings (on safe material handling, first aid, & all safety aspects) shall be provided every 15 days by the safety officers. In addition to regular employees, limited contractor labors will also be given safety training.

To evaluate the effectiveness of emergency preparedness and to spread the awareness among employees mock drill will be carried out at the interval of every six months. After completion of the mock drill, summary report shall be made and corrections will be done if any weakness has been observed.