CHAPTER – 7

ADDITIONAL STUDIES

7.1 PUBLIC CONSULTATION/HEARING

Public consultation is not applicable for the proposed project as per Para 7(i) III Stage (3)(i)(b) of EIA Notification, 14th September, 2006 as the project is located in the notified industrial area.

7.2 RISK ASSESSMENT

7.2.1 INTRODUCTION

Industrial accidents results in great personal and financial loss. Managing these accidental risks in today's environment is the concern of every industry including CHWIF, because either real or perceived incidents can quickly jeopardize the financial viability of a business. Many facilities involve various processes that have the potential for accidents which may be catastrophic to the plant, work force, environment, or public. The main objective of risk assessment study is to propose a comprehensive but simple approach to carry out risk analysis and conducting feasibility studies for industries and planning and management of industrial prototype hazard analysis study. It is essential to achieve and maintain high standards of plant integrity through good design, management and operational controls. However, accidents do occur and these can cause serious injury to employees or to the public, and damage to property. The public concern at such events invariably leads to call for additional control at national and international levels. It is against this background that the various Section and Rules under the Environment Protection Act, 1986, the Factories Act, 1948 and other Acts specify the requirements for a safe and reliable working of an industry. These require carrying out various studies and analysis to assess and mitigate hazards prevalent in the factory in line with the above goal of safe and reliable working.

The main objectives of the Risk Assessment Studies are as given below:

a) Identification of safety areas,
b) Identification of hazard sources,
c) To define and assess emergencies, including risk impact assessment.
d) To control and contain incidents.
e) To safeguard employees and people in vicinity.
f) To minimize damage to property and environment.
g) To establish preventive measures to avoid/ reduce hazards.

The study includes predictions of the WORST CASE SCENARIO (catastrophic failure) and MAXIMUM CREDIBLE ACCIDENT SCENARIO along with damage distances and preparedness plan for effectively combating such situations. The report also discusses and demarcates the vulnerable zones. No plan is complete or total of its requirements and its scope of improvement is a continuous process.

Hence, the Risk Assessment Report is to be reviewed and updated as and when:

- Any expansion, alteration, or extension of the plant is planned / implemented,
- An incident has occurred and been dealt with, based on feedback gathered on any shortcomings in the handling of the situation.
- Any feedback is received from the users of the report.

Risk Assessment is therefore defined as a continuous and integrated process of identification, evaluation, and measurement of risks, along with their potential impact on the organization.

Risk Assessment is therefore defined as a continuous and integrated process of identification, evaluation, and measurement of risks, along with their potential impact on the organization.

The benefits of risk assessment include the following:

- Mitigation or reduction of the risk of an incident.
- Mitigation of the severity and/or consequences by way of improved process techniques, fire protection systems, arrangements of storage, inventory monitoring to fit production requirements.
- Confidence building in employees by improving competency.

Preparedness and prompt response to deal with any accident

7.2.2 DETAILS OF INCINERATION & AFR PROCESS

Details of Incineration, AFR process and site layout plan are discussed in chapter-2.

The plant is planned to have all safe guards as per the latest laws of the land, innovative and optimized preventive measures to achieve safe and sustained operating conditions.

7.2.3 HAZARD IDENTIFICATION

Hazard is the characteristic of any system or process which has the potential for accident. Identification of hazards, in presence of any hazardous waste generating units within the project facility is of primary significance in the analysis, quantification and cost-effective control of accidents involving chemicals and process. Hence, all components of a system/unit need to be thoroughly examined to assess their potential for initiating or propagating an unplanned event/sequence of events, which can be termed as an accident. Typical methods for hazard identification employed is Identification of major hazardous units based on Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989 of Government of India (as amended in 2000). Hazardous substances may be classified into three main categories namely flammable, unstable and toxic substances. Flammable substances require interaction with air for their hazard to be realized. Under certain circumstances, vapours arising from flammable substances when mixed with air may become explosive, especially in confined spaces. However, if present in sufficient quantity, such clouds may explode in open air also. Unstable substances are liquids or solids, which may decompose with such violence giving rise to blast waves. Besides, toxic substances are dangerous and cause substantial damage to life when released into the atmosphere.

7.2.4 HAZARD ASSESSMENT AND EVALUATION

A preliminary hazard analysis shall be carried out to identify major hazards associated with storages in the facility. This is followed by consequence analysis to quantify these hazards. Finally the vulnerable zones are plotted for which risk reducing measures are deduced and implemented.

Frequent causes of accidents

- Fire, flammable material,
- Being struck by falling objects,
- Snapping of cables, ropes, chains, slings,
- Handling heavy objects,
- Electricity (electrocution),
- Poor illumination,
- Falls from height inside industrial units or on the ground,
- Struck by moving objects,
- Slipping on wet surfaces
- Sharp objects,
- Oxygen deficiency in confined spaces,
- Lack of personal protective equipment (PPE), housekeeping practices, safety signs,
- Hackles, hooks, chains,
- Cranes, winches, hoisting and hauling equipment.

Hazardous substances and wastes

- Heavy and toxic metals (lead, mercury, cadmium, copper, zinc, etc.)
- Organometallic substances (tributyltin, etc.)
- Lack of hazard communication (storage, labelling, material safety data sheets)
- Batteries, fire-fighting liquids,
- PCBs and PVC (combustion products),
- Welding fumes,
- Volatile organic compounds (solvents),
- Inhalation in confined and enclosed spaces,
- Physical hazards,
- Noise,
- Extreme temperatures,
- Vibration,

Physical hazards

- Noise,
- Extreme temperatures,
- Vibration,

Mechanical hazards

- Trucks and transport vehicles,
- Scaffolding, fixed and portable ladders,
- Impact by tools, sharp-edged tools,
- Power-driven hand tools, saws, grinders and abrasive cutting wheels,
- Failure of machinery and equipment,
- Poor maintenance of machinery and equipment,
- Lack of safety guards in machines,
- Structural failure,

Ergonomic and psychosocial hazards

- Repetitive strain injuries, awkward postures, repetitive and monotonous work, excessive workload
- Long working hours, shift work, night work, temporary employment
- Mental stress, human relations (aggressive behaviour, alcohol and drug abuse, violence)
- Poverty, low wages, minimum age, lack of education and social environment

General concerns

- Lack of safety and health training
- Poor work organization
- Inadequate housing and sanitation
- Inadequate accident prevention and inspection
- Inadequate emergency, first-aid and rescue facilities
- Lack of medical facilities and social protection

Fuel that is employed in plant, together with their hazardous characteristics are listed in following table 7.1.

TABLE 7.1 FUEL WITH ITS CHARACTERISTICS

S. No.	Name of Fuel	Qty Stored (MT)	Boiling Point (C^o)	Flash Point (C^o)	LD50 Oral (mg/kg)
1	F.O.	25	184 TO 339	38 TO 54	>5

The major hazards described below.

- Electrical hazards due to the electrical major equipment/ machinery, operations, welding, motors, heavy lift devices, cabling, human intervention (short circuit possibility), maintenance work (due to machinery breakdown etc.), plant lighting related electrical hazards.
- Possibility of human injury due to working with mechanical machines, manual handling etc.
- Possibility of injury during chemicals handled, during operations and due to intoxication
- Major dropped objects hazard due to large number of physical handling steps / operations involved with crane/ overhead lifting/ hoisting equipment.
- Fires in any part of the plant working areas; there is a possibility of rapid escalation if it is not brought under control quickly.

7.2.5 STORAGE AND HANDLING OF HAZARDOUS MATERIALS

Both hazardous and non-hazardous materials generated within the project facility shall be temporarily accommodated in designated storage units within the project facility built/made in line with the safety, health and environmental standards.

Size of these temporary units would depend on the quantity and type of hazardous waste materials like oils, fuels, etc., with appropriate storage capacities placed in the project facility in compliance with the Hazardous Waste Management and Handling Rules. Also, if gas cylinders must be stored in the facility, rules applicable for gas cylinders under the Explosives Act shall be followed. Later, these materials must be disposed off at a centralized disposal facility with utmost care following safety norms. Each unit in the facility should have fire hydrant system to handle fire hazards. Storage as per guidelines is shown in Chapter 2.

TABLE 7.2 HAZARDS AND ITS CONTROL

S. No	Name of Possible Hazard And Emergency	It's Source and Reasons	It's Effect On Persons Property and Environment	Place of Effect	Control Measures Provided
1.	Fire	Transformer Transfer oil short circuit etc. supply	- Electrical power failure - Loss of transformer	Transformer near power control centre	* Fire Fighting Equipment's * Graved bed for oil spillage or soaking isolated fenced area * Lightening arrestor nearby * DG set for emergency power supply
2.	Toxic chemical spillage	Natural Disaster, Earthquakes, Lighterning, Man made war	- Trapping under debris, death, Chemical burn, Toxic chemical spillage	Whole Facility and population nearby	* First aid available * Smoking prohibited inside the factory * Security at all the time guarding important locations
3.	Fire and smoke	Fire in storage tank	- Burns - Storage tank catching fire - Production Hindrance	Fuel storage area	* Adequate earthing Tanker unloading permit * Unauthorized person not allowed to enter * Breathing Apparatus for rescue operations * Alarm system for indicating unusual incidence

7.2.6 TRANSPORTATION

All the incinerable hazardous waste from member units and hazardous waste generated from facility are transported through road only.

7.2.7 RISK ASSESSMENT AND CONSEQUENCE ANALYSIS

In a plant handling hazardous waste and hazardous chemical, the main hazard arises due to storage, handling and use of these hazardous waste and hazardous chemical.

Operating Parameters: Potential vapour release for the same material depends significantly on the operating conditions.

Inventory: Inventory Analysis is commonly used in understanding the relative hazards and short listing of release scenarios. Inventory plays an important role in regard to the potential hazard. The potential vapour release (source strength) depends upon the quantity of liquid release, the properties of the materials and the operating conditions (pressure, temperature).

Loss of Containment: Plant inventory can get discharged to Environment due to Loss of Containment. Certain features of materials to be handled at the plant need to the clearly understood to firstly list out all significant release cases and then to short list release scenarios for a detailed examination. Liquid release can be either instantaneous or continuous. Failure of a vessel leading to an instantaneous outflow assumes the sudden appearance of such a major crack that practically all of the contents above the crack have to released in a very short time.

7.2.7.1 SELECTION OF INCIDENTS AND CONSEQUENCE CALCULATIONS

The Consequence Analysis has been done for selected scenarios. In Consequence Analysis, geographical location of the source of potential release plays an important role. Consideration of a large number of scenarios in the same geographical location serves little purpose if the dominant scenario has been identified and duly considered.

7.2.7.2 MAXIMUM CREDIBLE LOSS ACCIDENT SCENARIOS

A Maximum Credible Accident (MCA) can be characterized as the worst credible accident. In other words: an accident in an activity, resulting in the maximum consequence distance that is still believed to be possible. A MCA-analysis does not include a quantification of the probability of occurrence of the accident. Another aspect, in which the pessimistic approach of MCA studies appears, is the atmospheric condition that is used for dispersion calculations. The Maximum Credible Loss (MCL) scenarios have been developed for the Facility. The MCL cases considered, attempt to include the worst "Credible" incidents what constitutes a credible incident is always subjective. Nevertheless, guidelines have evolved over the years and based on basic engineering judgement, the cases have been found to be credible and modeling for assessing vulnerability zones is prepared accordingly. Only catastrophic cases have been considered and not partial or small failures (as is the case in Quantitative Risk Assessment where contributions from low frequency-high outcome effect as well as high frequency - low outcome events are distinguished). The objective of the study is emergency planning, hence only holistic and conservative assumptions are used for obvious reasons. Hence though the outcomes may look pessimistic, the planning for emergency concept should be borne in mind whilst interpreting the results.

SOFTWARE USED FOR CALCULATIONS

Aloha is a computer program designed especially for use by people responding to chemical accidents, as well as for emergency planning and training. ALOHA can predict the rates at which chemical vapors may escape into the atmosphere from broken gas pipes, leaking tanks, and evaporating puddles. It can then predict how a hazardous gas cloud might disperse in the atmosphere after an accidental chemical release. ALOHA is an air dispersion model, which you can use as a tool for predicting the movement and dispersion of gases. It predicts pollutant concentrations downwind from the source of a spill, taking into consideration the physical characteristics of the spilled material. ALOHA also accounts for some of the physical characteristics of the release site, weather conditions, and the circumstances of the release. Like many computer programs, it can solve problems rapidly and provide results in a graphic, easy-to-use format. This can be helpful during an emergency response or planning for such a response. ALOHA provides output as amount of chemical discharged from the source as well as its concentration in air it takes in to account different levels of concentrations for a specified chemical. Different concentration levels are given below:

ERPG 1: is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined, objectionable odor.

ERPG 2: is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action.

ERPG 3: is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects.

IDLH: The Immediately Dangerous to Life or Health (IDLH) level. A chemical's IDLH is an estimate of the maximum concentration in the air to which a healthy worker could be exposed without suffering permanent or escape-impairing health effects.

7.2.7.3 SCENARIOS (VULNERABILITY AREA IDENTIFICATION)

Possible accident scenarios are given in following table 7.3.

TABLE 7.3 POSSIBLE ACCIDENT SCENARIOS

Short Description of Scenario	Chemical Involved	Type of Risk	Probability	Severity	Concentration and damage distance from source (meters)
Release from damage of FO Storage tank of 25 MT	Fuel oil	Toxic Effect	Very unlikely	IDLH	20 ppm <3.3 km
		Flammable area vapour cloud	Very unlikely	IDLH	20 ppm <3.3 km

Identification of risks is done qualitatively and quantitatively through the selection of hazardous substances and by studying the manufacturing process, to arrive at possible failures and their inherent causes. Probability of risk occurrence is also ascertained in order to determine the MAXIMUM CREDIBLE ACCIDENT SCENARIO and the WORST CASE SCENARIO. Hazardous substances have been identified as follows considering the applicable criteria laid down under the Chemical Accident (Emergency Planning, Preparedness and Response) Rules, 1996, as well as other relevant guidelines.

TABLE 7.4 HAZARDOUS CHARACTERISTICS

S. No.	Description	Cas No.	Phase/ Sp. Gravity	F.P.	B.P.	Lel% Uel%	TLV mg/m³ Ppm	NFPA Rating HFRO	IDLH	UN
1	FO	68476-30-2	136° F (USCG, 1999)	38 to 54°C	184 to 339°C	0.6 to 1.3%	100 mg/m3 TWA (vapour & aerosol)	1 2 0	NA	1202

TABLE 7.5 LIST OF HAZARDOUS CHEMICALS

S. No.	Source	Inventory	Cas No.	Nature of hazards
1	FO	25 MT	68476-30-2	Oily yellow-brown liquid. Less dense than water and insoluble in water. Floats on water. (USCG, 1999), Warning!, Combustible, eye and skin irritant, Slightly hazardous, Ignites when moderately heated, Contains Material Which May Cause Cancer; TLV TWA: 100 mg/m3 As total hydrocarbons. Skin. Suspected Human carcinogen. (ACGIH, 2003); TEEL1: 100 mg/m3 (TEEL, 2005), TEEL2: 100 mg/m3 (TEEL, 2005), TEEL3: 500 mg/m3 (TEEL, 2005); Specific Gravity: 0.879 at 68° F (USCG, 1999); Fire Extinguishing Agents Not to Be Used: Water may be ineffective, Fire Extinguishing Agents: Dry chemical, foam, or carbon dioxide (USCG, 1999)

The handling, processing, and storage of Hazardous chemicals were analyzed and the risks as shown in **Table 7.4 & 7.5** had been identified. The risks are then analyzed quantitatively in terms of probability, and severity. The risks have also been rated according to the matrix **R = Probability x Severity.** Based on generally accepted definitions, the **MAXIMUM CREDIBLE ACCIDENT SCENARIO (MCAS)** indicates most likely or possible accident scenario, taking into account the effect of existing control measures also. The risk marked "**5**" was selected from **Table 7.6.**

TABLE 7.6 RISK RATING OF HAZARDOUS CHEMICALS

S. No.	Source Scenarios	Failure Mechanism	Risk Consequence	Probability 1	Severity 2	Risk Rating 3 (max = 25)
1	Fuel Oil direct exposure to atmosphere with flammable area of Vapour cloud	Catastrophic failure	Filling of tank dyke with FO – flammable vapor cloud	1	5	5

LEGEND

[1]PROBABILITY:	[2]SEVERITY:	[3]RISK RATING:
1 – HIGHLY UNLIKELY	1 – EXTREMELY MILD	PROBABILITY x SEVERITY
2 – UNLIKELY	2 – MILD	
3 – SOMEWHAT LIKELY	3 – MODERATE	
4 – LIKELY	4 – SEVERE	
5–VERY LIKELY	5–MOST SEVERE	

- There are few toxic severity scenario risks, on the operational and storage of chemicals.
- The worst case scenario is also well within the reach of fire protection/mitigation measures, planned for installation.
- Fire protection/ control / mitigation measures are incorporated (under execution).
- Hence M/s. V-Tech Waste Managements can be categorized as a less hazard industry who can manage their risks through invoking On-site emergency plan and actively participating in Off-site emergency plan.

WORST CASE SCENARIO

RISK –Catastrophic failure of Fuel oil storage tank, causing dyke to fill with Fuel oil and RELEASE TOXIC FUMES. The risk of **TOXICITY** is a concern in such a situation. The Risk of **FLAMMABILITY** is also analyzed.

A vulnerability analysis is carried out on the **Worst Case Scenario**. The analysis is carried out using the help of sophisticated computer software which provides the zone of influence as well as the geographical risk contours. The calculations are complex in nature, and various parameters are defined to assist the software in simulating the risk contours. The parameters include details such as the size of the leakages / holes, quantity of materials released, duration of the release, weather and geographical conditions. The simulations are generated under standard operating conditions. Data given in the reports and manuals are taken as correct information. The weather conditions are taken as per **Table 7.7** for all simulations.

TABLE 7.7 WEATHER CONDITIONS

Parameters	Condition A	Condition B
Wind Speed	10.0 m/s	3.0 m/s
Wind Direction	225° true at 3 m	45° true at 3 m
Pasquill Stability	D	F
Ground Roughness	Open country	Open country
Air Temperature (°C)	32	20
Surface temperature	32	20
Relative Humidity	75%	50%
Cloud Cover	50%	50%

WORST CASE SCENARIO

We have assumed a catastrophic failure of single **Fuel oil** – 25 MT storage tank as the WORST CASE SCENARIO. In such a scenario, we have assumed that all control systems have failed. The 25 MT of **Fuel oil** released from the tank. The large quantity of **Fuel oil** in the isolated dyke area will cause the M/s. V-Tech Waste Managements in that area to be exceeded, resulting in a TOXIC CLOUD. Accordingly, the ALOHA TOXIC Module was used to obtain the various vulnerability zones for this scenario.

TABLE 7.8 (A) WORST CASE TOXIC SCENARIOS SIMULATION FOR WEATHER CONDITIONS 'D', 'F'

Parameters	Risk	Threat Zones 'D'	Threat Zones 'F'	Affected Population	Threat at Point: DW 10 m, CW 5 m
Generation of Fuel Oil	Flammable Vapor Cloud	20 m	110 m	-	No significant Concentration. No risk.
		-	-	-	
		58 m	298 m	-	
	Toxic Vapor Cloud	135 m	724 m	-	No significant effect.
		321 m	1900 m	-	
		321 m	1900 m	-	

TABLE 7.8 (B) WORST CASE TOXIC SCENARIOS SIMULATION FOR WEATHER CONDITIONS 'D', 'F'

Parameters	Risk	Threat zones- Down Wind
25 MT F.O. direct discharged out from tank, Weather Conditions D, F	Toxic Cloud Exposure	Red Zone – 135 m (D) Red Zone – 724 m (F)
		Orange Zone – 321 m (D) Orange Zone – >1900 m (F)
		Yellow Zone > 321 m (D) Yellow Zone >1900 m (F)

*Horizontal downwind distance from the source. As weather conditions have been considered with minimal wind, the same may also be considered as radial distances from the center of the failure, in this case.

The tank failure will result in spreading toxic fumes release from the isolated dyke area. Three zones have been shown in the above table for D, F stability conditions. The red zone, which signifies the area within which loss of life can be expected within 60 minutes of continuous exposure, has a distance of 0.135 km /0.724 km meters respectively. The orange zone, which signifies the area within which 2nd degree disbursement are expected within 60 minutes of exposure, has a distance of 0.321km/ 1.9 km meters. Firefighters with proper protection shielding PPE can operate from this distance. Beyond the yellow zone of 10 km, the toxic risk is negligible.

SOURCE STRENGTH:
Direct Source: 5 tons/hr Source Height: 1 meters
Release Duration: 60 minutes
Release Rate: 75.6 kilograms/min
Total Amount Released: 4,536 kilograms

FIGURE 7.1 (A) LAYOUT FOR MAJOR RELEASE OF FUEL OIL - FLAMMABLE AREA OF VAPOUR CLOUD (CONDITION A)

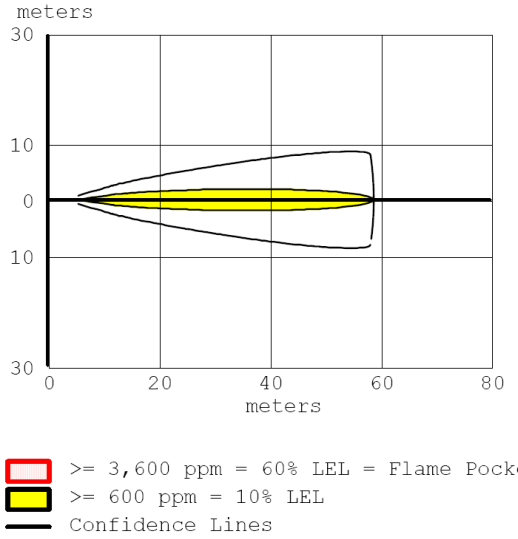


FIGURE 7.1 (B) LAYOUT FOR MAJOR RELEASE OF FUEL OIL - FLAMMABLE AREA OF VAPOUR CLOUD (CONDITION A)

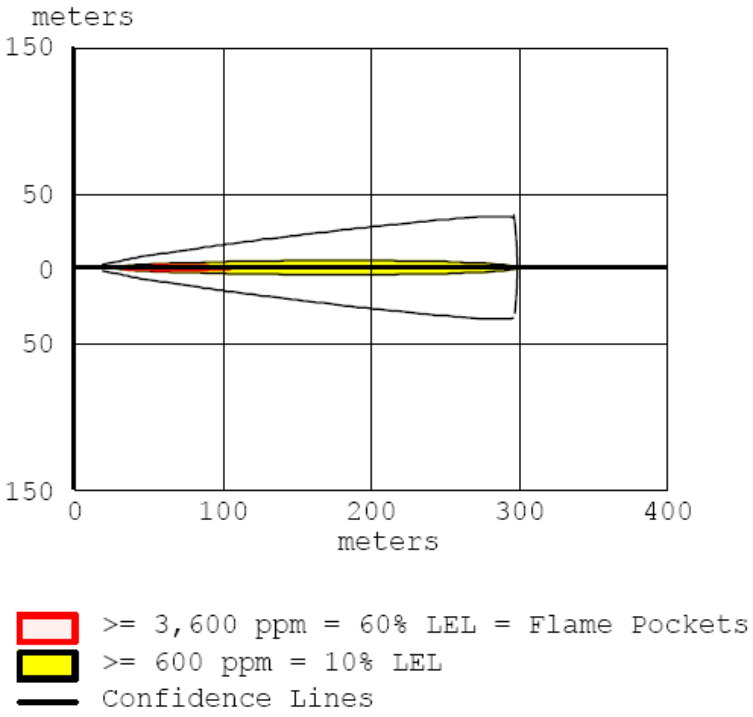


FIGURE 7.2 (A) LAYOUT FOR MAJOR RELEASE OF FUEL OIL – TOXIC RELEASE (CONDITION A)

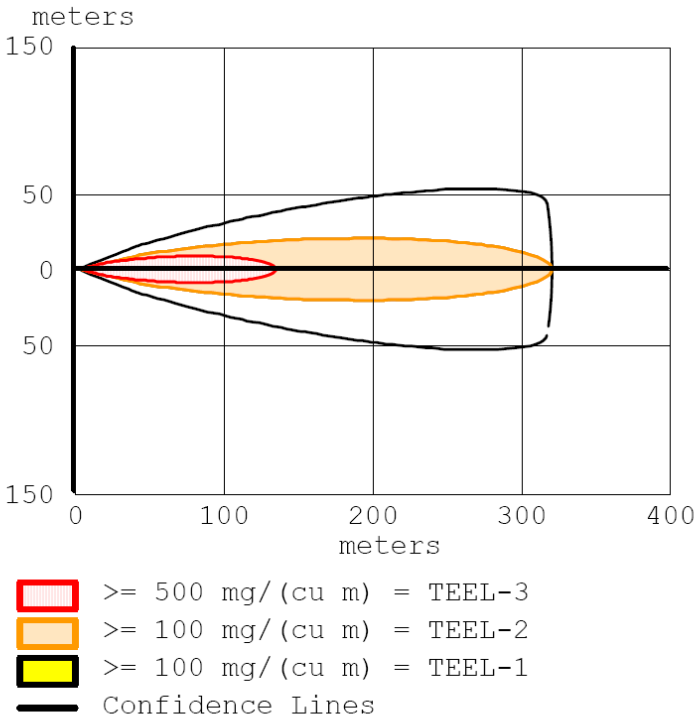
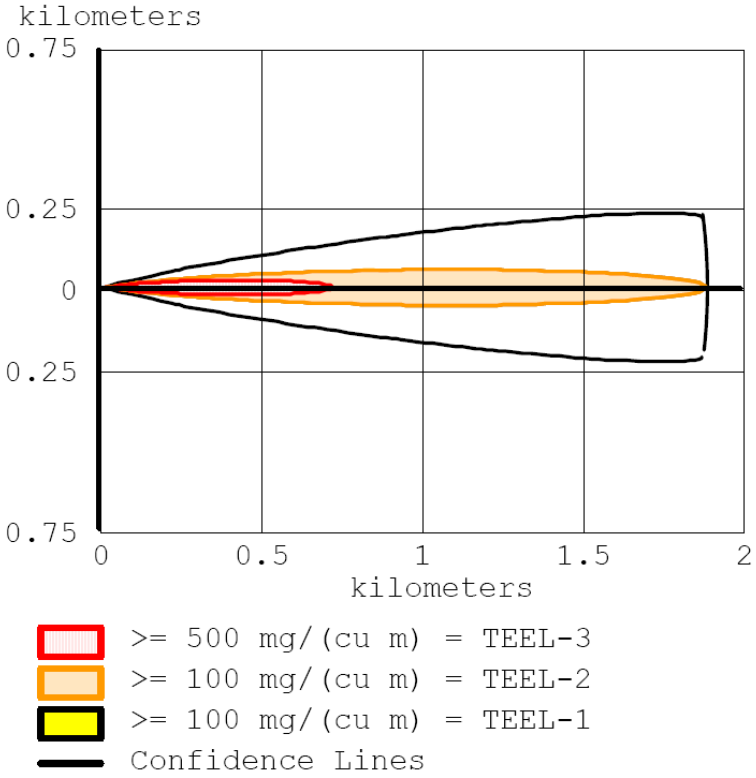


FIGURE 7.2 (B) LAYOUT FOR MAJOR RELEASE OF FUEL OIL – TOXIC RELEASE (CONDITION B)



7.2.8 RISK PREVENTION AND RISK MITIGATION

Accident prevention is the primary safety goal of any organization. There are risks that can be eliminated through preventive measures and those which can be reduced through mitigation measures.

7.2.8.1 PREVENTIVE MEASURES

The 4 **E**'s for elimination of hazards and prevent accidents are as follows:

- Engineering and technological innovation to improve reliability
- Experience in the study of hazards and operations- Risk analysis
- Enforcement of decisions on study results – Preventive mechanisms
- Education, awareness, and practice in prevention of accidents (Training and drills)

Various measures have been / will be adopted at each stage of the project for ensuring safety of people, environment, and property. These measures include the following:

- Site selection.
- Choice of technology.
- Equipment design incorporating domestic and international safety codes.
- Plant layout with utmost consideration given to operational safety aspects.
- Incorporation of interlocks and protection systems in plant design.
- Safety awareness for key management persons.
- Safety training of all operational, maintenance staff.
- Regular safety monitoring - Audits and inspections.

A. Site Selection

The plant is located in at KIADB Industrial Estate. The site soil conditions are rigid and safe, complying with the requirements of the load bearing capacity of various installations. The size of the plot is large enough to ensure proper layout of plant buildings with adequate interconnecting roads and distance from administrative areas.

B. Choice of Technology

The process is carefully chosen for reducing wastes, reducing the risk to human beings and the environment.

C. Equipment Design

Hazchem Storage Tank

1. Tank is fabricated out of carbon steel, stainless steel, sheeting material of appropriate grade steel.
2. Tank exterior is painted with GREY epoxy for protection against atmospheric corrosion and for reflection of solar heat.
3. Pumps are located outside the dyke wall and are connected to tank through flexible hose connection.
4. Flexible hose section is located in a **separate dyke** area so as to limit the spread of any hazchem leaked during tanker unloading.
5. Provision has been made for interlocking tanker earthing with pump start.
6. Tank will be filled using a dip pipe to prevent splashing inside the tank
7. All pumps are **canned / Mechanical seal pumps** which are without glands and seals for reducing the possibility of leakage during transport.
8. Lighting arrestors are provided.

Piping

1. All pipes, fittings, and valves carrying the haz-chem are made of appropriate grade Steel, stainless steel and with PTFE (Teflon) envelop gaskets.
2. All pipes carrying haz-chem are designed to ensure non-restrictive flow from equipment to another with minimum hold up of haz-chem in the lines.
3. Wherever required, design incorporates suitable by-pass system to carry out maintenance work during plant operations and also to enable sectional close-down during machinery break down, etc.
4. Safety valves, relief valves, breather valves and rupture discs are mounted on hook-up piping to all critical equipment.
5. All manually operated valves will be located within easy reach of operator and at a operable height. Wherever necessary approach platforms will be provided.
6. Adequate number of flange joints shall be provided with adequate supports in long lines for easy dismantling and maintenance.

Electrical

1. For standby power diesel generator of adequate capacity will be installed with auto-start facility in case of power trip/failure. This DG set will be located far away from the processing area.
2. Tank, pumps, tanker and pipelines are properly earthed and bonded for electrical continuity and prevention of static electric charges. Double earthing will be provided to drain electrical charge to two independent earth pits.
3. Adequate ventilation fans will be provided in electrical panels for effective heat dissipation.
4. Earthing pits locations and requirements with looping grids shall be provided as per the legal and regulatory requirements.
5. All panels will have incomer earth fault relay.
6. Lightning arrestors will be provided on top of all structures.
7. All cables running on trays at elevation shall be properly dressed up and tied with clamps for rigidity.
8. All areas of plant and machinery and roads including all open operating areas are illuminated sufficiently to carry out operations round the clock.

D. Plant Layout

Tank Storage Area

1. Tank are surrounded by a dyke wall capable of holding 110% of the largest tank's capacity.
2. The dyke walls and floors are made of concrete, which is impervious to liquid seepage.
3. The dyke area is subdivided into smaller compartments to restrict spreading of Hazchem in the pool.
4. The floor of the dyke area is sloped away from the tank to prevent collection of material near the tank.
5. The valves for drainage of Hazchem in the dyke area are located outside the dyke wall.

6. In case of catastrophic failure of a tank, the spilled hazchem will drain to a further isolated dyke area located several meters away from all storage tank to restrict the effects of radiation on surrounding equipments in case of fire.
7. The tank is located in an open, well-ventilated area.

General / Other Areas

1. The plant is laid out in such a way that hazards are either eliminated or isolated so as to manage it effectively.
2. The location of the disaster prone areas of the plant is such that, they cause less impact to the nearby factories or inhabitations.
3. Buildings housing heat generating equipment or containing chemicals are well-ventilated with adequate air circulation.
4. Administrative office is located away from process plants and storage tank.
5. Security office is located close to gate and away from process plants and storage tank.
6. Workers' rest area, shower, and dispensary is located close to administrative office, away from process plants.
7. Canteen is located close to administrative office and away from process plants.
8. A large area has been provided on site in the upwind direction for emergency evacuation- Assembly Points.
9. Proper drainage and enclosures are provided to drain away storm water from unforeseen flooding.
10. Flame proof areas have been isolated from the non-flameproof areas.
11. DG room and electrical transformer located away from administrative office, process plant and storage tank.
12. The storage tank of hazchem are located in an isolated area, protected by dykes with adequate facilities for handling spills and leakages.
13. Fire hydrant system covers the entire operating area of the plant.
14. Separate installation for fire water storing and pump house, with alternate and independent power source.
15. Hazardous waste bins are located away from processing and administrative areas in an area clearly demarcated for the same.
16. Warning boards will be put up in areas where entry is restricted
17. No Smoking boards will be put up at the entrance and at other locations throughout the plant
18. Boards showing the numbers and contact details of government / district officials as well as fire department, police department, district commissioner, etc. will be installed at security gate as well as in the operational area.
19. Hazardous chemical shall be stored as per compatibility and based on corrosive and reactive capabilities as per the guidelines in the MSDS.
20. MSDS of hazardous chemical will be kept in the areas where such materials are used and stored.
21. Waste containers will be located at appropriate locations throughout the plant, and will be coded according to the type of waste.
22. Precautions for storage of incinerable hazardous waste in drums or bags; Separately stored with proper enclosures and marked, within premises in closed shed, Proper ventilation have to be provide; Sufficient fire extinguishers and PPE have to be provided; Flame proof fittings have to be provided; PPE have to be used; Proper Earthing bonding; Contact with skin and eyes have to be avoided.

E. Safety Awareness for Key Management

1. Key management personnel will be made aware from the beginning of the project of the key issues regarding the safety in design and operation of the plant.
2. Discussions on safe handling of hazchems have been carried out with various safety experts, technical collaborators, and with overseas suppliers through conference calls.

F. Safety Training for All Operational Staff

1. All operational staff will be given safety training as a compulsory part of their induction program.
2. Safety training will include, among other things, the following important aspects:
    a. awareness of hazards of individual chemicals through study of MSDS
    b. correct usage of Personal Protective Equipment (PPE)

c. explanation of the hazards and risks present in the premises, as well as their analysis
d. impact on safety, health, and environment due to improper handling of hazardous chemicals
e. guidelines for safety in operations
f. Do's and Don'ts

G. Safety Audits and Inspections

1. Regular safety audit will be conducted once a year to ascertain the safety levels followed in the plant and suggestions for improvement
2. Special safety audits will be conducted whenever there are process-related equipment / operational changes made in the plant
3. Safety audits will be carried out jointly by HSE personnel and external agencies, and corrective actions will be recorded and presented to management for review.
4. Daily safety inspections are carried out throughout the plant by HSE personnel.
5. Calibration of control valves, instruments as and when required, but at least once in a year during maintenance shutdown
6. Testing of thickness of all equipments with thickness meter will be carried out at least once in three years during maintenance shutdown
7. Testing of electrical measurements, such as earthing resistance, will be carried out every month
8. Testing of all fire hydrant installations, fire extinguishers, fire pumps, fire water level monitors will be carried out on a daily basis by HSE personnel.

H. Personnel Protective Equipment

Personnel protective equipment (PPE) is needed to protect individuals from injury. Several types of PPE are necessary for providing the optimum protection to individuals from the various risks. In addition to the PPE which will be used for regular plant operation, the following PPE has been selected for preservation at the plant's Emergency Control Centre room for use in case of emergency.

1. Self contained Breathing Apparatus (SCBA)	1 sets
2. Chemical face masks	5 sets
3. Full body chemical suits with goggles	2 sets
4. Firefighting suits	1 sets
5. Helmets	20 pieces
6. Chemical resistant gloves	5 pairs

Details of Personal Protective Equipment (PPE's), it's Care and Management System proposed by the company are given as follow:

Training:

1. Induction Training:

All employees including contract workmen given Induction training at the time of Joining for proper use of safety equipment and PPEs with demonstration.

2. Special Training:

Company will arrange Special training for types of PPEs and adequate Use of PPEs as per training calendar.

3. On Job training:

During On Job training, company will cover the right Use of PPEs as hazard and work

4. Training for Self Contained Breathing Apparatus and Emergency Life Saving Apparatus:

Company arranges training for Use of Self Contained Breathing Apparatus and Emergency Life Saving Apparatus for all Employee including contract workmen.

Body Protection (Non Respiratory):

1. Protecting Clothing
1. Chemical Resistant Suit: for protection against chemical other then Acid.
2. PVC Suit: for protection against Acid & Alkali other then Hydrofluoric Acid
3. Apron: for working in Laboratory, Laboratory Apron is compulsory.

2. Head Protection (Safety Helmet):
Use of different color helmet for easy identification during the Emergency Situation.
- Yellow Color Helmet : for the Employees of the company
- Green Color Helmet : for Contract Workmen.
- White Color Helmet : for Visitor
- Blue Color Helmet : for Incident Controller at time of Emergency Handling.

3. Face & Eye Protection :
1. Face Shield: For working at Hazardous chemical, grinding work etc.
2. Safety Spectacles: for working in anywhere in plant side.
3. Safety Goggle: for covering of Full eye at time of certain defined job.

4. Ear Protection :
Ear Muff/Ear Plug: For working in High noise area.

5. Hand Protection:
1. PVC Gloves: For Hazardous waste handling
2. Chemical Resistant Gloves (Neoprene)
3. Rubber Gloves (Electrical): for electrical work available with different voltage ratings
4. Rubber Gloves: for chemicals, oil greases

6. Foot Protection:
1. Safety Shoes: all employees of the company should wear safety shoes compulsory.
2. Gum Boot: for working in water, deep mud or bottom sediment.

Respiratory Protection:

1. Air Purifying Type:
1. Dust Mask: for protection against dust particle use at dusting atmosphere.

2. Air Supplying Type:
1. Self Contain Breathing Apparatus (SCBA): for emergency Handing.
2. Emergency Life Saving Apparatus (ELSA): as like SCBA but its capacity is low.

General Protection:
1. Safety Belt: double harness full body safety belt is compulsory for work at height.
2. Safety Net: used for work at height.
3. Safety Shower: for first aid treatment in case of chemical exposure on body
4. Eye Washer Fountains: for first aid treatment in case of eye exposure.

Care of PPE's:
- Each and every personal protective equipment should be visual checked by the user for its integrity before its use and, if any defects are observed, the concerned supervisor should be promptly informed and the defects corrected or PPE replaced.
- Self contained breathing apparatus must be inspected monthly and details of the inspection and maintenance recorded.
- All employees should familiarize themselves with different types of PPEs available in the company.
- When not in use, PPE should be carefully stored in a designated place. Do not put it in tool box where it is likely to be damaged or allow it to lie in an open place where it may collect dust. Store PPE in a safe place well covered, away from sunlight and dust.

I. Firefighting Systems

It is necessary to provide an effective and efficient firefighting system. Some of the salient features are described as follows:

1. Fire water tank capacity and pump capacity of are based on the number of monitors, risers, and outlets provided.
2. All firewater piping is located **above ground** to prevent hidden corrosion effects.
3. All fire hydrant points will have two independent ring mains for adequate water flow and safety.
4. All fire Nozzles shall be Spray type OR Mist type suitable for surround fighting system.
5. The company shall take into consideration fire prevention measures at the project planning and during plant commissioning stage to avoid any outbreak of fire. But looking to the hazardous nature of waste operation shall be handled and processed, the chances of outbreak of fire is however less but cannot be refuted. Facilities of fire and safety services are easily available in the study area. Hence to avoid such a scenario, a well laid fire protection system will be provided in the factory.
6. The facility is provided with storage of water and various types of portable fire extinguishers namely Dry Chemical Powder type and CO_2 type & Foam Type to face any emergency arising due to the occurrence of fire.

Fire pumps

There will be one electric and one diesel engine driven. The pumps supply water for the fire line and the fixed fire extinguishing systems. The pressure by the pumps shall be between 6 Kg/cm$_2$ - 10 Kg/cm$_2$.

Jockey Pumps

An electric motor driven jockey pump will maintain automatically system pressure in the fire line. In case of emergency main pump will be turned on manually. One jockey pump maintaining pressure between 4 to 6 Kg/cm$_2$)

Fire Extinguishers

Sufficient number of dry Chemical Powder type and CO_2 type portable fire extinguishers are installed on each floor of the plant. Suitable fire extinguishers are also provided in all MCC room, PCC room & ETP, storage area & Security gate.

7.2.8.2 DO'S AND DON'TS

Suitable notices / boards displayed at several locations indicating appropriate hazards warning as well as DOs and DON'T for ensuring operational and personal Safety for information of workers / staff and visitors.

Do's:

1) For good physical condition, check the facility expected to be used in the process.
2) Check the availability of utilities required till the end of the batch / job.
3) Check for proper manpower available till the entire operation in over.
4) Each and every equipment including the stand-by should be in operable condition.
5) Verify the test certificates of materials being taken for process.
6) Time schedule should prepare for material flow on basis of the process.
7) Monitor the temperature and pressure if possible during the process.
8) The worker or operator should have sufficient knowledge of the hazardous waste handling.
9) Ensure proper training of personnel.
10) Ensure sufficient numbers of safety devices are available.
11) Ensure the workers wear proper PPE of adequate grade.
12) Demarcation of the storage area
13) Ensure removal of used containers from workspaces.
14) Prepare and follow the safe work instruction.
15) Record every incident that led to an accident irrespective of the seriousness of the accident and analyze the same to improvise the system continuously.
16) Always check the fire water tank to be filled up to the brim to ensure availability of fire water in sufficient quantity at all times. The design of other water to be used shall be from the overflow of the fire water tank to ensure this system.

17) Never work bare foot or without safety shoes.
18) Never use mobile phones in work zones.
19) Use only proper grade PPEs and use them properly.
20) Participate wholeheartedly in all safety related exercises an keep yourself updated.

Don'ts:

1) Don't use the facility expected to be used in the process without checking.
2) Don't fail to check the availability of utilities required till the end of the batch / job
3) Don't work without enough and proper man power.
4) Don't use the equipments which are not in operable condition.
5) Don't use the waste for process without verify the test certificates.
6) Don't perform without Monitoring the temperature and pressure during process.
7) Don't handle waste with open hands where manual handling is a must.
8) Don't keep the workers under wraps about what is the job on hand.
9) Don't let the worker / operator do the work having lack of sufficient knowledge of the materials handled.
10) Don't let the personnel do the work without giving proper training.
11) Don't work without sufficient numbers of safety devices.
12) Don't let the workers do work without wearing proper PPE of adequate grade.
13) Don't store used containers at workspaces.
14) Don't breach the safe work instruction.
15) Don't try to conceal information regarding missed accidents or small injuries. Remember every and any mishap can be fatal if not for yourself for others.
16) After any shutdown never start operation without having ensured the fire water tank filled up.
17) Don't work bare foot or without safety shoes.
18) Don't use mobile phones in work zones.
19) Do not use PPEs which are not relevant to the operational aspect that has been identified.
20) Don't open or use containers on which instruction are not written.
21) Don't work without Verifying the label with the instruction before use.
22) Don't ever even thinking of evading safety instructions.

7.2.9 OCCUPATIONAL HEALTH OF WORKERS

7.2.9.1 CHEMICAL EXPOSURE

Sources: Dioxin and Furan emission from process

1. The two primary objectives of the study were
    a. To compare the societal cost of a specific pollutant with societal cost of other causes of mortality.
    b. To develop an approach that would attempt to relate the cost of pollution control to the societal cost consequent to a standard specified for the pollutant.
2. The present work has, in general and to a large extent, conceptualized an approach to achieve the above objectives. Specifically
    a. The concept of life span reduction was developed which seems to be an effective tool to bringm various causes of mortality to a common platform.
    b. The concept also permits the computation of societal cost.
3. The societal costs, combined with costs associated with a given standard for emission control, can lead to a rational approach incorporating economic aspects in the development of standards.
4. The study also provided useful insight into the requirement of data for more rigorous study.
   For example
    a. The need for more extensive and intensive data base for ambient air quality especially forn specific pollutants.
    b. Similarly more data on emissions from incinerators handling hazardous wastes coupled with meteorological data is also required
5. It must be emphasized that the present study should be considered more as a development of an approach, to be widely discussed, vetted and modified as required. It should not be taken as sacrosanct with respect to "numbers" which are generated using a number of assumptions in absence of real and valid data.

6. It is to be recognized that there is no relation in reality in the available data between emission of dioxin & furan and cost of incineration of hazardous wastes and control of emission of dioxin & furan. This is because the systems considered in this report for the incineration of hazardous waste and emission control of dioxin and furan are designed to achieve the lowest possible emission and meet the prevailing standard. The variations in dioxin emission generally, in these incinerators, are, hence, due to a variety of reasons including O & M practices and not because of choosing a less expensive technology of incineration and emission control.
7. It should also be recognized that the societal costs calculated here are based only on mortality. The cost of treatment, hospitalization and consequent economic loss are not factored in as reliable and valid data on these aspects is difficult to obtain. This means that the societal costs as calculated here are lower than the real costs.
8. The health impact has only considered mortality directly attributable to dioxin and furan. It does not include synergistic or antagonistic health impacts due to other pollutants in the ambient air. This once again would impact the societal costs.
9. At a more fundamental level, the issue of sustainability of economic considerations in the framing and setting of standards is debatable. From a policy point of view, to base the standards for polluting substances by comparing the cost of pollution control to achieve a given standard with that of consequent health management. For example the standard for SO2 cannot be based on cost of treating affected people for respiratory diseases with that of controlling SO2 emission to the desired level. The policy that mandates the control of pollution to prevent adverse health impact, irrespective of the cost of such control, should remain the guiding policy for framing standards of emission.

7.2.9.2 NOISE EXPOSURE

Sources: DG sets

Effects: Hearing impairment, Hypertension, Annoyance, Sleep disturbance

Attenuation And Conservation: Tools for assessing noise levels (A) successful noise control program that focuses on engineering control of noise requires the institution of a hearing conservation plan and the use of proper monitoring equipment, surveys, maps, and modeling. A thorough hearing conservation plan should program consists of the following components:

- Noise measurement and analysis.
- Engineering control of noise sources where feasible.
- Administrative controls and personal protection where noise control is not feasible.
- Audiometric testing.
- Employee training and education.
- Record keeping.
- Evaluation.

Control Measures:

- Adopting proper scheduling of construction activities.
- Scheduling noisy activities during the daytime periods.
- Operating well-maintained mechanical equipment on-site.
- Using personnel protection gear such as earplugs, muffs, etc.
- Installing noise barriers around air blowers, pumps, and generators to reduce noise impacts at nearby receptors.
- Devising and implementing a rigorous inspection and maintenance program applicable to Equipment on-site.

7.2.9.3 HEAT STRESS

Aim is to maintain body core temperature within +1°C of normal (37°C). This core body temperature range can be exceeded under certain circumstances with selected populations, environmental and physiologic monitoring, and other controls. High temperature and humidity; direct sun or heat; limited air movement; physical exertion; poor physical condition; some medicines; inadequate tolerance for hot workplaces like working near thermic fluid heater and insufficient water intake can all lead to heat stress.

Administrative or work practice controls to offset heat effects:

- Provide accurate verbal and written instructions, annual training programs, and other information about heat stress
- Acclimatize workers by exposing them to work in a hot environment for progressively longer periods.

• Replace fluids by providing cool water or any cool liquid (except alcoholic and caffeinated beverages) to workers and encourage them to drink small amounts frequently, *e.g*. one cup every 20 minutes.
Ample supplies of liquids should be placed close to the work area.
• Reduce the physical demands by reducing physical exertion such as excessive lifting, climbing, or digging with heavy objects. Use relief workers or assign extra workers, and minimize overexertion.
• Provide recovery areas such as air-conditioned enclosures and rooms and provide intermittent rest periods with water breaks.
• Reschedule hot jobs for the cooler part of the day, and routine maintenance and repair work in hot areas should be scheduled for the cooler seasons of the year.
• Monitor workers who are at risk of heat stress, such as those wearing semi-permeable or impermeable clothing when the temperature exceeds 70°F, while working at high energy levels. Personal monitoring can be done by checking the heart rate, recovery heart rate, and oral temperature.

7.2.9.4 ILLUMINATION

Illumination standards are shown in table 7.9. The use of energy saving. Power factor lamp fittings must be preferred.

TABLE 7.9 ILLUMINATION STANDARDS

S. No.	Location	Illumination By	Illumination In Lux
1.	Low roof buildings	Fluorescent tube lights	100-150/300(control rooms)
2.	Shops/ High roof building	HPSV lamps	100-150
3.	High color rendering required (low color distortion)	Metal halide lamp fittings	-
4.	Open yard and area Illumination	HPSV flood light fittings	15-30

7.2.9.5 ERGONOMICS

Ergonomics is the term applied to the field that studies and designs the human-machine interface to prevent illness and injury and to improve work performance. It attempts to ensure that jobs and work tasks are designed to be compatible with the capabilities of the workers. Some physical agents play an important role in ergonomics such as Force, Acceleration and Thermal factors. Force is an "important causal agent in injuries from lifting. Other Important ergonomic considerations include work duration, repetition, contact stresses, postures, and psychosocial issues.

Work-Related Musculoskeletal Disorders: Work-related musculoskeletal disorders (MSDs) are an important occupational health problem that can be managed using an ergonomics health and safety program. The term musculoskeletal disorders refers to chronic muscle, tendon, and nerve disorders caused by repetitive exertions, rapid motions, high forces, contact stresses, extreme postures, vibration, and/or low temperatures. Other commonly used terms for work-related musculoskeletal disorders include cumulative trauma disorders (CTDs), repetitive motion illnesses (RMIs), and repetitive strain injuries (RSIs). Some of these disorders fit established diagnostic criteria such as carpal tunnel syndrome or tendinitis. Other musculoskeletal disorders may be manifested by nonspecific pain. Some transient discomfort is normal consequence of work and is unavoidable, but discomfort that persists from day to day or interferes with activities of work or daily living should not be considered an acceptable outcome of work.

Control Strategies: The incidence and severity of MSDs are best controlled by an integrated ergonomics program. Major program elements include:

- Recognition of the problem,
- Evaluation of suspected jobs for possible risk factors.
- Identification and evaluation of causative factors,
- Involvement of workers as fully informed active participants, and
- Appropriate health care for workers who have developed musculoskeletal disorders.

General programmatic controls should be implemented when risk of MSDs is recognized. These include:

- Education of workers, supervisors, engineers, and managers;
- Early reporting of symptoms by workers; and

• Ongoing surveillance and evaluation of injury, health and medical data, Job-specific controls are directed to individual jobs associated with MSDs. These include engineering controls and administrative controls. Personal protection may he appropriate under some limited circumstances.

Control Measures: Among engineering controls to eliminate or reduce risk factors from the job, the following may be considered:

- Using work, methods engineering, e.g., time study, motion analysis, to eliminate unnecessary motions and exertions.
- Using mechanical assists to eliminate or reduce exertions required to hold tools and work objects.
- Selecting for designing tools that reduce force requirements, reduce holding time, and improve postures.
- Providing user-adjustable workstations that reduce reaching and improve postures.
- Implementing quality control and maintenance programs that reduce unnecessary forces and exertions, especially associated with non value-added work. Administrative controls reduce risk through reduction of exposure time and sharing the exposure among a larger group of workers. Examples include:
- Implementing work standards that permit workers to pause or stretch as necessary but at least once per hour.
- Re-allocating work assignments (e.g., using worker rotation or work enlargement) so that a worker does not spend an entire work shift per forming high-demand tasks. Due to the complex nature of musculoskeletal disorders, there is no "one size fits all" approach to reducing the incidence and severity of cases. The following principles apply to selecting actions:
- Appropriate engineering and administrative controls will vary from industry to industry and company to company.
- Informed professional judgment is required to select the appropriate control measures.
- Work-related MSDs typically require periods of weeks to months for recovery. Control measures should be evaluated accordingly to determine their effectiveness.

7.2.9.6 OCCUPATIONAL HEALTH AND SAFETY PROGRAM

Health hazards associated with the occupation are called occupational hazards. In hazardous waste treatment storage and disposal facility due to handling of toxic and hazardous waste there are possibilities of developing occupational diseases. The company has to carry out the following checks to curb the problem:

i. Pre -employment medical checkup at the time of employment.
ii. Annual medical check will be done for all employees.
    1. Age <30 Once in five years
    2. Age 31-40 Once in four years
    3. Age 41-50 Once in two years
    4. Above >50 years once every year
iii. First aid training must be given to the employees.
iv. Monitoring of occupational hazards like noise, ventilation, chemical exposure shall be carried out at frequent intervals, the records of which shall be documented.
v. Evaluation of health of workers viz. chest x ray, Audiometry, Spirometry Vision testing (Far and Near vision, color vision and any other ocular defect) ECG, during pre-employment and periodical examinations must be carried out.

Pre Employment Check up	**Vision, audiometry, spirometry, chest skiagram, urine, rbs, t.b. Cancer, aids, etc.**	**Once at Time Of Appointment**
Periodical Check up once every year Once before relieve.	Spirometry, Urine, RBS, LFT, complete blood count, dental X ray, Anemia, etc.	Age <30 yrs. Once in five years Age 31-40 yrs. Once in four years Age 41-50 yrs. Once in two years Age Above >50 yrs.
Post employment check up	Vision, Audiometry, Spirometry, chest Skiagram, Urine, RBS, T.B. Cancer, AIDS, etc.	Once before relieve.

Medical Facilities

Medical facilities are needed to provide immediate medical attention to people who may be exposed to certain health risks during an accident.

1. First Aid Centre will be located at the Workers' Facility near the administrative building and canteen.
2. A doctor will visit the plant periodically.
3. First Aid Centre will be equipped with a safety shower, eye wash centre, and oxygen-administering facility, etc.
4. Medicines and antidotes for relevant hazardous chemicals will be stored for 5 persons.
5. The contact numbers of all nearby hospitals and medical facilities will be kept and put up on a board in the First Aid Centre.
6. A general agreement for immediate treatment will be made between the nearest hospital and the plant.

7.2.10 DISASTER MANAGEMENT PLAN

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 & social care and other necessities of life. The Disaster Management Plan (DMP) 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 DMP, it should be widely circulated and a personnel training is to be provided through rehearsals/drills. To tackle the consequences of a major emergency inside the plant or immediate vicinity of the plant, a DMP has to be formulated and this planned emergency document is called DMP. The objective of the DMP is to make use of the combined resources of the plant and the outside services to achieve the following:

- Effective 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 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 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.

The DMP should include emergency preparedness plan, emergency response team, emergency communication, emergency responsibilities, emergency facilities, and emergency actions

7.2.10.1 OBJECTIVES OF EMERGENCY PROCEDURES

Measures those are required to be taken during emergency are co-ordination of activities with many departments/ services and outside resources. The objective of the procedure is to define role of key personnel of different services during major emergency to be effectively utilized to:

1) Safeguard lives
2) Contains of incident and bring it under control
3) Minimize damage to property and neighboring environment
4) Rescue and treatment of casualties and evacuation of persons to safe areas
5) Identification of affected persons, information to relatives and extending necessary assistance.
6) Preservation of information, records etc. which will help in investigation
7) Welfare assistance to casualties
8) Providing relevant information to police, district authorities and news media
9) Mobilizing inside resources
10) Initiating and organizing evacuation of affected persons

Collecting latest status, other information and requirement

7.2.10.2 BASIS OF PLAN AND HANDLING OF EMERGENCY

1) It is not possible to envisage and detail every action, which should be taken during an emergency. The basic philosophy is to get key personnel of necessary discipline who have the knowledge and background to assess the situation and give directions as per the objectives as quickly as possible.
2) The plan identifies the services/departments required to combat emergencies and also identifies the key persons to discharge the duties.
3) Key personnel have been identified for emergencies and are responsible for providing necessary assistance.
4) Any outside assistance, which company shall get, shall be co-ordinate by the MAIN SITE CONTROLLER on duty.
5) Messages via telephones are restricted to key personnel only. This is required to keep the telephones free for key personnel to contact for necessary feed-back.
6) Senior person who arrives on scene is automatically in charge for the service group. He should not leave the site without entrusting the charge to his deputy. All the key personnel should be available at the main control room. All key personnel of other services will report to main site controller, who will co- ordinate between various departments and outside agencies.

7.2.10.3 INFORMATION ABOUT EMERGENCY AND SUBSEQUENT ACTIONS

1) Any person noticing fire/explosion/re lease of hazardous gases should shout FIRE, FIRE or HELP, HELP and will activate the emergency bell.
2) Inform respective control rooms.
3) The Executive in-charge along with the concerned Dept. Head will immediately rush to the incidence site to assess and take immediate action required to control the source of incidence. They will also inform Security and Safety personnel to come to the place of disaster/emergency and assist them.
4) If he feels that the situation is likely to escalate and may lead to emergency will communicate following minimum information to all senior persons.
    a) Brief description of incident.
    b) Status and seriousness of the situation
    c) Actions immediately taken.
    d) Immediate assistance required.
    e) All key personnel of respective services, depending on nature of emergency will arrive at site to take charge of positions.

7.2.10.4 INSTRUCTIONS TO EMPLOYEES

The plan assumes certain discipline at site during emergency as given below:
1) Do not get panicky.
2) Do not approach the scene of disaster as a spectator.
3) Do not engage phones/ P.A. system unnecessarily
4) Non-essential personnel to gather at security gate after receiving instructions
5) Do not move here and there unnecessarily.
6) Do not approach unnecessarily to get information or more inquiry.
7) Remain at your working place unless called and be attentive to instructions.
8) Ensure that all contract laborers working in the premises are immediately sent to main security gate.
They will receive further instructions from main site controller.
All non-essential staff members should gather at safe assembly point after assessing the wind direction and wait for further instructions which will be communicated through PA system or by other available means.

7.2.10.5 INSTRUCTIONS TO CONTRACTORS

The plan assumes certain discipline at site during emergencies as given below;

1) Do not get panicky
2) Do not approach the scene of disaster as a spectator
3) Do not engage phones/ P.A. system unnecessarily
4) Non-essential personnel to gather at security gate after receiving instructions
5) Do not move here & there unnecessarily.
6) Do not approach unnecessarily for information or more inquiry.

7) Remain at your working place unless called and be attentive to instructions
8) Ensure that all contract laborers working in the premises are immediately sent to main security gate. They will receive further instructions from main controller. All should gather at safe assembly points after assessing the wind direction and wait for further instructions which will be communicated through PA system or by other available means.
9) All fabricator contractors should ensure that all welding machines are switched off and all cylinders are closed before leaving the working area.
10) All civil contractors should be gathered at assembly points after declared emergency.

7.2.10.6 MITIGATION OF CONSEQUENCES DURING MAJOR ACCIDENT

No major hazard installation can ever be absolutely safe. Even if a hazard assessment has been carried out, if the hazards have been detected and appropriate measures have been taken, the possibility of an accident cannot be completely ruled out. So safely systems provide measures, which can mitigate the consequences of accident or emergency situation. In order to be able to initiate counter measures in the event of an accident, company shall install various safety systems to mitigate the consequences during Major Accident are as under:

(1) ECC room with full equipped with Fire Fighting Equipment
(2) TAC approved Fire Hydrant system with electric motor and D.G. Set and water reserved for fire fighting
(3) QRA to be done by competent party
(4) Alarm System and method of reporting / declaring emergency
(5) Regular rehearsal of emergency preparedness
(6) Training to all employees regarding emergency preparedness

7.2.10.7 EMERGENCY CONTROL CENTRE WITH LIST OF EQUIPMENT AND ACCESSORIES

Safety Office in front of Operation Building will act as Emergency Control Center. It is equipped with all necessary accessories as mentioned below.

(A) DOCUMENTS
- Site Plan
- Disaster Control Plan copy
- List of essential telephone numbers
- List firefighting equipment
- Shift Schedule of Emergency Control members

(B) PERSONAL PROTECTIVE EQUIPMENT
- B. A. Sets (Breathing Apparatus)
- Face Masks
- Hand gloves
- Gum boots
- Goggles
- Helmets
- Safety belts
- Aprons
- Fire proximity suit

(C) EQUIPMENT LIST
- Internal / External Telephone
- Portable alarm
- Torches
- Emergency Cupboard with necessary PPE
- Artificial Respirator
- Racer watches (STOP WATCH)

7.2.10.8 INFORMATION REGARDING KEY PERSONS AND THEIR RESPONSIBILITIES DURING EMERGENCY

A. SITE MAIN CONTROLLER

After getting information of emergency, the site main controller will rushed to the Emergency Control Center immediately.

1) On reaching he will assess the magnitude of the situation in consultation with Incident Controller and decide whether inside or outside help are to be called (i.e. Fire Service, Police, Ambulance etc.).
2) Ensure that key persons are called in.
3) Give guidance and direction in vital and important activities to control the emergency situation.
4) Direct to close down and evacuation of the plants in consultation with Incident controller and key personnel.
5) If necessary arrange for evacuation of neighboring population.
6) Inform the Government authorities such as Collector, MC, Factory Inspector, Health Officer & medical Officer and request them for their help as situation demands.
7) Give prime importance to human life and guidance in organizing the rescue operations as well as ensure whether injured people getting proper medical attention in time.
8) Always be in touch with the Incident Controller to get further progress and decide further plan.
9) On completion of emergency situation declare the normalcy through Administrative Officer.
10) Control the re-occupation of the affected areas on discontinuation of emergency.
11) Do not permit to re-start the plant unless it is safe.
12) Give authentic statement of the incident to News Media & Government Authorities.

B. INCIDENT CONTROLLER

1) Take the charge of situation and assess the magnitude of the event
2) Control and guide all the operations with priorities to the Safety of Personnel, minimize pollution, loss of material and loss to the plant equipment and property.
3) Provide advice and guide to the Fire Fighting and Rescuing squad and Fire Brigade while they arrive.
4) Establish communication with emergency control center.
5) Report on all significant developments to the emergency control center through phone/Messenger.
6) Ensure that evacuation of the areas in the factory getting affected is complete.
7) After the emergency situation is brought under control, assure that the necessary evidence for further investigation in the incident is preserved and inform Site Controller regarding control of emergency.

C. TECHNICAL STAFF / DEPARTMENT HEAD

1) As soon as informed, rush to the spot and take charge of the situation till senior group arrives.
2) Ensure that emergency siren is raised which gives information to Security, Safety, Administration Staff and Technical Staff.
3) On arrival of Incident Controller, inform him about the gravity of the situation and then to work under his guidance to control the situation.
4) Ensure that only experienced and essential people remains at the location for controlling, while others to be evacuated from the scene.

D. EMPLOYEES NEAR THE SPOT (INCIDENT AREA)

The employees near affected area, under the guidance of the **Incident Controller** shall

1) Tackle the emergency as per laid down procedures for the area bearing in mind the requirements of the situation called for by the progress of the emergency.
2) Remove all non-essential employees (who are not assigned any emergency duty) shall evacuate the area and gather at the specified assembly points.

E. EMPLOYEES OF OTHER DEPARTMENTS

1) On getting information of incident, take permission of superior and confirm own plant, department, safety and then after trained and skill persons will rush to incident spot with necessary personnel protective equipment.
2) Approach the spot from up wind direction and assemble at safe place near to the spot taking in to consideration the wind direction.
3) Extend help to control the situation as per the instruction and guidance given by the senior persons controlling the operation.

F. PERSONNEL OFFICER

1) When emergency declared immediately rushed to emergency control center.
2) Basically he will work as a Liaison Officer and will stationed at emergency control center during emergency. He will work under the direction of Site Controller.
3) To ensure that the casualties receives adequate attention at first aid center, also ensure additional help if require from Government authorities or outside agencies.
4) Arrange transport facility for injured personnel to get timely medical help.
5) He will also arrange for head count at assembly points and will inform Site Controller.
6) Also be in touch with the Security and Other Departments for help.
7) Will check the Roll call from Time Office for availability of trained personnel during emergency situation at the site.
8) Determine the need to inform statutory authorities of the accident and fill the necessary forms for submission with consultation of the Site Controller.
9) When emergency is prolonged, arrange for the relief of personnel as well as inform the families of injured persons and organize refreshments / catering facility.

G. ADMINISTRATIVE OFFICER

1) When emergency declared, immediately rushed to the emergency control center and establish contact with Site Main Controller.
2) Ensure the communication between site controller and incident controller. Keep messenger for communication.
3) Make arrangement to send portable megaphone and torches to the Incident Controller if required.
4) On receiving instructions from Site Controller, organize transportation for the evacuation of people from the assembly points.
5) As per instructions from Site Controller will inform to Head Office, Insurance Surveyor, other relevant authorities and neighboring areas.
6) On getting instructions from Site Controller / Incident Controller, he will be in touch with other Industries for help in emergency.
7) Will arrange to announce necessary instructions for all personnel.
8) Ensure that telephone operator keeps the EPABX free to extend possible for in coming calls.
9) Ensure that Press and other Media do not publish unauthentic news.

H. ENGINEERING SERVICES KEY PERSONNEL

1) When emergency declared, immediately proceed to Emergency Control Center.
2) Ensure the availability of electrical wiremen, utility, maintenance employees and drivers.
3) Ensure the water supply & electric power generator in case of power failure.
4) Be in touch with the Site controller / Incident Controller to extend help as and when required.
5) Ensure availability of Light Motor Vehicles as well as Fork Lifts, JCBs etc.
6) Arrange the vehicle as per required by Administrative / Personnel Officer.

I. SECURITY & FIRE IN-CHARGE

1) When emergency declared and Security guards at the main gate are sufficient.
2) On getting instruction from Site Controller/Incident controller, cordon the affected area to maintain law and order.
3) As per instruction from Site Controller/ Incident controller, arrange to start the fire hydrant pump.
4) Ensure the following duties by Security Guards;

- Stop all vehicles and visitors entering into the factory, except any Government authorities such as Fire Brigade, Police, Factory Inspector, Medical Staff and inform the Administrative Officer on their arrival.
- If any press reporter and local Leader comes at the main gate, take them to the Administration Office.
- Do not allow any vehicle to park at the main gate or nearby at main road.
- Assure that the entrance of the gate is clear for thorough fare. In Similar way control/ guide internal traffic for smooth operations.
- Act according instructions given by Personnel and Administrative Officer.
- Ensure that all essential personnel evacuated and assembled at Assembly points.
- Arrange effective security nearby the incident place.

J. FIRST AID ATTENDANTS

1) As per the instructions given by the Incident Controller, arrange the supply of additional emergency related equipment to the incident place. Give necessary First Aid treatment to the affected persons immediately.
2) Inform the Personnel and Administration Officer regarding the severity of injury and advise for further medical help if necessary.
3) Ask for additional trained First-Aider, if required.
4) On arrival of Doctor, assist him to give medical treatment to the affected people.

K. SAFETY OFFICER

1) On hearing emergency siren rush to the spot and assume the position of incident controller and take care of the situation till a senior personnel arrives and on their arrival work with them in team, extending their own expertise.
2) Give instructions and guideline to the people involved in control measures. As well as help in providing required PPE.
3) Give instructions to the safety attendants.
4) Brief the Site Main Controller about the progress of control measures.
5) Advise site controller regarding type of help required from outside.
6) Give instructions to other department through internal phones /Communication Officer.
7) Make arrangement to carry out monitoring whenever necessary and appraise results to the concerned seniors

7.2.10.9 EMERGENCY ORGANIZATION FOR IDLE HOURS

1. SECURITY

i) After getting information through emergency hooter inform at least two senior persons at their residence by telephone/messenger.
   (a) Site controller
   (b) Safety Officer
   (c) Incident controller.
   (d) Technical Staff/Senior Staff

ii) Assure that the front side of the gate is clear for thoroughfare.

iii) Act according to the instructions of Incident Controller/Senior Officers

iv) Inform Emergency Control Center for emergency.

2. SAFETY/FIRST AID ATTENDANT

One attendant remains present around the clock.

Duties:

1) On hearing emergency hooter/alarm does not leave the Occupational Health Center.
2) As per the instructions given by the person In charge of the emergency operation or Incident Controller arrange the supply of additional emergency safety equipment to incident place.

3) Give necessary first aid to the affected person immediately. Inform the site controller about the severity of the Injury and advice for further medical help if required. On arrival of doctor, assist him for medical treatment offered to the affected people.

7.2.10.10 LIST OF IMPORTANT AUTHORITIES WITH THEIR ROLE IN EMERGENCY AND TELEPHONE NUMBERS

List of important authorities with their role in emergency and telephone numbers will prepared and placed/displayed at important locations.

7.2.10.11 INFORMATION ABOUT EXTERNAL COMMUNICATION SYSTEM

(1) Communication will be through Emergency Central Alarm System

(2) Telephones: An EPABX unit will be installed to connect all departments internally. Company will also provide mobile connections to all important personnel at site.

(3) STD PHONE & FAX/TELEX: Will be provided at IMP places

7.2.10.12 ANNOUNCEMENT SYSTEM DETAILS

During emergency it is necessary that the alarm should be heard by all employees wherever they work, for that speakers will be placed at various locations within plant.

7.2.10.13 OUT SIDE IMPORTANT ADDRESSES AND PHONE NUMBERS

List of important addresses in the nearby area such as hospitals, ambulance services, fire fighting services, Government personnel (Municipal Commissioner, district collector, police station and emergency control services and their telephone numbers will be prepared and displayed outside emergency control room.

7.2.10.14 REHERSAL AND UPDATION OF PLAN

1) Every year mock drills will be organized. Shortfalls in actions observed during drill will be explained to participants and will be corrected accordingly.
2) Any shortcomings regarding On–Site Emergency Plan observed during such drills will be corrected and incorporated in On-Site Emergency Plan and same will be communicated to all.
3) The On-Site Emergency Plan will be updated after any significant development in factory or change in the law.

7.2.10.15 INFORMATION OF ASSEMBLY POINTS

At the time of emergency, non - essential workers, casual workers, visitors and others are to be replaced to Assembly Points and separate in charge are nominated. No of assembly points and location will be decided based on the layout of the plant.

In case of an emergency, the visitors, contract persons and factory employees will gather at nearby assembly point. Pre-designated persons will take their roll call. If needed, they can be evacuated easily through any gate in a short period as per instruction of site main controller.