

7.2 RISK ASSESSMENT

This chapter includes a brief description of Risk & Hazard study.

Integrated Chemisol Pvt. Ltd. proposes to establishe green field Technical grade pesticides manufacture plant for Aluminium Phosphide, Zinc Phosphide, Magnesium Phosphide Technical & Its Formulation of 500 TPM locted at Plot No. 4924, Notified Industrial Area, GIDC Sarigam, District - Valsad, Gujarat 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 and Qualitative/Quantitative Risk Assessment have been developed to improve upon the integrity, reliability and safety of industrial plants, the same has been discussed in detail under their respective headings.

Scope of Study

- Compliance of TOR
- Hazard Identification
- Risk Management
- Disaster management Plan

Methodology:

The steps involved in risk assessement methodology are as follows:

- 1. Hazard identification by studing the information on plant location, layout of the equipment & process condition;
- Hazard assessment by qualitative risk analysis and quantitative risk analysis. Quantification of Hazard involves selection of most credible scenario or wort case scenario; Eastimate consequences scenarios in the plant such as fire, explosion and toxic effect; Eastimate frequence of occurance of any incident is to be found out by reliability analysis;
- 3. Prioritize and Reduce Risk by providing control / mitigation measures;
- 4. Preparing disaster management plan to face any accident and disaster caused by the project operations.

7.3 Hazard identification

7.3.1 Storage Details & Layout

Total Plant area 2351.25 m^2 having storage area is provided for storage of Raw material and Finished Product. The storage condition of liquid acid tanks is given in **Table 7-1**.

Table 7-1:	Chemical	Storage	Details
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Sr No	Dreducto		Storage Condition					
Sr.NO.	Products		Temperature	Pressure				
1	Phosphorus		Ambient	Atmospheric				
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Sr.No. Broducts		Storage Condition				
Sr.1NO.	Products	Temperature	Pressure			
2	Aluminium Powder	Ambient	Atmospheric			
3	Urea	Ambient	Atmospheric			
4	Ammonium Carbamate	Ambient	Atmospheric			
5	Graphite Powder	Ambient	Atmospheric			
6	Paraffin Wax	Ambient	Atmospheric			
7	Zinc Stearate	Ambient	Atmospheric			
8	Aluminium Phosphide	Ambient	Atmospheric			
9	Aluminium Stearate	Ambient	Atmospheric			
10	Black Carbon	Ambient	Atmospheric			
11	Zinc Powder	Ambient	Atmospheric			
12	Zinc Phosphide	Ambient	Atmospheric			
13	Iron Oxide	Ambient	Atmospheric			
14	Red Phosphorous	Ambient	Atmospheric			
15	Magnesium Oxide	Ambient	Atmospheric			
16	Magnesium Phosphide	Ambient	Atmospheric			

7.3.2 Layout map

The storage facilities for the raw material and finshed goods have been shown in the layout map as shown in *Map 7-1*.



Map 7-1: Layout Plan Showing Storage Facilities



7.3.3 Chemical Properies

The information on the hazardouse properties from MSDS of the chemicals handled at the site has been reviewed to identify the associated hazards. The Physico-chemical properties of various chemicals are listed along with relevant hazard as per given in *Table 7-2.*

SN	Name of Chemical	Storage Facility / Packing	Storage of Chemical (MT/M)	Flash Point ⁰C	Storage condition
1	Phosphorus	MS Barrel	50 MT	< 20°C	NTP
2	Aluminium Powder	Plastic bag	20 MT	N/A	Pressure-200 kg/m ² Room Temp
3	Urea	Plastic bag	10 MT	N/A	Pressure-200 kg/m ² Room Temp
4	Ammonium Carbamate	Plastic bag	5 MT	N/A	Pressure-200 kg/m ² Room Temp
5	Graphite Powder	Plastic bag	5 MT	N/A	Pressure-200 kg/m ² Room Temp
6	Paraffin Wax	Plastic bag	5 MT	>193°C	Pressure-200 kg/m ² Room Temp
7	Zinc Stearate	Plastic bag	5 MT	N/A	Pressure-100 kg/m ²
8	Aluminium Phosphide	20 kg corrugated boxes	100 MT	N/A	Pressure-400 kg/m ² Room Temp
9	Aluminium Stearate	Plastic bag	5 MT	177°C	Pressure-100 kg/m ² Room Temp
10	Black Carbon	Plastic bag	2 MT	N/A	
11	Zinc Powder	Plastic bag Sepaate room	20 MT	N/A	Pressure-200 kg/m ² Room Temp
12	Zinc Phosphide	Plastic bag	100 MT	N/A	Pressure-400 kg/m ² Room Temp
13	Iron Oxide	Plastic bag	2 MT	N/A	NTP
14	Red Phosphorous	MS Barrel	100 MT	N/A	Atm Pressure Around 30 Deg C
15	Magnesium Oxide	Plastic bag	2 MT	Not Combustible	NTP
16	Magnesium Phosphide	20 kg corrugated boxes	100 MT	N/A	Pressure-400 kg/m ² Room Temp

NA: Not Available



7.4 QUALITATIVE RISK ASSESSMENT

Many a times Risk involved in various processes / process equipment's cannot be addressed completely by Consequence Analysis. As a conservative approach, these risks have been considered separately under this topic. The approach is to identify hazards associated in operation of equipment as well as in processes, assessing its impacts, ranking the risk posed by it and finally to propose remedial actions/mitigation measures such that the risk is minimized to tolerable level.

Qualitative Risk Assessment has been carried out for the following areas:

- Hazard involving during Construction Phase;
- Storage and Handling of Red Phophorus;
- Storage and Handling of yellow Phosphorus;
- Manufacturing of Zinc Phosphide;
- Manufacturing of Magnesium Phosphide;
- Storage and Handling of Phospine;

In Qualitative Risk Assessment, risk has been analyzed using methodology called HIRA-Hazards Identification & Risk Assessment. In HIRA, major manual activities carried out by plant personnel as well as contract labors have been considered. The Risk Matrix presented in **Table 7-3** is referred in evaluating the assessment. Risk acceptability criteria given in **Table 7-4**.

SEVERITY							
LIKE HOOD/ PROBABILITY		Catastrophic (Death/ System Loss)	tastrophic (Death/ System Loss) Major/ Critical (Serious injury/ Illness) Moderate (Less Serious Injury/ Illness) Minor/ Marginal (Minor Injury/ Illness)		Insignificant/Negligible (No injury /illness)		
		5	4	3	2	1	
Almost Certain	Е	Н	Н	H	Μ	Μ	
Likely	D	Н	н	Μ	Μ	L	
Possible C		Н	Μ	Μ	Μ	L	
Unlikely	В	Μ	Μ	Μ	L	L	
Impossible	Α	Μ	Μ	L	L	L	

Table 7-3: Risk Matrix for Qualitative Risk Assessment

Table 7-4: Risk Acceptability Criteria

Risk Range	Risk Acceptability Criteria	Remarks
н	Unacceptable/ High	Management's Decision/Action Plan Required. Potential off-site Impact.
м	Medium	Generally Minor Impact. Acceptable with Management's Review. Specific monitoring or SOP to be followed.
L	Low	Acceptable without Review. Manage through Routine Procedure.

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Table 7-5: Hazard Identification and Risk Assesement

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				I	Initial Risk		Res	idual Ris	k	
S. No.	Process Or Activity	Associated Hazards	Health & Safety Impact (Risk)	Severity	Likelihood	Risk	Control / Mitigation Measures	Severity	Likelihood	Risk
А			Hazard in	olving du	ring Cons	truction P	hase	-		
1	Site Clearence, excavation and paving of site	Dust generation & increase in SPM/RSPM in air Fall into pit due to caving the side	Health effect on workers and surrounding People Risk of injury to workers	2	С	М	Water spray on the ground before excavation. Work permit procedure to be followed. Shoring of the sides while manual digging the ground. Use of dust mask.	1	В	L
	Fabrication work for erecting major plant equipment including operation of equipment like crane, concrete mixtures, vibrators etc. and preventive maintenance work	Noise generation	Health effect on workers and surrounding People.	2	С	М	Ear plugs will be provided / and use ensured. Grinding will be carried out in a closed shed area to.Thick greenbelt will be developed to reduce the noise level going outside factory premises	2	С	М
2	Vehicular movement for transportation of construction material	Emission of PM ₁₀ , HC, NOx, & CO Noise generation	Health effect Risk of injury to workers due to accidents	2	E	М	P.U.C Certfied Vehicles Regular Maitenance of Vehicles Speed control of the vehicles.	1	С	L
В			Storage	and Hand	lling of Re	ed Phopho	rus			

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				I	nitial Ris	k		Residual Risk		k
S. No.	Process Or Activity	Associated Hazards	Health & Safety Impact (Risk)	Severity	Likelihood	Risk	Control / Mitigation Measures	Severity	Likelihood	Risk
1	Loading & Unloading	Fire Explosion due to leakage /spillage in pipe/container/ valves etc. if contct with heat/sparks/open flames/hot surfaces	Skin/Eye irritation. Toxic Vapor inhalation etc.	2	С	Μ	Safety glasses with side- shields conforming to EN166 for Eye Protection. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product for skin Protection. Flame retardant antistatic protective clothing, for body Protetion. Store in cool place. Keep container tightly closed in a dry and well-ventilated place.	2	В	L
С			Storage ar	nd Handlir	ng of yello	w Phosph	norus			
1	Handling / Charging	Fire Explosion due to leakage /spillage in pipe/container/ valves etc. if contact with heat/sparks/open flames/hot surfaces	Eye irritation and respiratory disorder.	2	С	М	Inspection of Bags/Barrel. Use of eye goggle & nose mask.	2	В	L
D		•	Manu	ufacturing	of Zinc P	hosphide	·			



				I	Initial Risk Re		Resi	dual Ris	k	
S. No.	Process Or Activity	Associated Hazards	Health & Safety Impact (Risk)	Severity	Likelihood	Risk	Control / Mitigation Measures	Severity	Likelihood	Risk
1	Mixing of Yellow Phosphorus and zinc Powder into closed reactor.	Generation of P_2O_5	Health effect on workers and surrounding People. Eye irritation and respiratory disorder	2	С	М	Scrubber is installed to avoid releasing of P ₂ O ₅ into the environment and treated as Phosphoric Acid. Appropriate PPEs like Safety Goggles, Butyl or Nitrile rubber gloves, gumboot, plastic apron etc. will be used.	2	В	М
E			Manufact	uring of N	/lagnesiur	n Phosph	nide			
1	Mixing of Magnesium Phosphate and Magnesium ground nut Oil MgO into reaction pot.	Generation of P_2O_5	Health effect on workers and surrounding People. Eye irritation and respiratory disorder	2	С	Μ	Scrubber is installed to avoid releasing of P ₂ O ₅ into the environment and treated as Phosphoric Acid. Appropriate PPEs like Safety Goggles, Butyl or Nitrile rubber gloves, gumboot, plastic apron etc. will be used.	2	В	М
F	Storage and Handling of Phospine									
	Charging of Zinc Oxide,Red phosphorus, Yellow Phosphorus.	Releasing of Phospine gas.	Health effect on workers and surrounding People. Eye irritation and respiratory disorder	2	С	Μ	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Use only non- sparking tools. Select eye protection in accordance with OSHA 29 CFR 1910.133.			

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7.4.1 Conclusion

It can be seen from the above table that:

- After providing mitigation measure in Vehicular movement for transportation of construction material activity of construction phase, the risk probability will change from alomost certain to possible as well as its residual risk will change from medium to low.
- In Other than all activity, the risk probability will change from possible to unlikely as well as its residual risk will change from medium to low.

7.5 CONTROL / MITIGATION MEASURES

Based on the risk assessment analysis following precautionary mitigation measures are recommended for the project.

- Work permit procedure to be followed;
- Use of P.U.C Certified Vehicles;
- Periodic Inspection of flanges/ferrule joints is carried out;
- Acid proof flooring will be done at storage and handling area;
- Inspection of Bags;
- Fire extinguishers are kept available;
- Use of Suitable protective clothing, gloves, and gumboot.

For various activities the adequate mitigation mesures are provided in Table 7-5.

7.5.1 General Safety Measures for Construction Phase

The following will be implemented by the contractor while carrying out civil construction.

Required PPE will be provided to cover occupational foot, head, hearing, and eye protection.

Fall Protection/ Working at height: The Contractor is required to provide fall protection to employees who are working at heights equal to or greater than 1.8 m. fall protection can be in the form of perimeter protection such as guardrails and toe rails, personal protective equipment (PPE), a safety monitoring system, or a fall protection plan. Activities that require personal fall protection systems include steel erection bolting, riveting, fitting-up and plumbing-up, work over water and some deep excavation work.

Foot Protection: If machines or operations present the potential for foot injury, the contractor will provide foot protection with safe design and construction for the work to be performed. Workers and visitors shall not be allowed on a construction site without safety boots. The foot protection will be provided for workers working with concrete or cement. Gum boot shall be provided to avoid contact with cement/RCC mixtures and mortar.

Head Protection: If head hazards remain after all steps have been taken to control them (safety nets for work at heights, proper housekeeping), the Contractor will provide workers with appropriate head protection. Safety helmet will be recommended. When the worker is carrying load on the head a suitable head protection will be provided.



Noise Protection: Workers shall wear hearing protection devices (ear plugs, ear muffs, canal caps), whenever the diesel operated engines, DG set or other noisy machines are operating in the area.

Eye Protection: When operations present potential eye injury from physical or chemical elements, the Contractor will select, provide, maintain and required affected workers to use appropriate eye protection. Eye protection is required while working on RCC dismantling, steel fabrication, welding, rough plastering and painting work. Any work which involves looking upside also requires the protection e.g. electrical cabling on walls and ceiling. The various eye protecting devices like safety glasses and goggles, face shields and welding helmets will be provided to workers.

Hand protection: Suitable hand gloves shall be provided for working with cement or mortar. A suitable anti-allergic cream or protecting gel shall be applied on the hands for persons who develop allergy with cement or lime.

Electrical Safety:

- A licensed electrician shall be deployed to complete all temporary wiring and electrical installations required for construction activities.
- Fuses and circuit breakers (ELCB's) shall be used to protect motherboards, conductors and equipment to avoid short circuiting and electric shock. MCB's and fuses will also to be used to protect the electrical equipment from over current and over voltage.
- Extension cords for equipment or as part of a temporary wiring system shall not be damaged or compromised in any way and insulation must be of the highest grade.
- The joints of electrical wires shall be avoided or an extension cord can be used if needed
- Anytime electrical equipment will be deactivated for repair, or circuits will be shut off, the equipment will be locked out and tagged at the point where it can be energized.
- Proper earthling will be ensured for all equipment and electrical panels
- Temporary lights shall not be suspended by their cords.
- The employer shall provide the necessary safety equipment, supplies and monitoring equipment to their personnel.
- During the operation stage maintenance of transformer and manning of electrical substation shall be by the competent persons only.

7.5.2 Safety Measures for Transportation, Storage and Handling of Chemicals

A. General safety measures for Transportation, Storage & Handling

- Layout and location of hazardous chemical storage area will be based on natural and Mechanical ventilation.
- Spare barrels of sufficient quantity will be kept ready for any emergency spillage or leakage.
- Regular inspection of all the storage tanks of hazardous chemicals will be carried out.



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- Display Boards will be provided on all storage tanks which include the name of the chemicals, Calibration of tanks and date of Painting.
- All equipments related to hazardous chemical storage will be maintained and calibrated regularly.
- SOP for handling will be displayed in local language for safe operating procedure.
- Standard procedure for unloading will be in place and will be implemented for safe unloading of road tanker.
- Muffler on the silencer of the tanker during entering in factory premises.
- Water showering system (Automated sprinkling system) will be provided to the flammable chemical storage area.
- On site detectors for fire based on heat &/or smoke detection with alarm system will be provided as required.
- Adequate firefighting system will be provided as required. Details of the same are elaborated in related section.
- First aids boxes will also be provided at prominent places in the plant.
- Area will be declared as "NO SMOKE ZONE".

B. Safety measures for storage and handling of Phosphorus (Red, Yellow)

Storage

- Ensure the container is tightly closed at all times.
- Keep in a cool, dry, well-ventilated area away from incompatible materials and conditions.
- Containers which are opened must be carefully resealed and kept upright to prevent leakage.
- Avoid direct sunlight.
- Avoid formation of dust and aerosols.
- Provide appropriate exhaust ventilation at places where dust is formed.
- Keep away from sources of ignition No smoking.
- Provide Labelling according Regulation (EC) No 1272/2008
- Provide NFPA label.
- Keep Away from water.

<u>Handling</u>

- The lab where the material is being handled has an approved / certified emergency eyewash and safety shower.
- Ensure you are wearing the following minimum PPE: tightly fitting safety goggles and face shield, fire/flame resistant lab coat, full length pants, close-toe rubber or leather shoes, nitrile gloves.
- Lab emergency contact information must be readily posted. Easy access to a cellular phone or land line is readily available.
- Avoid contact with skin, eyes, and clothing.
- Avoid inhalation of vapor or mist.
- Avoid Contact of water.



Personal Precaution

• Wear respiratory protection. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Do not attempt clean-up without minimum PPE.

Environmental Precautions

 Prevent further leakage or spillage – if safe to do so. Do not allow product to enter drains.

Hygiene Measures

• Avoid contact with skin, eyes, and clothing. Wash hands before breaks and immediately after handling the product.

Engineering Controls

• All operations should be carried out in a ventilated enclosure chemical fume hood to keep airborne concentrations below recommended exposure limits. Use explosion-proof ventilation equipment.

C. Safety Measures for Flammable Chemicals

- Storage for sealed drums will be out of direct sunlight and remote from sources of heat to avoid generation of pressure.
- Drums will be stored at ground level and measures taken to prevent corrosion of the drum base.
- Adequate ventilation will be available to ensure that in case of incidental release of chemicals (vapour) the vapour concentration is as low as possible, and in any event within the regulatory requirements.

D. Safety Measures for Transportation of Raw Material

- Training will be provided to driver and cleaner regarding the safe driving, hazards of Flammable chemicals, emergency handling and use of SCBA sets.
- TREM card will be kept with Threshold Limit.
- SCBA set will be kept with TL.
- 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. In case of leak or spill:
- 1. Area will be isolated.
- 2. Container shall be isolated.
- 3. Source of leakage will be checked.
- 4. Damaged containers or spilled material shall not be attended without wearing appropriate protective clothing.



- 5. Leakage will be stopped, if possible to do so without risk.
- 6. Water spray will be used to reduce vapors (but do not put water directly on leak, spill area or inside container).
- 7. Combustibles (wood, paper, oil, etc.) will be kept away from spilled material.

E. Safety Measures for Unloading of Raw Material from Tanker

- 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, TREM CARD, 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.
- After approval of QC department unloading procedure will be allowed be started, as per rules & guidelines.

F. Safety Measures for Drum Storage and Handling

- Drums will be stored at designated location or secured in a safety storage cabinet.
- Approved methods of equipping a drum and dispensing liquids from it will be followed.
- Drums, carboys and related accessories will be inspected on regular basis for maintenance purpose.
- All the vessels and equipments will be earthed properly and protected against static electricity. Also, proper earthing facilities shall be provided for drums.
- Materials will be transferred by pumping through pipeline or by vacuum, from drums.
- Drums for flammable liquids will have proper closures that can withstand the expected handling conditions without leaking.

G. Storage area Safety

- Pipes and equipment shall be inspected at regular intervals.
- Entry of unauthorized persons is prohibited.
- Spark-resistant tools will be used.
- Combustibles (wood, paper, oil, etc.) shall be kept away from spilled material.
- SS storage tank will be provided as per IS code.
- Dyke wall will be provided to storage tank.
- Level transmitter will be provided with low level/high level auto cut-off provision.
- Fire hydrant monitor with foam attachment facility will be provided.
- Suitably eye-wash, showers and water showers to body is provided nearby acid and Caustic Storage area.
- FLP type pump & electrical fittings will be provided.
- All storage areas shall be isolated from all sources of open flame and well posted with' NO SMOKING' signs and will provided with adequate firefighting/extinguishing system.

H. Ways to Minimize the Manual Handling of the Hazardous Chemicals

• SOPs, work instructions will be prepared and followed.

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- Fork lifts will be used for unloading chemical bags, bags movements within plant, etc.
- Cranes, hoists, pallet trucks, conveyors, etc. shall be used as per the requirement, to eliminate manual handling.
- Lifting tools & tackles will be used, wherever required.
- Trainings will be provided to relevant staff, operators, workers for the risk associated with manual handling of hazardous chemicals, ways to overcome those risk, etc.

I. Process Safety Measures

For the safety in production area some important critical safety measures must be provided within the process technology/equipment itself.

The details of the general safety measures for process unit are as below;

- Process parameters control will be provided vide Standard Operating Procedures.
- All reaction vents will be connected to either vapor condensers system or gaseous scrubber system.
- Trained person will be engaged for handling of hazardous materials.
- Proper safety precautions will be taken during handling of hazardous materials.
- Further all the vessels will be examined periodically by a recognized competent person.
- All the vessels and equipments will be well earthed appropriately and well protected against Static Electricity. Also for draining in drums proper earthing facilities have been provided.
- Reaction column pressure and temperature data will be regularly monitored and assessment of properties of flammable chemicals will be evaluated to avoid fire/explosion scenarios.
- Temperature indicators will be provided near all reactors.
- Caution note, safety posters, stickers, periodic training & updation in safety and emergency preparedness plan will be displayed and conducted.
- Total reaction will be carried out in closed jacketed vessel having cooling water supply to control temperature in case of run-away reaction.
- Emergency reactor shutdown system will be implemented.

J. Preventive safety

The safety measures in form of the general Do's & Don'ts for safety in process & other plant area are as below:

- Check VOC content for flammable and make sure that no flammable vapour contents.
- Keep proper and adequate fire extinguisher near work area.
- Check all motors are disconnected and fuse pulled out before maintenance.
- Work in any equipment must be conducted in presence of supervisor.
- Make sure all process lines are disconnected.
- Do not work on equipments without permission from plant head and maintenance head.

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- Do not allow any employment without pre medical checkup or without checking fitness.
- Use proper PPE.

K. DO's & DON'Ts

• Management has listed some of the Do's & Don'ts activities to strengthen the SAFETY AT WORK, which will be followed strictly:

For Preventive Maintenance

Do's:

- Ensuring that operators/workers etc. follows the SOPs, Safety procedures & standards, work permit system etc.
- Inspection of Storage Area, Earthing & Bonding system.
- Inspection of all Fire Fighting Facilities /Check Alarms operation.
- Checking the availability of Spill Containment Kit.
- Inspections of plant, machinery, tools, equipment, premises, work practices, processes, procedures and general environment must be carried out for the health and safety of plant, people and surrounding.
- On-site and Offsite Emergency Plans shall be reviewed and updated, as per the requirement.

Don'ts:

- Don't allow anyone who hasn't received specific safety and operational training to get indulge in any site activity.
- Don't perform any activity without proper permit.
- Don't perform your own maintenance.
- Don't compromise on Design and Engineering part.
- Don't panic if you are in a risky situation.
- Don't allow spilled chemicals to drain to sewers/gutters etc.

7.5.3 Occupational Health and Safety

The main effects of chemicals especially VOCs are anticipated in proposed project. No other source of adverse effects on occupation health & safety is likely to occur. However, MSDS of hazardous chemicals will be prepared & made available with the management as well as concern personnel working with the materials or area likely to be affected by the materials.

In general following are the key safety measure recommended for the proposed project.

- Provision of drinking water supply for the employees as per standard of the drinking water as per WHO guidelines.
- Availability of proper sanitary facilities for the employees so that they do not suffer from any health ailments.
- Provision of all necessary equipment like portable detector, online detectors and other laboratory equipments as proposed for regular monitoring of workplace air and other conditions.



- Establish the safety policy.
- Organize training program for information on accident prevention, proper control and maintenance of equipment, first aid training and safe material handling practices.
- Monitoring of occupational hazards like noise, ventilation, chemical exposure will be carried out at frequent intervals.
- Provision of ear muffs/ ear plugs to the workers exposed to higher noise level.
- Provision of proximity suits and self-breathing apparatus.

Provision and compulsory use of necessary PPEs like helmet, safety goggles, face mask, hand gloves and safety shoes etc. for all workers.

7.6 DISASTER MANAGEMENT PLAN (DMP)

The Disaster Management Plan (DMP) is a guide, giving detailed organizational responsibilities, actions, reporting requirements and support resources available to ensure effective and timely management of emergencies likely to arise from planned operations. The DMP has been prepared for the Pesticides production plant on the basis of the Risk Assessment and related findings covered in the foregoing topics in this report.

7.6.1 Structure

The DMP is supposed to be a dynamic, changing, document focusing on continual improvement of emergency response planning and arrangements. A structure working on a Plan, Do, Check and Review (PDCR) cycle has been therefore suggested. Another advantage of doing this is to have a system that is in synchronicity with commonly used EHS systems such as ISO: 14001 and OHSAS: 18000. The DMP is covered in further detail in the remaining sections of this Chapter.

7.6.2 Policy

The Environment, Health and Safety (EHS) policies are to be made accessible to all personnel at site and to other stakeholders. The policies must be framed considering statutory compliance, stakeholder involvement, continual improvement, and management by objectives. If required, the explanation for the EHS policies will be provided in simple language which could be easily understood by the personnel.

7.6.3 Planning

- Identification and Prevention of Possible Emergency Situations
- Possible emergency situations in the fertilizer plant can broadly be classified into unintended explosions, fire, electrical short-circuits and resultant fire, vehicle collision, and inundation. Additional emergency situations can be developed on the basis of audit or other procedures prior to commencement of operations.
- Emergency Prevention

Some of the ways of preventing emergencies are as follows:



- Preparation of a Preventive Maintenance Programme covering periodic maintenance schedules for all the equipments, instruments and system as a whole as per recommendations provided in the Operation and Maintenance manual supplied by the respective manufacturers. The maintenance schedule may also incorporate additional recommendations based on the hands-on experience of engineers gained from working in similar plants.
- Importantly, it is of great importance to collect and analyze information pertaining to minor incidents and accidents at similar sites, as well as for recording near misses or emergencies that were averted. This information gives an indication of how likely or unlikely it is for the site to face actual emergencies and what should be further done to prevent them from occurring.
- Establishment of an ongoing training and evaluation programme, incorporating the development of capabilities amongst employees about potential emergencies and ways and means of identifying and averting the same. Most emergencies do not occur without some incident or an abnormal situation. Hence, there is always sometime of few seconds to few minutes to arrest an incident of abnormal situation from turning into an emergency. This is the role of the shift in-charge who is generally the incident controller (IC) along with his shift team.

Classification of Emergency

The Level of Emergency can be classified in three Categories, which is given in Table 7-6.

Classification	Description	Causes	Applicability
Level – 1	The leakage or emergency, which is confinable within the plant/area.	Small pipe/valve rupture or similar leakages that do not affect outside premises. Release of toxic chemicals for short duration. Small fire in the plant.	NA
Level – 2	The emergency, which is confinable within the factory premises.	Leakage of toxic chemicals for long duration. Medium scale explosion confined to the factory premises. Medium scale fire inside the factory premises.	Phosphorus
Level – 3	The emergency, which is not confinable within the factory premises and general public in the vicinity are likely to be affected.	Heavy / Profuse leakage of toxic / flammable gases for a long duration. Explosion of high magnitude affecting the adjacent area.	NA

Table 7-6: Emergency Types

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	Major fire inside the factory premises	

Emergency Plan Objectives

Specific objectives of the Emergency Response Plan are listed with regards to the responses desired for successful management of the possible emergency situations. Suggested Objectives would include:

- To define and assess emergencies
- To control and contain incidents.
- To safeguard the employees.
- To minimize damage to the property and/or the environment.
- To inform the employees, the general public residing around the plant and the authority on the hazards/risks assessed.
- To safeguard provided residual risk, if any, and the role to be played by the employees in the event of emergency.
- To inform the state authorities like Police and Fire Departments, Mutual Aid Centers, Medical Centers to come up for help.
- To effectively rescue and to provide treatment of casualties and to count the injured.
- To identify and list fatal accidents, if any.
- To secure the safe rehabilitation of affected areas and to restore normally.
- To provide authoritative information to the news media for the incident.
- To preserve records, equipments, etc. and to organize investigation into the cause of the emergency and to suggest preventive measures to stop its recurrence.
- To ensure safety of staff and patients and resume work.
- To work out a plan with all provisions to handle emergencies and to provide for emergency.

On-Site Emergency

The On-site emergency plan: deals with, measures to prevent and control emergencies within the factory and not affecting outside public or Environment.

Sr.No.	Code of Practice	Objective	Line of Action
1	In Case of Fire at hazardous chemicals Storage area.	To deal with Fire efficiently and quickly at different locations in the storage area and electrical Panel	Any person notices any sign of fire shall start shouting FIRE, FIRE (Aag, Aag) to seek assistance and also immediately take steps to give warning by blowing the siren continuously and take steps to extinguish the fire by using fire extinguishers available near the site of fire. After giving information reach the spot remove Man & Machinery and take steps to tackle the fire in accordance with the firefighting instructions. Inform at security

Table 7-7: On-Site Emergency Planning



			office to get Ambulance if required.
2	In case of Heavy Spillage, Leakage of chemicals.	To deal with the incidence of chemical spillage or leakage efficiently and Quickly.	Any person who notices any leakage or spillage of chemicals from storage tank, pipe line or from any equipment should try to warn the nearby persons and report to the shift supervisor without any delay. The Person should not go near the spill unless he is wearing a proper PPE and has been fully trained to handle the chemicals leaks.

2 Preventive measures and plant safety

During construction

Safety precaution and preventive measures adopted in built in design, maintenance, instrumentations, handling housekeeping, storage, loading, unloading, transportation etc.

During operation

Colour code system: Will be adopted

Work permit system: Will be adopted

Safety Audit: Internally and externally planned

Breakdown/Periodic maintenance and preventive maintenance schedule: Schedule will be prepared and regular breakdown maintenance is carried out after getting written job order from department where the equipment is used.

Other precautions: All other precautions will be taken (need based) from time to time.

Details of Safety Organization

1. Safety organization chart



Emergency Organization chart



Figure 7-1: Emergency Organization Chart

2. Constitution of Safety Committee

A safety committee will be constituted and it comprises equal number of members from workmen as well as management side. Issues related to safety will be discussed in the meeting and implemented accordingly. Plant manager acts as a chairman of the committee and this meets as and when required.

3. Development of details inspection procedures for various equipment and system

4. Record keeping

All identified vital records of the factory will be kept in safeguard them in the event of an emergency. Back up storage facility will be provided.



Details of training and periodic retraining programs for the personnel of safety and fire department

Security guards who act as firemen during fire emergency are trained, retrained and refreshed on regular basis. Safety professional is sent for external training and some training program also conducted at works site by external experts of the field.

Details of Training and retraining programs for the workers

Training programs on safety aspects with special attention to firefighting are regular feature of company. Plant organizes 3-4 sessions every month on safety aspects and cover good number of workmen in these programs.

All these training programs would at least include the following:

- Lectures
- Seminars and workshop
- Practical Exercises
- Distribution and practice safety instructions
- Safety quiz contests/competitions for individual as also for groups
- Display of safety posters and safety slogans at convenient and conspicuous places.
- Explanation of instructions (in the language easily understood by workers) about the possible hazards involved in handling of chemicals ad methods to deal with such hazards failing which possible emergency situation are likely to arise.
- Developing safety instructions for every job and ensuring practice to these instructions/ booklets or manuals by workers.
- Educating workers about the
 - Physical and health hazards arising out from the exposure of handling substance
 - Measures taken to ensure safety and control physical and health hazards.
 - Measures to be taken by workers to ensure safe handling, loading and unloading.
 - Storage and transportation of hazardous substances
 - Meaning of various labels and marking used on containers of hazardous substances and to whom to report
 - Measures to be taken in case of any spillage or leakage.

Off-Site Emergency

The Off-site emergency plan: deals with, measures to prevent and control emergencies affecting public and the environment outside the premises.

Arrangement made for off- site emergency

Considering distance from district Head Quarters, other nearby external emergency control organization. Following arrangements will be arranged in consultation with DY. DISH, district collectorate, SDM, mamlatdar.

Disclosure of information to neighboring organization and population:

Integrated Chemisol Pvt. Ltd will prepare booklet and circulate among neighboring organization and population containing hazardous operation and chemicals. First aid,



emergency treatment, probable types of emergencies that can arise. Preventive steps will be taken to control emergency. Emergency warning siren code system, to make them aware in advance. Integrated Chemisol Pvt. Ltd. will carry out group get together, acquaintance round, meeting with neighboring public, population to train and make them aware about our operation and preparedness.

The same groups along with external emergency control organization were invited during mock drill, rehearsals for training and acquaintance.

Local crisis group

As per central government notification and DISH office for preparation of offsite emergency plan and Integrated Chemisol Pvt. Ltd. will become member of local level crises group, will set up disaster management center of industrial area using available facility of industries in the area with facility and emergency contact phone numbers.

During emergency with in local group reach in and around industrial area any one can contact DMC – control room situated in both the factories and manned round the clock will initiate actions and arrange to organize resource mobilization and communication.

Communication and warning by Disaster Management Center

When a disaster occurs, the industry affected by the disaster will immediately inform the disaster management center with all available information, the DPMC will act as per the contingency plan and DPMC will also communicate immediately to district Collectorate. The integration of on – site plan with district contingency plan and various functions to be carried out are mentioned in chart OFF – SITE emergency plan as follow:

Emergency Organization Chart



Figure 7-2: Emergency Organizational Chart





Implementation

Allocation of Resources

Key Personnel are identified for carrying out specific and assigned duties in case of any kind of emergency. All such key personnel shall be available on call even on holidays and off duty as well.

- Commander (Office Manager)
- Deputy Commander (Personnel Officer)
- Site Incident Controller (Shift-in-charge)
- Deputy Incident Controller (Deputy to Shift-in-charge)
- Other key personnel
- Essential Workers

Responsibilities of Commander / Deputy Commander

- To reach the identified Emergency Control Center as soon as information for incident is provided and take charge of situation and send his deputy at the place of incident.
- To activate the Emergency Preparedness Plan according to severity of situation.
- To call Safety Officer and Fire Officer with all necessary resources at site of incident.
- To call for outside help from State Fire Department, nearby industries, if required, looking at magnitude of incident.
- Call all key personnel and inform Doctor/Medical Center to be ready for treatment.
- Commander shall deploy staff to carry out following functions.
- To liaise with other departments and guide their personnel.
- To supervise Assembly and Evacuation at all points.
- To look after patients who are bed ridden and any casualties and give psychological support.
- To activate Assembly and Evacuation Plan, if required, as per situation by ordering Site Incident Controller.
- To inform and liaison with Chief Operating Officer, Police Department and District Emergency Authority.
- To inform all the employees and relatives of the affected employees.



- To arrange for chronological records of emergency for future reference and supplement the investigation of incident.
- Issue authorized statements to News Media.
- To ensure prompt action for preservation of evidence and arrange for video shooting/ photographs.
- Deputy Commander to carry out the responsibilities of Commander in his absence and assist him in his duties when present.
- Assign Medicare and Emergency Management tasks to all persons of management cadre
- Responsibilities of Site Incident Controller / Deputy Incident Controller
- To rush to the site of incident and take immediate charge.
- To ensure that immediate steps as per Emergency Preparedness Plan are taken and direct the worker staff accordingly.
- To inform Commander, Deputy Commander and other key personnel for the situation from time to time.
- To blow the Siren as per situation to declare Emergency.
- To supervise assembly and evacuation as per plan, if required, from the site of incident.
- To take decisions for controlling the emergency and incorporate advice given by Commander after taking charge in Emergency Control Centre.
- To ensure that casualties receive adequate attention and medical care.
- To ensure accounting for the personnel present at site of incident and personnel rescued and personnel missing.
- To control traffic movement in the premises.
- To arrange for relief of rescue workers and catering facilities, when emergency is prolonged.
- Deputy Incident Controller shall take charge at site of emergency in the absence of Site Incident Controller.
- When Site Incident Controller shall be present at the site of incident, Deputy Incident Controller shall assist Site Incident Controller or take charge at another location, if emergency exists at more than one place.

Responsibilities of Essential Workers

A task force of essential trained staff will be made available to get work done by Incident Controllers. Such work would include:

- Firefighting using portable extinguishers / hydrants (as feasible) and controlling the spill, if any, till fire department people takes the charge.
- To help the fire brigade, if required.
- Emergency engineering work e.g. isolating equipment, shifting materials, urgent repairing or replacement, electrical work etc.
- Provision of emergency power, water, lighting, material etc.



- Direct movement of people, equipment, special vehicle and transport to or from the scene of the incident and provide barricade to area of incident to prevent unauthorized trespassing.
- Search, evacuation, rescue and welfare, first-aid and medical help.
- Manning of assembly points to record the arrival of evacuated personnel.
- Manning of outside shelters and welfare of evacuated persons there.
- Assistance at casualty's reception areas to record details of casualties.
- Assistance at communication centre to handle outgoing and incoming calls and to act as messengers, if necessary.
- Control of traffic at the premises.

7.6.4 Setting up of Emergency Infrastructure

To enable the key persons to implement the DMP, the following infrastructure will be set up:

Assembly Points

In case of emergency, the site needs to be evacuated immediately. On evacuation, the personnel working in the plant will go to pre-assigned assembly points. The charge will be taken by Shift-in-charge, and in his absence, a person deployed by Commander will be in charge of respective assembly points and will supervise Assembly and Head Count. The sign boards indicating the Assembly Point with number having relevant information will be placed at all such point for guidance. Each assembly point will be earmarked for the personnel from specific plant areas for assembly in the event of emergency.

Task Force of Essential Staff

A task force of essential trained staff will be made available to get the work done by Commander. Task Force personnel will be trained to perform various tasks as mentioned above.

Emergency Control Centre

A small separate room (generally located near Security Office at Main Entry Gate) will be provided to facilitate Emergency Control Centre. This room will be equipped with dedicated and direct communication facilities. The Control Centre will be situated in this area, which is of minimum risk with immediate availability of security personnel nearby. Moreover, the area will be on the arterial road to allow easy access by a vehicle, if other systems fail or extra communication facilities needed to be set up. The Emergency control centre will consist of following items:

- 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, and first aid centers etc.;
- Map of surrounding area with Fire Extinguishers location;
- M.S.D.S.;



- Copy of ON SITE 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;
- Adequate numbers of PPE's.

Fire Fighting

The personnel working in the plant, in case of noticing fire, will immediately raise an alarm and ask the nearest personnel to inform Manager. He may make an attempt to extinguish the fire depending on intensity using a portable fire extinguisher along with other personnel working with him. The severity of fire will be assessed and if it is likely to be severe, will take following steps:

- Call his departmental head/Shift-in-charge to inform about the incident.
- Call fire tenders and mobile trailer pump from nearby fire department.
- Call nearby personnel to move away from the site of incident and go to assembly points.
- Arrange for switching off electricity supply to that specific area of incident.
- Manager shall review the steps taken by Shift-in-charge in his capacity as COMMANDER and will reach "Emergency Control Room".

Steps in Case of Spreading of fire

Commander, after taking charge of the situation, will continuously assess the situation and if it is not being controlled then ensure:

- Ensure evacuation, in orderly fashion and assembly of all persons at the assembly points.
- Arrival of fire tenders and/or Mobile Trailer Pump from outside resources.
- Ensure that any vehicle parked near the fire site is taken away to safe area.

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.
 - 1. All persons working inside the plant.
 - 2. Key Personnel outside during normal working hours & during off-duty hours.
 - 3. Outside emergency services, Statutory and Local Authorities &
 - 4. 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 begin with raising the alarm declaring the emergency, Telephone messages and Procedure to communicate the emergency to other persons & General Public.

Treatment of affected persons

Injured / Affected persons will be provided suitable first-aid treatment and sent to the Company's Doctor and/or designated local medical center nearby in town for further treatment depending on injury.

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Patients requiring further treatment shall be sent in Ambulances to Hospitals in nearest area.

Patients suffering from minor problems will be discharged and sent home after preliminary treatment by the Company's Doctor.

Post Emergency Activities

Medical check up

Medical checkup of affected persons in the incident, if any, will be carried out, and suitable medical aid shall be provided to set right the problem.

Collection of Records

All possible evidences will be collected along with shift logs and personnel nearby or connected with the incident will be called for narrating the details so as to facilitate finding of the most probable and convincing cause of incident and emergency situation. The proposed procedure will help in suggesting the remedial measures for preventing recurrence.

Inquiry

Detailed inquiry for the incident will be carried out to find out the cause, which will be in the form of fact finding mission and recommendations made to the suitable authority.

Training

Regular training program for all the concerned personnel will be conducted to enable them to face any type of emergency situation, be it natural disaster, fire in equipment, building or any explosion in equipment.

Review of Emergency Performance

The site/head office management will review the findings of the audit and the noncompliances. It will consider whether the DMP is providing adequate safety assurance to the management, delivering performance as desired, and whether it continues to be in the spirit of Environment, Health and Safety Policies and changing requirements. On the basis of these, the management will record its decisions and consider modifying the DMP, as deemed appropriate.

7.6.5 Occupational Health and Safety Programme

M/s. Integrated Chemisol Pvt. Ltd. has prepared the Occupational Health Surveillance Programme which shall be followed right from the project construction & erection phase and the same shall be updated for the upcoming new facility, if required.

The details of the same are described in the following sections.

1. First Aid

The First Aid kit as per Gujarat Factory Rules.



2. Plan for Periodic Medical Checkup As Per Gujarat Factory Rules.

3. Safety Trainings & Mock Drills

Safety trainings (on Safe Material Handling, First Aid, & all Safety Aspects) shall be provided by the Safety Officers.

4. Mock Drills

• 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.

7.7 Socio Economic

The social management plan proposes to improve the quality of life of inhabitants of nearby villages.

Social – Awareness on project benefits, gender empowerment, increases livelihood opportunities due to proposed project and generating community participation.

Health – Awareness on health, hygiene, environmental sanitation and generic issues related to improving quality of life with specific emphasis on potable drinking water, HIV/AIDS/STI mitigation.

Infrastructure – Developing prioritized infrastructure facilities which are related to the continuum of project benefits to the local communities and area as a whole.

Details on Corporate Environment Responcibility are givne in Section 6.2, Chapter 6.