**Final Report**
**October 2022**

# Environmental Impact Assessment (EIA)
## Medical & Hazardous Waste Incineration and
# Waste Material Recovery and Recycling Facility

EMC Pakistan
Private Limited

Eco Care
Waste Management (Pvt)Ltd

# Eco Care Waste Management Private Limited

## Environmental Impact Assessment (EIA)

# Medical & Hazardous Waste Incineration and Waste Material Recovery and Recycling Facility

**Final Report**
**October, 2022**
Ref: EIA/01/10/22


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# EXECUTIVE SUMMARY

This report presents the findings of the Environmental Impact Assessment (EIA) study conducted by EMC Pakistan Pvt. Ltd for the proposed Medical and Hazardous Waste Incineration and Waste Material Recovery & Recycling Facility Off-Northern Bypass, Karachi. The proponent of the proposed Project is ***Eco Care Waste Management Private Limited***. The Environmental Impact Assessment (EIA) of the Proposed project has been carried out in compliance with the mandatory requirement of Section 17 of Sindh Environmental Protection Act, 2014 which requires that:

***"No proponent of a project shall commence construction or operation unless he has filed with the Agency an initial environmental examination or environmental impact assessment, and has obtained from the Agency approval in respect thereof."***

The objective of the project is to construct an incineration and waste material recovery and recycling facility, which after completion will provide services to incinerate pharmaceutical & clinical waste. The project aims for safe disposal of medical and industrial hazardous waste.

The proposed incinerator project comprises of two incinerators, to be installed and operationed one after other and waste material recovery and recycling facility at Survey # MB5A, Plot # 75, Sector O, Muhammad Khan Colony, Ittehad Town, Karachi. It is situated at Opposite Street, Al-Asif Kanta, near Asim Steel.

The salient features of the project are as under:

| **Table 1.1: Project Details** | |
|---|---|
| **General** | |
| Project Title | Medical & Hazardous Waste Incineration and Waste Material Recovery and Recycling Facility |
| Project Location | Survey # MB5A, Plot # 75, Sector O, Muhammad Khan Colony, Ittehad Town, Karachi |
| Proponent | M/s Eco Care Waste Management Pvt. Ltd. |
| Total Area of Plot | 4800 sq.yds |
| Current status of the project | Design Phase |
| Project Cost | 50 Million PKR |
| **Plant Specifications** | |
| Burning Capacity | 500 kg/hr |
| Operational Hours | Initially 8 hrs per day, then 2 shifts/day each of 8 hr |
| Chimney Height | 35' |
| Refractory | Alumina 17 Refractory |
| Max design temperature of refractory | 1600°C |
| Temperature in Chamber 1 | 800°C-1000°C |
| Temperature in Chamber 2 | 1400°C-1500°C |
| Combustion Air System | Induced Drafting By Fan |
| Cooling System | Air Cooling Between Shells |
| Ignition System | Diesel Oil Burner With Sparking Electrodes |
| Operation System | Sequential Starting And Stopping Wi Th On/Off Control Depending On Furnace And Exhaust Gas Temperatures And Automatic Shut-Off For Safety |
| Burner System | Low NOx burners |

| **Table 1.1: Project Details** | |
|---|---|
| Number of Chamber | 2 (Primary and Secondary Chambers) |
| Fuel | LPG, Natural Gas |
| Type of waste to be Incinerated | Medical waste (excluding body parts), hazardous industrial waste (waste chemicals, fuels, oils, pharmaceutical waste) |
| Waste material recovery and recycling | Chemical drums, cartons, packaging |
| Ancillary facilities (incinerator) | Emergency Cleaning Door, Ash Removing Door, Inspection Pit |
| Ancillary facilities (waste material recovery and recycling) | Table Cutter, Shredder, Waste Press Machine |

Project site is located in an industrial area Off-Northern Bypass (M10). Nearby entitites include Asim Steel, AT Engineering Workshop, Dua Trading, Ghafoor Enterprises, Rechina recycling plant, Sai Steel Re-rolling Mills, Al-asif Weighbridge, etc.

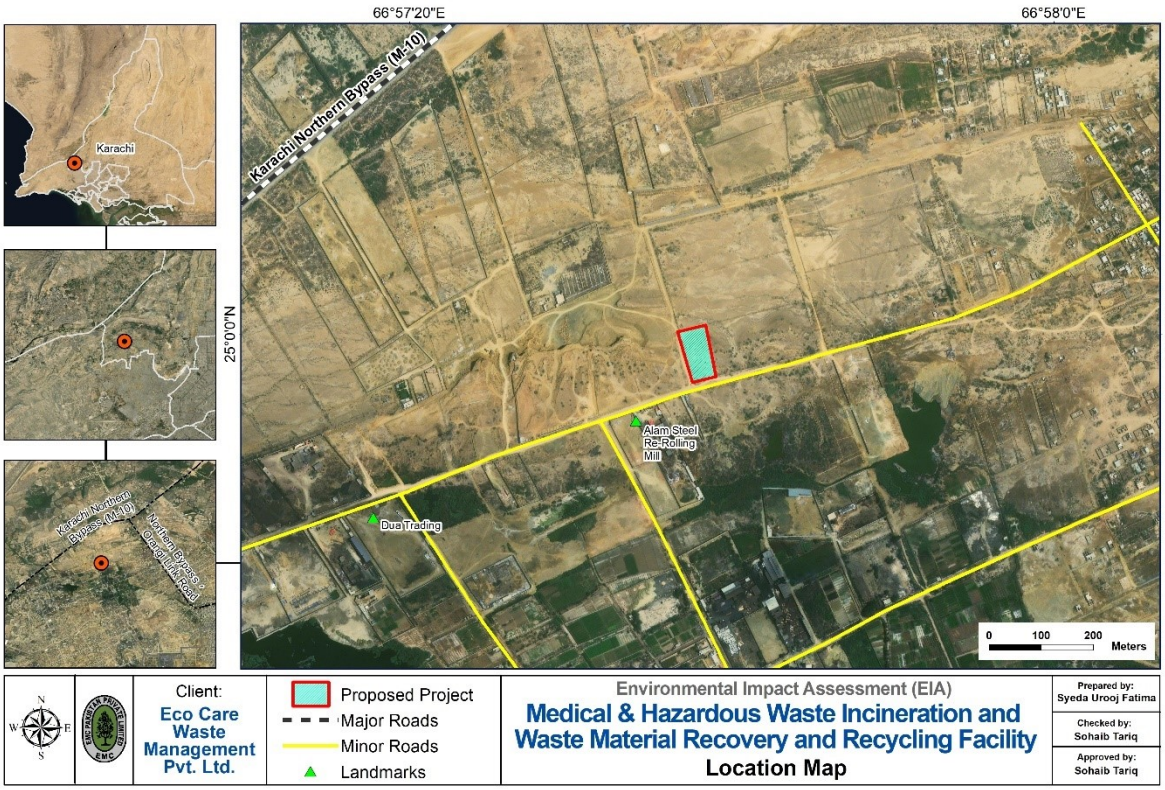


**Figure ES-1: Location Map**

The baseline conditions of the project area were studied based on the results of the investigations conducted by the field study team as well as through studying available materials and literature. Ambient air monitoring, and noise level Monitoring of the project area was also carried out through EPA approved laboratory. Results of the air and noise monitoring are within SEQS.

The likely adverse environmental impacts during the construction phase will include the following: degradation of soil, soil erosion due to improper disposal of excavated materials and construction waste; spillages of hazardous substances during the construction; pollution of groundwater resources and soil by construction run-offs; use of temporary construction sites (access roads, camps, machinery sites,

storage facilities, etc.); temporary air pollution related to increased truck traffic during the construction, release of dust from digging -loading works and heavy machinery operation; noise and vibration disturbances; occupational hazards during construction works.

The likely adverse environmental impacts during the operation phase include: emissions to atmosphere associated with the waste incineration, dumper truck movements and operation of standby power generators due to emission of pollutants originated during burning of fuel; impacts on water and soil as a result of improper waste management including ash management and discharge of wastewater without treatment.

The measures specifically developed for the construction phase of the project include: construction materials storage, monitoring of these sites closely so that they do not expand unduly during construction; compacting the top surface of access roads and worksites to facilitate water runoff and avoid flooding the area; conduct dust-depressing measures aimed at prevention of air pollution; use closed/covered trucks for transportation of loose construction materials; regular check of proper technical conditions of machinery and equipment; disposal of excavated materials and construction waste in agreed disposal sites; ban the disposal of waste into water channels. Where possible; restoration to original conditions of the landscape after completion of construction works; use of appropriate safety equipment by the personnel involved in construction works.

Mitigation measures proposed for the operation phase include: follow standard operating procedures for incinerator operations, focusing on type of waste to be incinerated, ensuring that temperature in primary and secondary chamber is as per specifications, ensuring the effective operation of emission controls, use of wet scrubber, regular maintenance of all machinery and equipments, Regular monitoring of air emissions to check compliance with SEQS, ash management, wastewater treatment before disposal, ensure presence and working condition of fire-fighting equipment. The bottom ash will either be sent for utilization in cement and road making or will be disposed in authorized disposal sites. The project will provide a consolidated platform for the safe disposal of medical and hazardous waste.

The project is not expected to have long-term significant or irreversible negative environmental impacts neither at the construction nor at operation phase. There are no specially protected areas or threatened or endangered endemic species in the project area.

The likely adverse impacts mentioned above can be prevented, minimized and additional loads on natural resources can be minimized by timely and due implementation of mitigation measures provided in the Environmental Management Plan (EMP). To ensure effective implementation of EMP, environmental monitoring plan has also been developed for each phase of the project.

In summary, based on the findings of this assessment there is no reason why the facility proposed for the site should not be authorized, contingent on the mitigations and monitoring for potential environmental and socio-economic impacts as outlined in the EIA and EMP being implemented.

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**ANNEXURES**

Annex – I: Sindh Environmental Protection Act, 2014

Annex – II: Sindh EPA Environmental Assessment Regulations, 2021

Annex – III: Sindh Environmental Quality Standards (SEQS)

Annex – IV: Environmental Monitoring Reports

# Chapter 1 INTRODUCTION

## 1.1 General

This Report presents the findings of the Environmental Impact Assessment (EIA) study conducted by EMC Pakistan Pvt. Ltd for the proposed two Incinerators, to be installed and operated one after other, with a capacity of 500kg/hr/incinerator and waste material recovery and recycling facility at Survey # MB5A, Plot # 75, Sector O, Muhammad Khan Colony, Ittehad Town, Karachi. The EIA study has been conducted in compliance with the mandatory requirements of Section 17 of the Sindh Environmental Protection Act, 2014 and the rules & regulations framed thereunder.

Environmental Impact Assessment is a planning tool accepted as an integral component of sound decision-making. The purpose of EIA is to give the environment its due place in the decision-making process by clearly evaluating the environmental consequences of the proposed activities before action is taken. Early identification and characterization of critical environmental impacts allow the public and the government to form a view about the environmental acceptability of the proposed development project and what conditions should apply to mitigate, reduce or compensate those risks and impacts.

Field surveys were conducted in the study area by EMC Pakistan Pvt. Limited team, which included environmentalists, sociologists, and ecologists. Field data collection included observational surveys, consultations, and meetings for data collection with government departments, Communities, and ground verification of available secondary information. Secondary information was collected from proponent in-house sources, Government Departments, and NGOs. Applicable international guidelines, conventions, and environmental assessment procedures prepared by the Sindh EPA have been gone through while preparing this document.

### 1.1.1 Project Proponent

**M/s Eco Care Waste Management Pvt. Ltd.**
Mr. Aarish
Contact: 0300-8521866

## 1.2 EIA Consultant

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## 1.3 Project Need

Increasing industrialization and waste management challenges in Karachi has necessitated the need of more waste management facilities in the metropolitan city. Karachi generates over 12,000 tons of solid

waste per day (Sabir et al., 2016)[1]. Incineration as a waste management facility is capable of treating all types of solid waste, including hazardous and non-hazardous hospital, municipal and, industrial waste. Incineration facility is more effective in waste management as compared to other alternatives because it can reduce the volume of waste to 95-97%. Presently, there is no planned landfill facility in the Karachi division, although it is planned to be developed. In the absence of a planned landfill site, alternative waste management practices like Autoclaving and Chemical Treatment are not possible as these alternatives do not reduce the volume of the waste generated. For open dumping of the waste, incineration is the only feasible option available for hazardous and non-hazardous management.

Waste is an unavoidable by-product of most human activity. Economic development and rising living standards in the city have led to the increase in the quantity and complexity of generated waste, whilst industrial diversification and the provision of expanded health-care facilities have added substantial quantities of industrial hazardous waste and biomedical waste into the waste stream with potentially severe environmental and human health consequences. Karachi city is unable to manage medical waste by applying scientific methods. Hospital waste is simply mixed with municipal waste in roadside collection bins and disposed of similarly which is not acceptable. Hazardous, hospital and industrial waste are being treated as ordinary wastes.

The installation and operation of an incinerator facility in Karachi with waste material recovery and recycling facility is conceptualized by the proponent based on the intention to aid the local industry and the public sector to manage the hazardous and non-hazardous waste of the city. It will increase the infrastructural capacity of the city to manage the increasing issue of solid waste management. Moreover, several industrial and hospital facilities in Karachi are ISO 14001 certified that requires proper disposal of hazardous and non-hazardous waste. The proposed commercial incineration facility will not only help to meet the environmental regulations under the Sindh Environmental Protection Act, 2014 but also aid the economic and industrial base of Karachi to be environmentally and social responsible.

## 1.4 The Project at a Glance

The proposed project involves construction/installation and operation of two incinerators and a waste material recovery and recycling facility. The project will provide a consolidated platform for safe disposal of medical and hazardous industrial waste.

The salient features of the project are as under:

| **Table 1.1: Project Details** | |
|---|---|
| **General** | |
| Project Title | Medical & Hazardous Waste Incineration and Waste Material Recovery and Recycling Facility |
| Project Location | Survey # MB5A, Plot # 75, Sector O, Muhammad Khan Colony, Ittehad Town, Karachi |
| Proponent | M/s Eco Care Waste Management Pvt. Ltd. |
| Total Area of Plot | 4800 sq.yds |
| Current status of the project | Design Phase |
| Project Cost | 50 Million PKR |
| **Plant Specifications** | |

[1] Sabir, W., Waheed, S. N., Afzal, A., Umer, S. M., Rehman, S. J. J. o. E., & Sciences, S. (2016). A study of solid waste management in Karachi city. *4*(2), 151-163.

| Table 1.1: Project Details | |
|---|---|
| Burning Capacity | 500 kg/hr |
| Operational Hours | Initially 8 hrs per day, then 2 shifts/day each of 8 hr |
| Chimney Height | 35’ |
| Refractory | Alumina 17 Refractory |
| **Max design temperature of refractory** | 1600°C |
| **Temperature in Chamber 1** | 800°C-1000°C |
| **Temperature in Chamber 2** | 1400°C-1500°C |
| Combustion Air System | Induced Drafting By Fan |
| Cooling System | Air Cooling Between Shells |
| Ignition System | Diesel Oil Burner With Sparking Electrodes |
| Operation System | Sequential Starting And Stopping Wi Th On/Off Control Depending On Furnace And Exhaust Gas Temperatures And Automatic Shut-Off For Safety |
| Burner System | Low NOx burners |
| Number of Chamber | 2 (Primary and Secondary Chambers) |
| Fuel | LPG, Natural Gas |
| Type of waste to be Incinerated | Medical waste (excluding body parts), hazardous industrial waste (waste chemicals, fuels, oils, pharmaceutical waste) |
| Waste material recovery and recycling | Chemical drums, cartons, packaging |
| **Ancillary facilities (incinerator)** | Emergency Cleaning Door, Ash Removing Door, Inspection Pit |
| **Ancillary facilities (waste material recovery and recycling)** | Table Cutter, Shredder, Waste Press Machine |

## 1.5 Project Location

The proposed project site is located at Survey # MB5A, Plot # 75, Sector O, Muhammad Khan Coloney, Ittehad Town, Karachi.

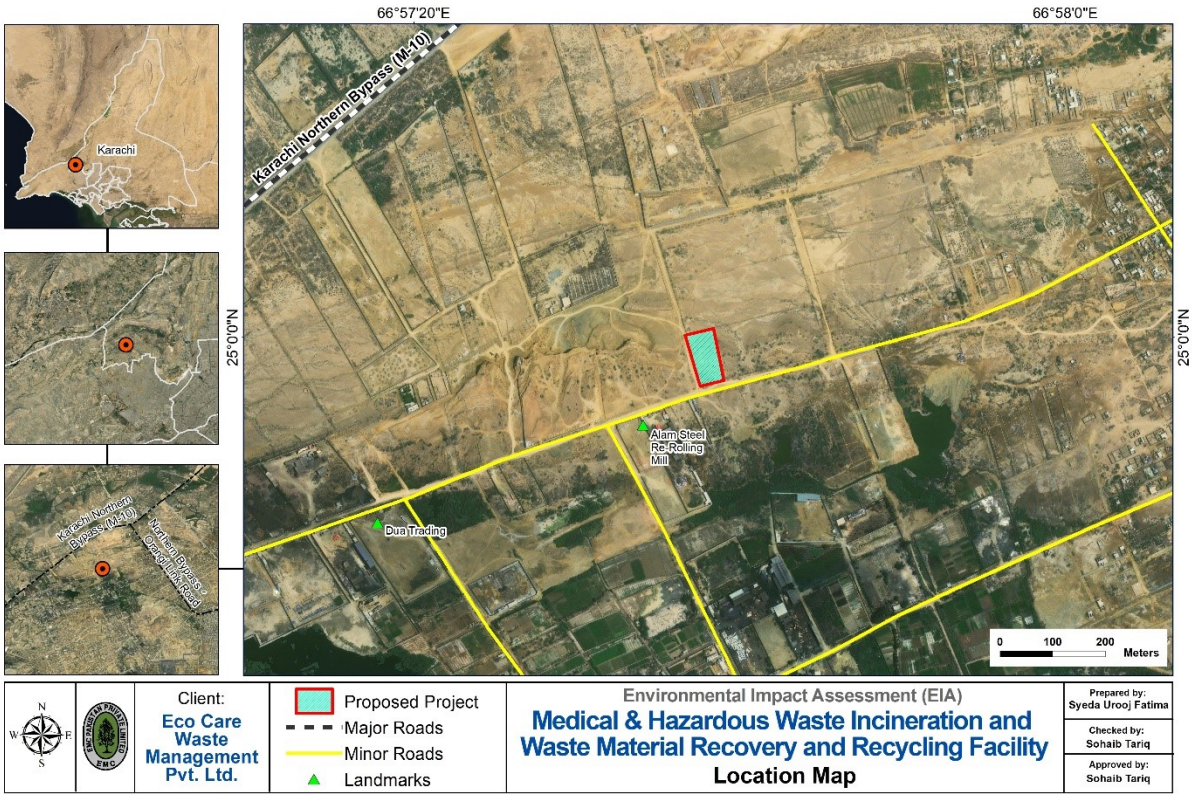



**Figure 1.1: Project Location**

## 1.6 Need of EIA Study

Environmental Impact Assessment of Incinerator Plant with an operational capacity of 2x500 kg/hr and waste material recovery and recycling has been carried out in compliance with the mandatory requirement of Section 17 of Sindh Environmental Protection Act (SEPA), 2014, which requires that:

***"No proponent of a project shall commence construction or operation unless he has filed with the Agency an initial environmental examination or environmental impact assessment, and has obtained from the Agency approval in respect thereof."***

This Environmental Impact Assessment report presents the evaluation of environmental impacts of the construction and operation of the proposed Incinerator project.

## 1.7 Project Categorization

Sindh Environmental Protection Agency (Environmental Assessment) Regulations, 2021 categorize projects into three separate schedules depending on whether a project requires an Environmental Checklist (Schedule-I) or an IEE (Schedule-II) or EIA (Schedule III). The Regulations also require that all projects located in environmentally sensitive areas need submission of an EIA.

On the basis of the nature and scope of project, it has been accordingly categorized into Schedule-III

**Schedule-III**, (EIA Project)

**Category H:** Waste Disposal and treatment

**Sub category:** 1. Facilities for handling, storage or disposal of hazardous or toxic wastes or radioactive waste (including landfill sites, incineration units, etc.)

Therefore, an EIA has been undertaken for the proposed incinerator Plant.

## 1.8 Scope and Objectives of the EIA Study

The main objectives of the Environmental Impact Assessment (EIA) study are to:

- Describe the project & all the activities to be carried out during the life of the project, including design, construction, operation, or any other activities relating to the project.
- Describe the key components of the microenvironment & macro environment of the project area.
- Identify, analyze and evaluate the type and extent of likely potential environmental and social impacts with emphasis on significant beneficial/adverse effects the proposed Project will cause on the existing biological, physical, and socio-economic environments of the project area.
- Recommend mitigation measures and strategies to minimize or avoid adverse environmental and social impacts, including monitoring plans for implementing the mitigation measures.
- Environmental Management Plan for sustainable construction and operation of the project is developed which forms an essential part of the EIA report.
- Fulfill the legal requirements of section 17 of SEP Act, 2014.
- Assist planners and decision-makers in evaluating the project's feasibility based on its potential environmental impacts.

## 1.9 Methodology of EIA

Environmental Impact Assessment (EIA) is a systematic process that identifies and evaluates the potential impacts (positive and negative) that a proposed project may have on the biophysical and socio-economic environment. It identifies mitigation measures that need to be implemented in order to avoid, minimize, or reduce the negative impacts and also identifies measures to enhance positive impacts. The EIA is not a fully linear process, but one where several stages are carried out in parallel and where the assumptions and conclusions are revisited and modified as the project progresses. The following sections provide additional detail regarding the key stages in this EIA process. These stages are:

### 1.9.1 Obtaining Project Specific Data

This was the very first step to embark on the study initiated through meetings held with the officials of Proponent. In the meetings, discussions were made to clarify the nature and extent of the project in environmental perspectives. Basic information of proposed project activities was collected from the proponent was analyzed by the experts to comprehend the project & to assess its influence on the environment.

### 1.9.2 Literature Review

While the project details were being acquired, a desktop study was also initiated simultaneously to draft environmental baseline information of the project area. The desktop study comprised literature review, collection of updated authenticated published/printed data on the physical, ecological, and social

environment related to the focused area. The same was also used to delineate the scope of surveys, which would then form the basis of environmental assessment.

### 1.9.3 Stakeholder Consultation

Stakeholder consultations were held to involve the public in the decision-making process and to have a fair interaction with all community groups and to assure them that every attempt would be made to reduce the negative impacts of the project, and that adequate remedial measures would be taken to recompense the loss of the affected persons if any.

### 1.9.4 Reconnaissance and Detailed Surveys

Preliminary surveys of project location were organized by EMC Pakistan Pvt. Ltd., in which experts visited the area and assessed the physical scenario in order to plan various detailed studies. The relevant surveys were carried out under the supervision of environmental experts. A preliminary socio-economic evaluation was also undertaken. This was followed by detailed and comprehensive surveys that were carried out in order to investigate various domains of environment and socio-economic sector to highlight various issues and concerns that may lead to the identification of aspects and subsequent assessment of impacts.

A detailed environmental baseline survey was conducted to collect primary data in the Project surrounding to identify sensitive receptors. The primary data were examined and compared with secondary data available from earlier environmental studies in the region. The scope of the survey included the collection of information on the following key aspects:

Collection of environmental and social baseline data of the project area, including the following items:

- Climate and Rainfall
- Air Quality
- Noise Quality
- Land and Soil
- Geology
- Hydrology
- Vegetation
- Fauna
- Geomorphology
- Administrative Division
- Nearby settlements
- Socio-Economic Activities
- Land use
- Infrastructure & Social Services

### 1.9.5 Aspects Identification

The EIA process requires the development of an inventory of all possible environmental and socio-economic aspects. The aspects provide the basis of categorization and evaluation of impacts and their likelihood to occurrence due to the materialization of the project. Aspects are those which are the causes of positive and negative impacts. Those aspects are primarily associated with activities performed during the construction and operation phases of the project.

### 1.9.6 Impact Assessment & Mitigation Measures

Based on the developed aspects inventory, experts analyzed the aspects for their logical outcome as potential impacts on the physical, ecological, and social environment. These impacts have been identified, assessed, and weighed for different activities during construction, commissioning, and

operational phases of the project. Mitigation measures were also proposed for various activities of projects in order to minimize the potential impacts during the life span of the project.

### 1.9.7 Environmental Management & Monitoring Plan

In the light of impacts identified and mitigations proposed, an Environmental Management Plan (EMP) has been developed, which has a pivotal role in assigning tasks to personnel for the environmental management and implementation of mitigation measures as well as to monitor its effectiveness throughout the life cycle of the project. It also provided monitoring plans/procedures to be followed for checking and compliance maintenance of environmental quality and legal requirements through suggested mitigation measures.

### 1.9.8 Documentation Review & Conclusion

This is the final step to complete the environmental assessment and compile all the work done in the shape of a report. Report writing started just after the initiation of environmental assessment. The report has been written by experts of EMC and compiled by the office staff in coordination with the experts. At the end of the study, the entire report is reviewed by the team leader followed by recommendations and conclusion in the light of the assessment.

### 1.9.9 Report Structure

The EIA report has been structured on the standard format prescribed by the EPA. The Report has been presented in the following sections:

**Chapter 1:** Provides an overview of the project and objectives, scope, approach and methodology adopted for the study;

**Chapter 2:** Provides an overall description of project activities;

**Chapter 3:** Gives an overview of policy and legislation along with international guidelines relevant to the project

**Chapter 4:** Provides description of the microenvironment and macro environment of the project area. This chapter contains the description of the physical environment, socio-economic condition, and built environment of the area.

**Chapter 5:** Provides details of stakeholder consultation and the issues and concerns raised by the stakeholders and interested parties.

**Chapter 6:** Describes the potential environmental and social impacts of the proposed Project. General and project-specific guidelines were used to assess the potential environmental impacts at the various stages - designing, construction, and operations of the project.

**Chapter 7:** Presents the Environmental Management Plan and Monitoring Program for the project

**Chapter 8:** Summarizes the report and presents its conclusions.

## 1.10 Study Team

| Table 1.3: List of EIA Study Team | | |
|---|---|---|
| **S. No** | **Names** | **Positions** |
| 1. | Mr. Syed Nadeem Arif | Project Manager |
| 2. | Mr. Ahmed Zohair | Environmental Engineer |
| 3. | Mr. Muhammad Haseeb | Environmental Specialist / Project Coordinator |
| 4. | Mr. Tanvir Arif | Social Expert |
| 5. | Mr. Syed M. Omer Arif | Environmental Engineer |
| 6. | Mr. Sohaib Tariq | Environmental Engineer |
| 7. | Mr. Muhammad Muddasir | Environmental Engineer |
| 8. | Mr.Ehtisham Ahmed | Sociologist |
| 9. | Mr. Shehryar Saleem | Field Social Staff |
| 10. | Mr. Sajid Ali | Field Sampling Staff |

# Chapter 2 PROJECT DESCRIPTION

## 2.1 The Project

The proposed incinerator project comprises of two incineration units and waste material recovery and recycling facility to be constructed/installed and operated on Survey # MB5A, Plot # 75, Sector O, Muhammad Khan Coloney, Ittehad Town, Karachi.

## 2.2 Project Location

Siting of the Incinerator Plant at measuring 4800 sq.yds situated Off-Northern Bypass (M10), Karachi by M/s Eco Care Waste Management Pvt. Ltd. therefore duly authorized.

Nearby entitites include Alam Steel, AT Engineering Workshop, Dua Trading, Ghafoor Enterprises, Rechina recycling plant, Sai Steel Re-rolling Mills, Al-asif Weighbridge, etc.

## 2.3 Project Details

The salient features of the project are as under:

| **Table 1.1: Project Details** | |
|---|---|
| **General** | |
| Project Title | Medical & Hazardous Waste Incineration and Waste Material Recovery and Recycling Facility |
| Project Location | Survey # MB5A, Plot # 75, Sector O, Muhammad Khan Colony, Ittehad Town, Karachi |
| Proponent | M/s Eco Care Waste Management Pvt. Ltd. |
| Total Area of Plot | 4800 sq.yds |
| Current status of the project | Design Phase |
| Project Cost | 50 Million PKR |
| **Plant Specifications** | |
| Burning Capacity | 500 kg/hr |
| Operational Hours | Initially 8 hrs per day, then 2 shifts/day each of 8 hr |
| Chimney Height | 35’ |
| Refractory | Alumina 17 Refractory |
| **Max design temperature of refractory** | 1600°C |
| **Temperature in Chamber 1** | 800°C-1000°C |
| **Temperature in Chamber 2** | 1400°C-1500°C |
| Combustion Air System | Induced Drafting By Fan |
| Cooling System | Air Cooling Between Shells |
| Ignition System | Diesel Oil Burner With Sparking Electrodes |
| Operation System | Sequential Starting And Stopping Wi Th On/Off Control Depending On Furnace And Exhaust Gas Temperatures And Automatic Shut-Off For Safety |
| Burner System | Low NOx burners |
| Number of Chamber | 2 (Primary and Secondary Chambers) |
| Fuel | LPG, Natural Gas |
| Type of waste to be Incinerated | Medical waste (excluding body parts), hazardous industrial waste (waste chemicals, fuels, oils, pharmaceutical waste) |

| Table 1.1: Project Details | |
|---|---|
| Waste material recovery and recycling | Chemical drums, cartons, packaging |
| Ancillary facilities (incinerator) | Emergency Cleaning Door, Ash Removing Door, Inspection Pit |
| Ancillary facilities (waste material recovery and recycling) | Table Cutter, Shredder, Waste Press Machine |

Main components of the Incinerator plants include;

- Primary & Secondary Chamber
- Heat Sheild
- Dilution Damper
- Charging Door
- Exhaust Fan
- Charging Drum (Double Safety)
- Ignition Burner
- Rotary Cup Burner
- Control Panel
- Burner Air Damper
- Furnace Air Damper

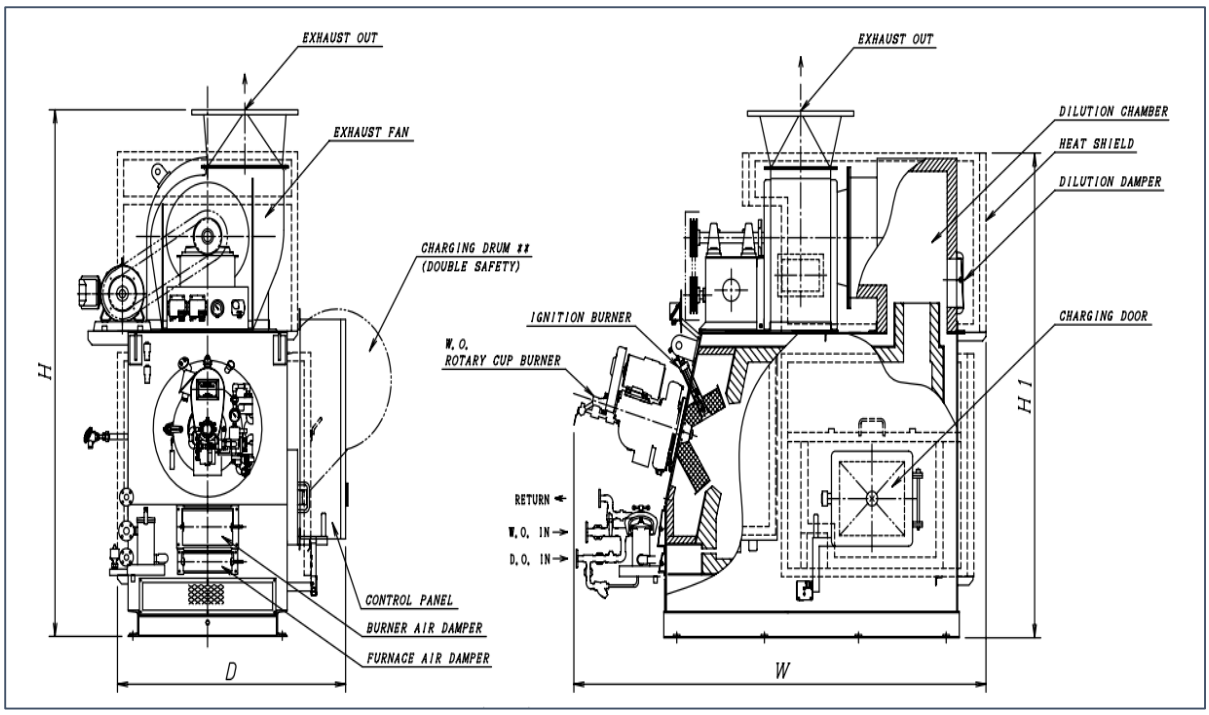



**Figure 2.1: Main components of the Incinerator plant**

## 2.4 Incineration Process

Waste from different sources (medical waste, hazardous industrial waste) will be transported to the project site via covered trucks in safe manner. If segregation required, liquid waste will be segregated and may be mixed with saw dust and left to dry. Once the waste is dried, it will be collected in bags and trolleys and feed in combustion chamber for complete burning of waste. A detailed process flow chart is presented below.

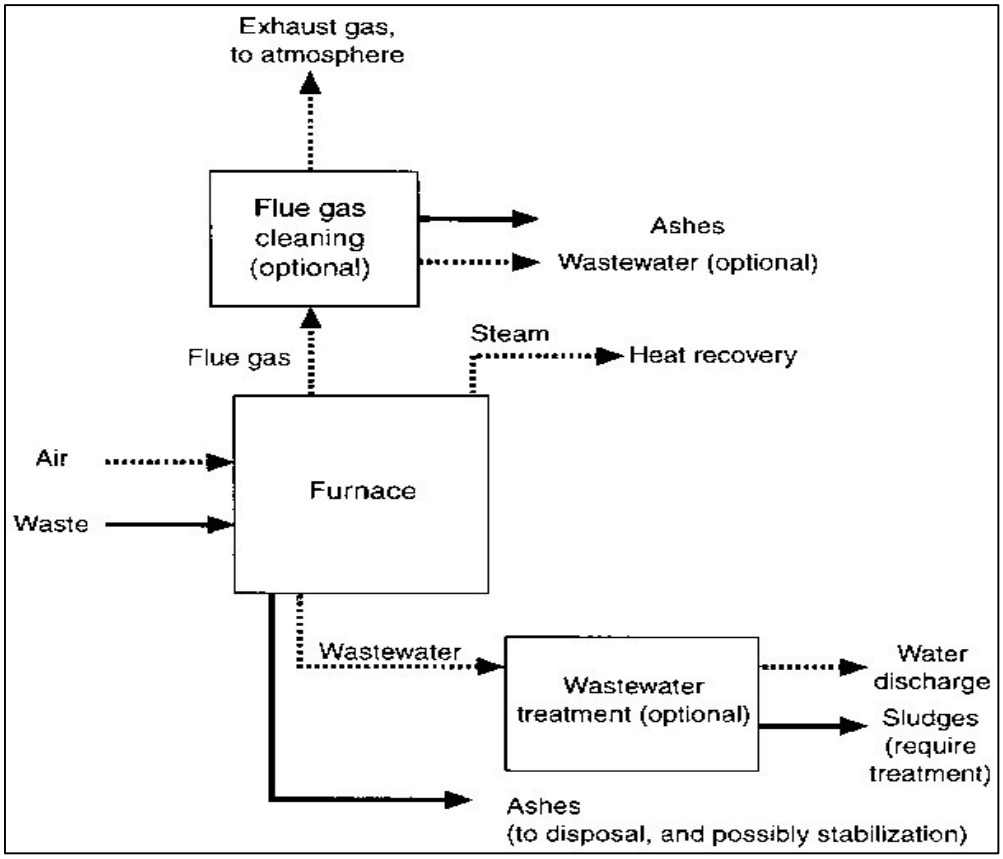



**Figure 2.2: Incineration Process Flow Chart**

Recyclable waste material such as empty drums, cartons and packaging will be recovered from waste.

## 2.5 Construction and Installation Activities

Typical Construction and installation activities will include;

- Land clearance and leveling
- Excavation for foundation
- Boundary wall construction
- Office building construction
- Waste storage area development
- Masonry work for Incinerator plant installation
- Installation/construction of Incinerator plant and its ancillary facilities and Mechanical and electrical works
- Installation/construction of waste material recovery and recycling section
- Landscaping
- Restoration

## 2.6 Work force

During construction phase, around 30 persons per day will be employed, whereas, operational phase will involve employment of around 10-20 personnel for the daily operations. Local workforce will be preferred for general construction work. The technical staff for installation of incinerator will use daily outback option.

## 2.7 Utilities Requirements

### 2.7.1 Electricity

**A. Construction**

During construction mobile Gensets will be used to meet electricity requirement. The estimated electrical load of the proposed project will be ***50 units/day.***

**B. Operation:**

During operation phase the electricity will be required for Office use and for Plant operation. During operation of incinerator plants electricity will be sourced from K-Electric. The estimated electrical load of the proposed project will be ***600 units/day.***

Backup Power

Generator will be made available for backup power in case of acute power failure.

### 2.7.2 Water Consumption

**A. Construction**

During construction, water will be supplied through Water tankers and through city water supply. Water requirement for construction activities is estimated as 50 US Gallons/day.

**B. Operation**

Water requirement during operation phase will be for drinking, domestic purpose and for scrubber. For drinking purpose bottled water will be used while for domestic and scrubber water will be obtained from existing water supply system and water tankers. Approximate water requirement during operations is estimated as 500 gallons per day.

## 2.8 Approvals

Approvals are in process.

## 2.9 Project Alternatives

Identification and assessment of feasible alternatives to project design and implementation is among the main components of Environmental Impact Assessment procedures. Alternatives illustrate and contrast the environmental implications and consequences of different options available to achieve the proposed objective. In this way, both the proponent and the authorities who must consider granting the authorization, are put in a position where all involved are able to make informed choices or decisions.

Selection of preferred alternative is based on scores of factors including cost, schedule of delivery, environmental and social impact and the cost for their redressal. The drivers that affect potential alternative options and scenarios include: availability of project sites, current technologies; design changes that need to be introduced, operational situation, capital & recurrent costs, environmental & social issues, their potential impacts, and costs of mitigation. The "No Project" alternative situation is taken into account to demonstrate the need of the Project. In consideration of the different drivers, potential alternatives within the Project are restricted to the following aspects:

- No Project Option
- Project Alternatives
  - Technology selection
  - Availability of site and infrastructure
  - Availability of appropriate energy source

**No Project Alternative**

No project alternative would mean that this project is not executed and the plan for waste incinerators and material recovery and recycling facility is scrapped. However, safe disposal of hazardous industrial and medical waste remains a major problem in Karachi. The increasing demand of environmentally safe disposal of hazardous nature will not be completely met if the project is not implemented. The No project alternative does not hold ground because it would mean keeping the populace exposed to toxic waste as proper incineration and waste recovery facilities are not provided.

**Project Location**

The project is located within an industrial area, away from urban centers. Therefore it provides an optimal opportunity to incinerate the waste in shortest possible time and avoid additional impact to environment and people and by minimizing long distance transportation.

**Availability of energy sources**

The industrial area has availability of electricity, gas and water supply as the project would use from the amount sanctioned to the facility.

**Technological Alternatives**

**Moving Grate Incinerator**

The moving grate enables the movement of waste through the combustion chamber to be optimized to allow a more efficient and complete combustion. A single moving grate incinerator can handle up to 35 metric tons (39 short tons) of waste per hour, and can operate 8,000 hours per year with only one scheduled stop for inspection and maintenance of about one month's duration. The waste is introduced by a waste crane through the "throat" at one end of the grate, from where it moves down over the descending grate to the ash pit in the other end. Here the ash is removed through a water lock. The holes in the grate elements supplying the primary combustion air are visible. Part of the combustion air (primary combustion air) is supplied through the grate from below through holes in grate elements. This air flow also has the purpose of cooling the grate itself. Cooling is important for the mechanical strength

of the grate, and many moving grates are also water-cooled internally. Moving grate incinerators are primarily used for the incineration of Municipal Solid Waste (MSW).

**Pollution Control Technologies**

Particulate is collected by particle filtration, most often electrostatic precipitators (ESP) and/or baghouse filters. The Baghouse filters are generally very efficient for collecting fine particles.

Acid gas scrubbers are used to remove hydrochloric acid, nitric acid, hydrofluoric acid, mercury, lead and other heavy metals. The efficiency of removal will depend on the specific equipment, the chemical composition of the waste, the design of the plant, the chemistry of reagents, and the ability of plant operators optimize these conditions, which may conflict for different pollutants. For example, mercury removal by wet scrubbers is considered coincidental and may be less than 50%. Basic scrubbers remove sulfur dioxide, forming gypsum by reaction with lime.

Sulfur dioxide may also be removed by dry desulfurization by injection limestone slurry into the flue gas before the particle filtration.

NOx is either reduced by catalytic reduction with ammonia in a catalytic converter (selective catalytic reduction, SCR) or by a high-temperature reaction with ammonia in the furnace (selective non-catalytic reduction, SNCR). Urea may be substituted for ammonia as the reducing reagent but must be supplied earlier in the process so that it can hydrolyze into ammonia. Substitution of urea can reduce costs and potential hazards associated with storage of anhydrous ammonia. Heavy metals are often adsorbed on injected active carbon powder, which is collected by particle filtration.

# Chapter 3 LEGISLATIVE & ADMINISTRATIVE FRAMEWORK

## 3.1 Introduction

This chapter provides synopsis of policies, legislation, and guidelines that may have relevance to the project. The proponent of this project will comprehensively follow the relevant requirements of the policy documents and legislative framework as well as those recommendations as described in the national and international guidelines. Many of those guidelines have been incorporated in the mitigation measures and the Environmental Management Plan (EMP) which has been formulated for the better environmental management.

The principle law in this regard prior to 18th amendment in the constitution of Pakistan was the Pakistan Environmental Protection Act (PEPA), 1997 that was enacted on 6th December 1997 with the objective of "protection, conservation, rehabilitation and improvement of environment for the prevention and control of pollution, and promotion of sustainable development". Guidelines were also prepared by the Pakistan EPA back in 1997 for the preparation of IEE/EIA report as well as sectorial guidelines.

After 18th Amendment the subject of Environment is being dealt at provincial levels. All provinces have enacted their own environmental Acts. Key legislations governing the current EIA study include the Sindh Environmental Protection Act, 2014, Sindh Environmental Protection Agency (Review of IEE/EIA) Regulations 2014, Sindh Environmental Quality Standards 2016, policies and several laws on conservation of nature.

The proponent will be required to adhere to the relevant requirements of the policies and legislation during the installation and operations phases of project; which have all been incorporated into the EMP.

## 3.2 National Environmental Policy & Plan

### 3.2.1 National Conservation Strategy

The National Conservation Strategy (NCS) is the primary policy document of the Government of Pakistan (GoP) on national environmental issues. The Strategy approved by the Federal Cabinet in March 1992 was also recognized by International Financial Institutions, principally the World Bank. The NCS had identified 14 core areas including conservation of biodiversity, pollution prevention and abatement, soil and water conservation and preservation of cultural heritage. It had also recommended immediate attention to the stated core areas in order to preserve the environment of Pakistan.

A mid-term review of the NCS in 2000 concluded that achievements under the NCS were primarily awareness raising and institutional building rather than meaningful improvement of the environment and natural resources and that the NCS was neither designed nor adequately focused as a national sustainable development strategy (GoP), November 2002. Thus, the need for a more focused National Environmental Action Plan (NEAP) was formulated and approved by the Pakistan Environmental Protection Council in 2001 to practically improve the national environment with emphasis on poverty reduction, and economic as well as sustainable development.

NEAP now constitutes the national environmental agenda and its core objective is to initiate actions that would safeguard public health, promote sustainable livelihoods and enhance the quality of life for the people of Pakistan.

The GoP and United Nations Development Program (UNDP) have jointly initiated an umbrella support Program called the NEAP-Support Program that was signed in October 2001 and implemented in 2002. The development objective supported by NEAP-Support Program is environmental sustainability and poverty reduction in the context of economic growth. The objectives of new policy has total 171 guidelines on sectoral and cross sectoral issues. The objectives of new policy include assurance of sustainable development and safeguard of natural wealth of country. The following are the approved Sectoral Guidelines:

- Water Supply and Management.
- Air Quality and Noise.
- Waste Management.
- Forestry.
- Biodiversity and Protected Areas.
- Climate Change and Ozone Depletion.
- Energy Efficiency and Renewable.
- Agriculture and Livestock.
- Multilateral Environmental Agreements.

### 3.2.2 National Environmental Policy 2005

The National Environmental Policy provides an overreaching framework for addressing the environmental issues facing Pakistan, particularly pollution of fresh water bodies and coastal waters, air pollution of fresh water bodies and coastal waters, air pollution, lack of proper waste management, deforestation, and loss of biodiversity, desertification, natural disasters and climatic change.

It also gives direction for addressing the cross-sectional issues as well as the underlying causes of environmental degradation and meeting international obligations.

National Environmental Policy, while recognizing the goals and objectives of the National Conservation Strategy, National Environmental Action Plan and other existing environment related national policies, strategies and action plans, provide broad guidelines to the Federal Government, Provincial Governments, Federally Administrated, Territories and Local Governments for addressing environmental concerns and ensuring effective management for their environmental resources.

The National Environmental Policy aims to protect, conserve and restore Pakistan's environment in order to improve the quality of life for the citizens through sustainable development.

### 3.2.3 Biodiversity Action Plan, 2000

The key to protection of the biological heritage of Pakistan lies in the involvement of local people and in the support provided by competent institutions for conservation and sustainable use. The Government of Pakistan has recognized the importance of these measures in the preparation of National

Conservation Strategy and in becoming a signatory to, and ratifying, the Convention on Biological Diversity (CBD) in 1994. Developing the Biodiversity Action Plan for Pakistan, 2000 has been the most significant direct steps towards addressing the biodiversity loss.

### 3.2.4 National Climate Change Policy 2012

The National Climate Change Policy provides a framework for addressing the issues that Pakistan faces or will face in future due to the changing climate. The main objectives of Pakistan's climate change policy include:

- To pursue sustained economic growth by appropriately addressing the challenges of climate change;
- To integrate climate change policy with other interrelated national policies;
- To focus on pro-poor gender sensitive adaptation while also promoting mitigation to the extent possible in a cost-effective manner;
- To ensure Water Security, Food Security and Energy Security of the country in the face of challenges posed by climate change;
- To minimize the risks arising from expected increase in frequency and intensity of extreme weather events: floods, droughts, tropical storms etc.;
- To strengthen inter-ministerial decision making and coordination mechanism on climate change;
- To facilitate effective use of the opportunities, particularly financial, available both nationally and internationally;
- To foster the development of appropriate economic incentives to encourage public and private sector investment in adaptation measures;
- To enhance the awareness, skill and institutional capacity of relevant stakeholders;
- To promote conservation of natural resources and long-term sustainability.

## 3.3 National Legislations

### 3.3.1 Pakistan Penal Code, 1860[2]

Section XIV of PPC deals with the offences affecting the public health, safety, convenience, decency and morals. Person may be guilty of public nuisance if his act or omission causes common injury, danger or annoyance to the public or results in spread of infection of diseases dangerous to life. The section also deals with environmental pollution.

Provisions under this Act relating to environment are no longer being enforced after promulgation of the Pakistan Environmental Protection Act, 1997. However, pollution offences can still be tried under the Pakistan Penal Code, 1860.

### 3.3.2 Antiquities Act, 1975[3]

The Antiquities Act of 1975 ensures the protection of cultural resources in Pakistan. The Act is designed to protect antiquities from destruction, theft, negligence, unlawful excavation, trade, and export. Antiquities have been defined in the Act as ancient products of human activity, historical sites, or sites

[2] *Pakistan Penal Code (XLV of 1860) 6th October 1860*
[3] *Act VII of 1976(Gazette of Pakistan, Extraordinary, Part 1, 14th January, 1976*

of anthropological or cultural interest and national monuments etc. The law prohibits new construction in the proximity of a protected antiquity and empowers the Government of Pakistan to prohibit excavation in any area that may contain such articles of archaeological significance.

There are no structures of historical or cultural significance within or immediately neighboring the project site.

### 3.3.3 Land Acquisition Act, 1894[4]

This Act provides law for the acquisition of land needed for public purposes and for companies and for determining the amount of compensation to be made on account of such acquisitions. The law provides details of various peculiarities involved in acquisition of land such as preliminary investigation, objection to acquisition, declaration of intended acquisition, enquiry This Act provides law for the acquisition of land needed for public purposes and for companies and for determining the amount of compensation to be made on account of such acquisitions. The law provides details of various peculiarities involved in acquisition of land such as preliminary investigation, objection to acquisition, declaration of intended acquisition, enquiry into measurements, value & claims, taking possession, reference to court and procedure thereon, apportionment of compensation, payment, temporary occupation of land, acquisition of land for companies, disputes resolutions, penalties and exemptions etc. This Act has 55 sections addressing different areas. Such as section 4(2) mentions that it shall be lawful for any official authorized by the Collector to enter upon and survey, to dig or to do all other acts necessary to ascertain that whether the land is adapted for such purpose.

## 3.4 Provincial/Local Legislations

### 3.4.1 Sindh Environmental Protection Act 2014

The Sindh Environmental Protection Act, 2014 (2014 Act) was passed by the Sindh Assembly on February 24, 2014. The 2014 Act is the basic legislative tool empowering the provincial government to frame regulations for the protection of the environment. The 2014 Act envisages protection, improvement, conservation & rehabilitation of environment of Sindh with the help of legal action against polluters and green awakening of communities. It equally lays emphasis for the preservation of the natural resources of Sindh and to adopt ways and means for restoring the balance in its eco-system by avoiding all types of environmental hazards. The 2014 Act is applicable to a broad range of issues and extends to air, water, industrial liquid effluent, marine, and noise pollution, as well as to the handling of hazardous wastes.

The following articles of the SEPA 2014 have a direct bearing on the proposed Project:

- **Article 11(1):** 'Subject to the provisions of this Act and the rules and regulations therein, no person shall discharge or emit or allow the discharge or emission of any effluent, waste, pollutant, noise or any other matter that may cause or likely cause pollution or adverse environmental effects, as defined in Section 2 of this Act, in an amount, concentration or level which is in excess to that specified in Sindh Environmental Quality Standards…'

4 The Land Acquisition Act 1894 (Act of 1894)

- **Article 11(2):** 'All persons, in industrial or commercial or other operations, shall ensure compliance with the Environmental Quality Standards for ambient air, drinking water, noise or any other Standards established under section 6(1)(g)(i); shall maintain monitoring records for such compliances; shall make available these records to the authorized person for inspection; and shall report or communicate the record to the Agency as required under any directions issued, notified or required under any rules and regulations.'
- Section 11(3): Monitoring and analysis under sub-section (1) and (2), shall be acceptable only when carried out by the Environmental Laboratory certified by the Agency as prescribed in the rules.

  All stipulated tests will be regularly performed from designated laboratories approved by Sindh EPA.
- **Article 14 (1):** 'Subject to the provisions of this Act and the rules and regulations, no person shall cause any act, deed or any activity', including;
  - (b) disposal of solid and hazardous wastes at unauthorized places as prescribed;
  - I dumping of wastes or hazardous substances into coastal waters and inland water bodies; and
  - (d) release of emissions or discharges from industrial or commercial operations as prescribed.
- **Article 15 (1):** 'Subject to the provisions of this Act, no person shall operate or manufacture a motor vehicle or class of vehicles from which air pollutants or noise are being emitted in an amount, concentration or level which is in excess of the Sindh Environmental Quality Standards or, where applicable, the standards established under sub-clause (i) of clause (g) of sub-section (1) of section 6'.
- **Article 17(1):** 'No proponent of a project shall commence construction or operation unless he has filed with the Agency an initial environmental examination or environmental assessment, and has obtained from the Agency approval in respect thereof'
- **Article 17(2):** The agency shall;
  - a) review the initial environmental examination and accord its approval, subject to such terms and conditions as it may prescribe, or require submission of an environmental assessment by the proponent; or
  - (b) review the environmental assessment and accord its approval subject to such terms and conditions as it may deem fit to impose or require that the environmental assessment be re-submitted after such modifications as may be stipulated or decline approval of the environmental assessment as being contrary to environmental objectives.
- **Article 17(3):** 'Every review of an environment impact assessment shall be carried out with public participation and, subject to the provisions of this Act, after full disclosure of the particulars of the project'.
- **Article 17(4):** 'The Agency shall communicate its approval or otherwise within a period of two months from the date that the initial environmental examination is filed, and within a period of four months from the date that the environmental assessment is filed complete in all respects in accordance with the regulations, failing which the initial environmental examination or, as the case may be, the environmental assessment shall be deemed to have been approved, to the extent to which it does not contravene the provisions of this Act and the rules and regulations'.
- **Article 20(1):** 'The Agency shall from time to time require the person in charge of a project to furnish, within such period as may be specified, an environmental audit or environmental review report or environmental management plan containing a comprehensive appraisal of the environmental aspects of the project'.

- **Article 20(2):** The report of a project prepared under sub-section (1) shall include:
  - (a) analysis of the predicted qualitative and quantitative impact of the project as compared to the actual impact;
  - (b) evaluation of the efficacy of the preventive, mitigation and compensatory measures taken with respect to the project; aI(c) Recommendations for further minimizing or mitigating the adverse environmental impact of the project.
- **Article 20(3):** 'Based on its review of the environmental audit report, the Agency may, after giving the person in charge of the project an opportunity of being heard, direct that specified mitigation and compensatory measures be adopted within a specified time period and may also, where necessary, modify the approval granted by it under section 17'.
- **Section 31(1):** The Agency shall cause relevant details of any proposed project regarding which an Environmental Assessment has been received to be published, along with an invitation to the public to furnish their comments thereon within a specified period. (2) In accordance with such procedure as may be prescribed, the Agency shall hold public hearings to receive additional comments and hear oral submissions. (3) All comments received under sub-sections (1) and (2) shall be duly considered by the Agency while reviewing the environmental assessment or strategic impact assessment, and decision or action taken thereon shall be communicated to the persons who have furnished the said comments.
  - A number of rules and regulations have been promulgated under the SEPA 2014. These are:
  - Environmental Samples Rules, 2014
  - Pollution Charge for Industry (Calculation and Collection) Rules, 2014
  - Provincial Sustainable Development Fund Board (Procedure) Rules, 2001
  - The Sindh Environmental Quality Standard (Self-Monitoring and Reporting by Industry) Rule, 2014
  - Sindh Environmental Protection Agency (Review of IEE and EIA), Regulations 2014
  - Sindh Environmental Quality Standards.

There is a long list of legislation that falls in the category of or is relevant to environmental law. Some of the more important ones are:

- Sindh Wildlife Protection Preservation Conservation and Management Act, 2020
- The Antiquities Act, 1975
- Sindh Cultural Heritage (Preservation) Act, 1994
- Land Acquisition Act, 1894
- Factories Act, 1934
- Electricity Act, 1910
- Boilers Act, 1923
- Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997.

### 3.4.2 Relevant Organization

Administration on environment has been divided into federal and provincial government. International issues such as the environmental policy and regulation has been managed by Ministry of Climate Change. On the other hand, national environmental matter has been managed by provincial government.

In Sindh province, Sind EPA has been responsible for the provincial matters. All of the environmental technical issues such as IEE/EIA, monitoring, enforcement of law/environmental quality standards are headed by Director General of Sindh EPA.

### 3.4.3 Environmental Protection Council (EPC)

It has been formed consisting of Chief Minister as Chairman with Minister in charge of Environment Protection Department, Addl. Chief Secretary, Planning & Development Department, Government of Sindh and Secretaries of Environment, Finance, Public Health Engineering, Irrigation, Health, Agriculture, Local Government, Industries, Livestock & Fisheries Forest & Wildlife, Energy, Education Departments Government of Sindh and Divisional Commissioners of Sindh. Non-official members are also included (i.e. representatives of Chamber of Commerce & Industry and from medical or legal professions etc.) along with DG, EPA & two Members of Provincial Assembly also form part of EPC.

The functions and powers of EPC include coordination & supervision of provisions of Act, approving provincial environmental & sustainable development policies & SEQS, provide guidance for protection & conservation, consider annual Sindh Environmental Report, deal with interprovincial and federal provincial issues, provide guidance for bio safety and assist Federal Government in implementation of various provisions of UN Conventions.

### 3.4.4 Sindh Environmental Protection Agency (SEPA)

SEPA would be headed by Director General (DG) with the aim to exercise the powers and perform the functions assigned to it under the provisions of this Act and the rules and regulations made there under. The Agency shall have technical and legal staff and may form advisory committees.

The Agency shall administer and implement the provisions of this Act and rules and regulations. It shall also prepare environmental policies, take measures for implementation of environmental policies, prepare Sindh Environment Report and prepare or revise Sindh Environmental Quality Standards. SEPA shall also establish systems and procedures for surveys, surveillance, monitoring, measurement, examination, investigation research, inspection and audit to prevent and control pollution and to estimate the costs of cleaning up pollution and rehabilitating the environment and sustainable development. SEPA would also take measures for protection of environment such as to promote research; issues licenses for dealing with hazardous substances, certify laboratories, identify need for or initiate legislation, specify safeguards etc. SEPA would also encourage public awareness and education regarding environmental issues.

SEPA would have powers to enter or inspect under a search warrant issued by Environmental Protection Tribunal or a Court search at any time, any land or building etc. where there are reasonable grounds to believe that an offence under this Act has been or is being or likely to be committed. SEPA may also take samples, arrange for testing or confiscate any article in discharge of their duties.

### 3.4.5 Sindh EPA (Environmental Assessment) Regulations 2021

SEPA Regulations 2021 categorize projects into three separate schedules depending on whether a project requires an Environmental Checklist (Schedule-I) or an IEE (Schedule-II) or EIA (Schedule III).

The Regulations also require that all projects located in environmentally sensitive areas need submission of an EIA.

On the basis of the nature and scope of project, it has been accordingly categorized into Schedule-III

**Schedule-III**, (EIA Project)

**Category H** Waste Disposal and treatment

**Sub category:** 1. Facilities for handling, storage or disposal of hazardous or toxic wastes or radioactive waste (including landfill sites, incineration units, etc.)

Therefore, an EIA has been undertaken for the proposed incinerator Plant.

### 3.4.6 Sindh Environmental Quality Standards

On June 28, 2016, the Sindh Environmental Industrial Waste Water, Effluent, Domestic, Sewerage, Industrial Air Emission and Ambient Air, Noise for Vehicles, Air Emissions for Vehicles and Drinking Water Quality Standards, 2015 have been notified by Sindh EPA.

Table 3.1- shows SEQS for ambient air.

**Table 3.1: Sindh Environmental Quality Standard for Ambient Air**

| Pollutant | Time-weighted average | Concentration in Ambient Air | Method of Measurement |
|---|---|---|---|
| **Sulfur Dioxide ($SO_2$)** | Annual Average* | 80 µg/m$^3$ | Ultraviolet Fluorescence Method |
| | 24 hours** | 120 µg/m$^3$ | |
| **Oxides of Nitrogen as (NO)** | Annual Average* | 40 µg/m$^3$ | Gas Phase Chemiluminescence |
| | 24 hours** | 40 µg/m$^3$ | |
| **Oxides of Nitrogen as ($NO_2$)** | Annual Average* | 40 µg/m$^3$ | Gas Phase Chemiluminescence |
| | 24 hours** | 80 µg/m$^3$ | |
| **Ozone ($O_3$)** | 1 hour | 130 µg/m$^3$ | Non dispersive UV absorption method |
| **Suspended Particulate Matter (SPM)** | Annual Average* | 360 µg/m$^3$ | High volume Sampling, (Average flow rate not less than 1.1m$^3$/minute) |
| | 24 hours** | 500 µg/m$^3$ | |
| **Respirable Particulate Matter ($PM_{10}$)** | Annual Average* | 120 µg/m$^3$ | B Ray absorption method |
| | 24 hours** | 150 µg/m$^3$ | |
| **Respirable Particulate Matter ($PM_{2.5}$)** | Annual Average* | 40 µg/m$^3$ *** | B Ray absorption method |
| | 24 hours** | 75 µg/m$^3$ | |
| **Lead (Pb)** | Annual Average* | 1 µg/m$^3$ | ASS Method after sampling using EPM 2000 or equivalent Filter paper |
| | 24 hours** | 1.5 µg/m$^3$ | |

| Table 3.1: Sindh Environmental Quality Standard for Ambient Air | | | |
|---|---|---|---|
| **Pollutant** | **Time-weighted average** | **Concentration in Ambient Air** | **Method of Measurement** |
| **Carbon Monoxide (CO)** | 8hours** | 5 mg/m$^3$ | Non Dispersive Infra Red (NDIR) method |
| | 1hours | 10 mg/m$^3$ | |
| ***Annual arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval.** | | | |
| ****24 hourly / 8 hourly values should be met 98% of the in a year. 2% of the time, it may exceed but not on two consecutive days.** | | | |
| ***** or 9 µg/m$^3$ plus baseline, whichever is low** | | | |

Table 3.2 shows the standards for motor vehicle noise.

| Table 3.2: The Motor Vehicle Ordinance (1965) and Roles (1969) | | |
|---|---|---|
| **Parameter** | **Standards (maximum permissible limit)** | **Measuring method** |
| **Noise** | 85dB(A) | Sound-meter at 7.5meter from the source |

Table 3.3 shows the proposed national environmental quality standard for noise.

| Table 3.3: Sindh Environmental Quality Standard for Noise | | | |
|---|---|---|---|
| **S. No.** | **Category of Area / Zone** | **Effective from 1st January, 2015** | |
| | | **Limit it in dB(A) Leq*** | |
| | | **Day Time** | **Night Time** |
| **1** | Residential area (A) | 55 | 45 |
| **2** | Commercial area (B) | 65 | 55 |
| **3** | IndustrialIea (C) | 75 | 65 |
| **4** | Silence Zone (D) | 50 | 45 |
| **Note: 1** | Day time hours: 6.00 a. m to 10.00 p. m | | |
| **2** | Night time hours: 10.00 p. m to 6.00p. m | | |
| **3** | Silence zone; Zone which are declared as such by competent authority. An area comprising not less than 100 meters around hospitals, educational institutions and courts. | | |
| **4** | Mixed categories of areas may be declared as one of the four above-mentioned categories by the competent authority. | | |
| ***dB(A)Leq** | Time weighted average of the level of sound in decibels on scale A which is relatable to human hearing. | | |

The SEQS for effluents are shown in Table 3.4.

| Table 3.4: Sindh Environmental Quality Standard for Municipal & Liquid Industrial Effluents | | | | | |
|---|---|---|---|---|---|
| **S. #** | **Parameter** | **Into Inland Waters** | **Into Sewage Treatment** | **Into Sea** | **unit** |
| **1** | Temperature or Temp. increase | <3 | <3 | <3 | ºC |
| **2** | pH value ($H^+$) | 6-9 | 6-9 | 6-9 | |
| **3** | Biological Oxygen Demand $(BOD)_5$ at 20ºC | 80 | 250 | 80 | mg/l |
| **4** | Chemical Oxygen Demand (COD) | 150 | 400 | 400 | mg/l |
| **5** | Total Suspended Solids (TSS) | 200 | 400 | 200 | mg/l |
| **6** | Total Dissolved Solids (TDS) | 3500 | 3500 | 3500 | mg/l |
| **7** | Oil and Grease | 10 | 10 | 10 | mg/l |
| **8** | Phenolic Compounds (as Phenol) | 0.1 | 0.3 | 0.3 | mg/l |
| **9** | Chloride (as $Cl^-$) | 1000 | 1000 | SC | mg/l |
| **10** | Fluoride (as $F^-$) | 10 | 10 | 10 | mg/l |
| **11** | Cyanide (as $CN^-$) total | 1.0 | 1.0 | 1.0 | mg/l |
| **12** | An-ionic detergents (as MBAS) | 20 | 20 | 20 | mg/l |
| **13** | Sulphate ($SO_4^{2-}$) | 600 | 1000 | SC | mg/l |
| **14** | Sulphide ($S^{2-}$) | 1.0 | 1.0 | 1.0 | mg/l |
| **15** | Ammonia ($NH_3$) | 40 | 40 | 40 | mg/l |
| **16** | Pesticides | 0.15 | 0.15 | 0.15 | mg/l |
| **17** | Cadmium | 0.1 | 0.1 | 0.1 | mg/l |
| **18** | Chromium (trivalent and hexavalent) | 1.0 | 1.0 | 1.0 | mg/l |
| **19** | Copper | 1.0 | 1.0 | 1.0 | mg/l |
| **20** | Lead | 0.5 | 0.5 | 0.5 | mg/l |
| **21** | Mercury | 0.01 | 0.01 | 0.01 | mg/l |
| **22** | Selenium | 0.5 | 0.5 | 0.5 | mg/l |
| **23** | Nickel | 1.0 | 1.0 | 1.0 | mg/l |
| **24** | Silver | 1.0 | 1.0 | 1.0 | mg/l |
| **25** | Total toxic metals | 2.0 | 2.0 | 2.0 | mg/l |
| **26** | Zinc | 5.0 | 5.0 | 5.0 | mg/l |
| **27** | Arsenic | 1.0 | 1.0 | 1.0 | mg/l |
| **28** | Barium | 1.5 | 1.5 | 1.5 | mg/l |
| **29** | Iron | 8.0 | 8.0 | 8.0 | mg/l |
| **30** | Manganese | 1.5 | 1.5 | 1.5 | mg/l |
| **31** | Boron | 6.0 | 6.0 | 6.0 | mg/l |
| **32** | Chlorine | 1.0 | 1.0 | 1.0 | mg/l |

The SEQS for drinking water are shown in table 3.5

| Table 3.5: Sindh Environmental Quality Standards for Drinking Waters (mg/l) | | | | | |
|---|---|---|---|---|---|
| **S.#** | **Properties / Parameters** | **Standard Values for Pakistan** | **S.#** | **Properties / Parameters** | **Standard Values for Pakistan** |
| Bacterial | | | **Chemical** | | |
| 1 | All water intended for drinking (E.Coli or Thermo tolerant Coliform bacteria) | Must not be detectable in any 100 ml sample | Essential Inorganics (mg/liter) | | |
| | | | 3 | Aluminum (Al) mg/l | ≤ 0.2 |
| | | | 4 | Antimony (Sb) | ≤ 0.005 |
| 2 | Treated water entering the distribution system (25xponenor thermo tolerant coliform and total coliform bacteria) | Must not be detectable in any 100 ml sample | 5 | Arsenic (As) | ≤ 0.05 |
| | | | 6 | Barium (Ba) | 0.7 |
| | | | 7 | Boron (B) | 0.3 |
| 3 | Treated water in the distribution system (E.25xponenor thermo tolerant coliform and total coliform bacteria) | Must not be Detectable in any 100 ml sample. In case of large supplies, where sufficient samples are examined, must not be resent in 95% of the samples taken throughout any 12-month period. | 8 | Cadmium (Cd) | 0.01 |
| | | | 9 | Chloride (Cl-) | < 250 |
| | | | 10 | Chromium (Cr) | ≤ 0.05 |
| | | | 11 | Copper (Cu) | 2 |
| | | | Organic (mg/L) | | |
| | | | 12 | Phenolic compounds | <0.0002 |
| | | | Toxic Inorganics (mg/liter) | | |
| | | | 13 | Cyanide (CN)- | ≤ 0.05 |
| | | | 14 | Fluoride (F) | ≤ 1.5 |
| | | | 15 | Lead (Pb) | ≤ 0.05 |
| | | | 16 | Manganese (Mn) | ≤ 0.5 |
| Physical | | | 17 | Mercury (Hg) | ≤ 0.001 |
| **4** | Color | < 15 TCU | 18 | Nickel (Ni) | ≤ 0.02 |
| **5** | Taste | Non objectionable/ Acceptable | 19 | Nitrate ($NO_3$)- | ≤ 50 |
| **6** | Odor | Non objectionable/ Acceptable | 20 | Nitrite ($NO_2$)- | ≤ 3 |
| **7** | Turbidity | < 5 NTU | 21 | Selenium (Se) | ≤ 0.01 |
| **8** | Total Hardness as $CaCO_3$ | < 500 mg/l | 22 | Residual Chlorine | 0.2-0.5 At consumer end 0.5-1.5 at source |
| **9** | TDS | <1000 | | | |
| **10** | pH | 6.5-8.5 | | | |
| Radioactive | | | | | |
| **11** | Alpha Emitters bq/L | 0.1 | 23 | Zinc (Zn) | 5.0 |
| **12** | Beta emitters | 1 | | | |

### 3.4.7 Self-Monitoring and Reporting by Industry Rules, 2014

These rules classify the industrial units for monitoring and reporting their liquid effluent and gaseous emissions into three and two categories respectively. According to each category they define the priority parameters to be monitored and reported to SEPA according to a specific frequency based on working conditions. This monitoring and reporting are in addition to the monitoring conditions as required by the conditions of approval of EIA/IEE. The sampling for testing must be carried out according to Environmental Samples Rules, 2014 and be sent to SEPA certified environmental testing laboratories.

### 3.4.8 Hazardous Substance Rule, 2014

These Rules were notified to streamline procedures for issuance of licenses to industries / businesses that generate hazardous waste, safety precautions for workers and devices them methods for the removal of hazardous wastes in an environmentally friendly manner. The rules also specify procedures to be adopted for import, transport and disposal of hazardous waste; and identify two hundred and forty-three hazardous substances and synthetic chemicals.

The rules also specify the requirement of obtaining license from Sindh EPA for the import, transport, storage and disposal of hazardous substances as specified in the rules.

### 3.4.9 The Sindh Hospital Waste Management Rules, 2014

In exercise of the powers granted under section 36 of Sindh Environmental Protection Act, 2014, the Sindh EPA published the Sindh Hospital Waste Management Rules, 2014 on 16th December 2014. Key provisions of the rules relevant to the project are as follows;

3. **Responsibility for waste management**.- Every hospital owner, occupier, operator shall be responsible for the management of the hospital waste generated by it till its final disposal in accordance with the provision of the Act and these rules.

4. **Hospital Waste Management Plan**.- (1). A Hospital Waste Management Plan shall be based on internationally or nationally recognized environmental management practices, standards, which shall efficiently and effectively address the hospital waste. (2) The Hospital Waste Management Plan shall include –

a) waste management points for every ward and department, indicating each point, location on the basis of risk assessment;
b) the categories of waste being generated in accordance with Schedule-I.
c) quantity of each waste category;
d) details of the types, numbers of containers, waste bags and trolley required annually;
e) schedule and frequency of waste collection from each ward and department;
f) effective arrangements for onsite and off-site transportation of waste as provided in Schedule-I and II;
g) contingency plans for storage or disposal of risk waste in the event of breakdowns of hospital waste facility, or of maintenance or collection arrangements;
h) training courses and programmes on waste management;

(3) The Waste Management Plan shall be regularly monitored, reviewed, revised and updated and submitted to the Agency on annual basis.

5. **Waste segregation**.- Risk waste shall be separated from non-risk waste at the point where the waste is generated by a doctor, nurse, or other person as per Hospital Waste Management Plan and Schedule-I.

6. **Waste collection**.- Waste shall be collected in accordance with the Schedule-I and II.

7. **Waste storage**.- (1) A separate central storage facility shall be established within the Hospital with the details provided in Hospital Waste Management Plan

8. **Waste Treatment**; (1) On recognition of the type and nature of the waste material and the organisms in the waste, risk waste shall be inactivated or rendered safe before final disposal by a suitable thermal, chemical, irradiation incineration, filtration or other treatment method, or by a combination of such prescribed and effective methods guided by validated and monitoring procedures.

9. **Waste disposal**.-(1) Risk waste shall be disposed of in accordance to the procedure provided in Schedule-I. (2) The operator, occupier, owner of the Hospital waste disposal and treatment facility shall obtain approval from the Agency under the section 17.

### 3.4.10 Sindh Solid Waste Management Board Act, 2014

The SSWMB Act, 2014 enacted to establish a board for collection and disposal of all solid waste, to arrange effective delivery of sanitation services, to provide pollution free environment and to deal with other relevant matters. The Board established under the Act headed by the Chief Minister or his nominee and constitutes of thirteen other ex officio members of other relevant departments.

The Act was promulgated to establish a board for collection and disposal of all solid waste, to arrange effective delivery of sanitation services, to provide pollution free environment and to deal with other relevant matters.

### 3.4.11 Sindh Wildlife Protection, Preservation, Conservation and Management Act, 2020

This Act provides for the preservation, protection, conservation and management of wildlife by the formation and management of protected areas and prohibition of hunting of wildlife species declared protected under the Act.

The Act also provides classifications of the protected areas; national parks, wildlife sanctuaries, game reserves and private game reserves, community game reserves. Activities such as hunting and breaking of land for mining are prohibited in national parks, as are removing vegetation or polluting water flowing through the park. Wildlife sanctuaries are areas that have been set aside as undisturbed breeding grounds and cultivation and grazing is prohibited in the demarked areas. Nobody is allowed to reside in a wildlife sanctuary and entrance for the general public is by special dispensation. However, these restrictions may be relaxed for scientific purpose or betterment of the respective area on the discretion of the governing authority in exceptional circumstances. Game reserves are designated as areas where hunting and shooting is not allowed except under special permits.

The project site does not fall in under any protected area.

### 3.4.12 Sindh Cultural Heritage (Preservation) Act, 1994

The Sindh Cultural Heritage (Preservation) Act, 1994 is the provincial law for the protection of cultural heritage. Its objectives are similar to those of the Antiquity Act, 1975.

None of the sites protected under this law has been identified in the vicinity/microenvironment of the project site.

## 3.5 Environment Related National and International Guidelines

### 3.5.1 Pakistan Environmental Assessment Procedures, 1997

The Pakistan Environmental Protection Agency prepared the Pakistan Environmental Assessment Procedures in 1997. They are based on much of the existing work done by international donor agencies and Non-Governmental Organizations (NGOs). The package of regulations prepared by PEPA includes:

- Policy and Procedures for Filing, Review and Approval of Environmental Assessments;
- Guidelines for the Preparation and Review of Environmental Reports;
- Guidelines for Public Consultation
- Guidelines for Sensitive and Critical Areas; and
- Sectorial Guidelines

### 3.5.2 World Bank Guidelines on Environment

The principal World Bank publications that contain environmental guidelines are listed below.

- Environmental Assessment Operational Policy 4.01.Washington, DC, USA. World Bank 1999.Environmental Assessment Sourcebook: Policies, Procedures, and Cross-Sectoral Issues.
- World Bank Technical Paper Number 139, Environment Department, the World Bank, 1991,Pollution Prevention and Abatement Handbook: Towards Cleaner Production, Environment Department, the World Bank, United Nations Industrial Development Organization and the United Nations Environment Program, 1998.
- Environmental Health and Safety (EHS) guidelines, International Finance Corporation (IFC) World Bank Group, 2007.
- The Sourcebook identifies a number of areas of concern, which should be addressed during impact assessment. It sets out guidelines for the determination of impacts, provides a checklist of tools to identify possible biodiversity issues and suggests possible mitigation measures. Possible development project impacts on wild lands, wetlands, forests etc. are also identified and mitigation measures suggested. The Sourcebook also highlights concerns in social impact assessment, and emphasizes the need to incorporate socio-economic issues in EIA exercises.

### 3.5.3 IFC- Environmental, Health, and Safety Guidelines

The EHS guidelines published by IFC are technical reference documents that address IFC's expectations regarding the industrial pollution management performance of its projects. They are designed to assist managers and decision makers with relevant industry background and technical information. This information supports actions aimed at avoiding, minimizing, and controlling EHS impacts during construction, operation, and decommissioning phase of a project or facility. The relevant industry specific IFC guideline for the proposed project is the EHS Guidelines for Gas Distribution Systems.

Environmental issues associated with the construction and maintenance activities may include, among others, noise and vibration, soil erosion, and threats to biodiversity, including habitat alteration and impacts to wildlife.

Examples of the impacts addressed in the General EHS Guidelines include:

- Construction site waste generation;
- Soil erosion and sediment control from materials sourcing areas and site preparation activities;
- Fugitive dust and other emissions (e.g. from vehicle traffic, land clearing activities, and materials stockpiles);
- Noise from heavy equipment and truck traffic;
- Potential for hazardous materials and oil spills associated with heavy equipment operation and fueling activities.

Environmental issues during the construction phase include the following:

- Terrestrial habitat alteration.
- Hazardous materials.

### 3.5.4 IFC- Environmental, Health, and Safety Guidelines for Waste Management Facilities[5]

The EHS Guidelines for Waste Management cover facilities or projects dedicated to the management of municipal solid waste and hospital waste, including waste collection and transport; waste receipt, unloading, processing, and storage; landfill disposal; physico-chemical and biological treatment; and incineration projects.

Hazardous wastes may be so defined because they share the properties of a hazardous material (e.g. ignitability, corrosivity, reactivity, or toxicity), or other physical, chemical, or biological characteristics which may pose a potential risk to human health or the environment if improperly managed.

[5]https://www.ifc.org/wps/wcm/connect/b8d0bf00488658d4b732f76a6515bb18/wastemgmt.pdf?MOD=AJPERES

# Chapter 4 DESCRIPTION OF ENVIRONMENT

## 4.1 Introduction

In order to carry out environmental assessment study, it is first necessary to demarcate the existing environmental feature in and around the proposed project, on the existing environment. This section therefore describes the environmental and socioeconomic conditions of the project area covering information on physical, biological and socio-economic aspects of the macro-environment as well as the microenvironment of proposed project site. Information for this section was collected from a variety of sources, including published literature, reports of other studies conducted in the area by the EMC and archives of the experts, consultations with institutions, and field surveys conducted for this study by the team of EMC. The physical environment of proposed site has been described in this study with respect to the airshed, watershed, geology, soil characteristics and seismicity. Baseline data on the airshed describe the climatic conditions and quality of air in the microenvironment and macroenvironment and characterize the airshed in terms of level of pollution, viz. unpolluted, polluted or grossly polluted. Similarly, baseline data on watershed describe the hydrology and quality of surface and groundwater as well as water availability. Data on Geology, geomorphology, soil characteristics and seismicity are needed to evaluate the terrestrial resources with respect to quality of minerals and soil characteristics particularly stability.

## 4.2 Microenvironment of the Project Area

Nearby entitites include Alam Steel Re-rolling Mill, AT Engineering Workshop, Dua Trading, Ghafoor Enterprises, Rechina recycling plant, Sai Steel Re-rolling Mills, Al-asif Weighbridge, etc.

**Figure 4.1: Photographs from Microenvironment**

Project Site

Unpaved access road to projet site

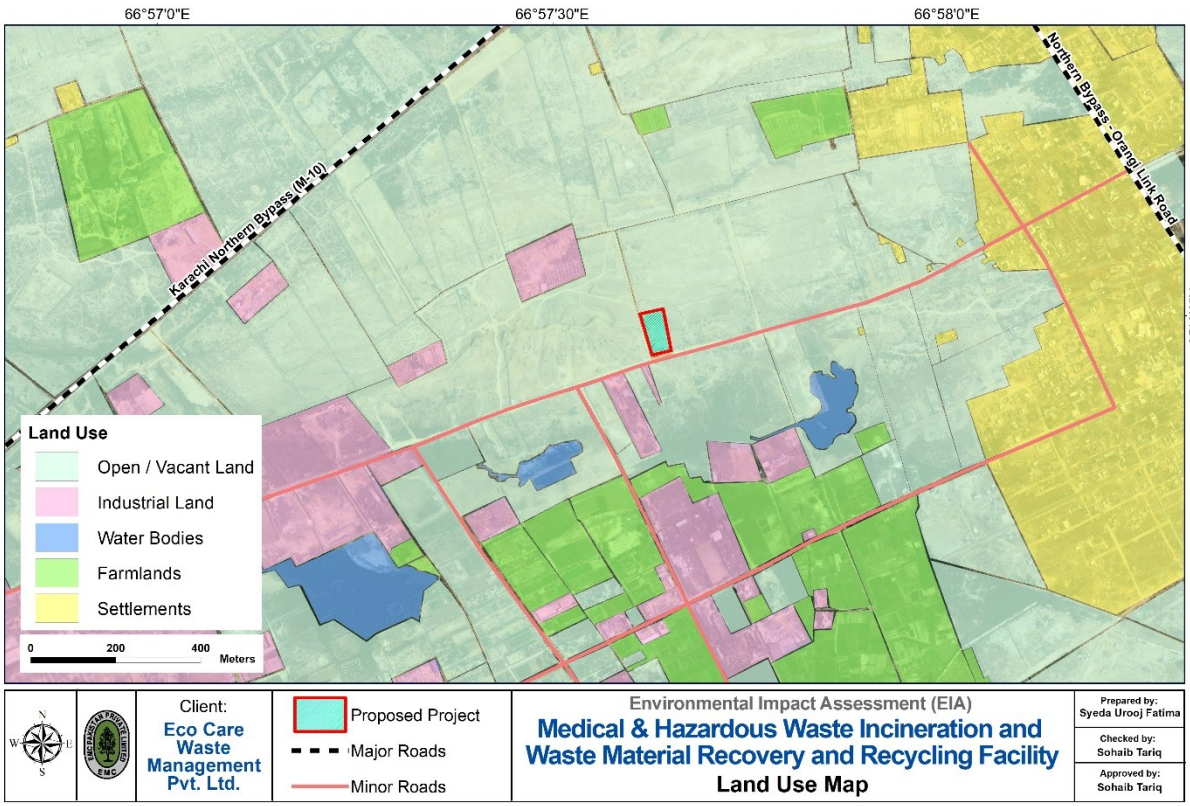



**Figure 4.1: Land Use Map**

## 4.3 Physical Environment

The physical environment of project site has been described here with respect to the terrestrial environment, watershed and air shed. Detailed description of the physical resources existing in the area is stated in the following sections. Major areas covered under physical resources are; topography, geology, soil conditions, climate, surface and ground water resources and seismology. Most of the information is collected from the secondary resources. Other studies and reports were referred and reviewed for the

verification of information. The climatic condition, geology and topography of Karachi has been described as the macro-environment of the project site.

### 4.3.1 Meteorology and Climatic

The coastal part of Karachi is largely influenced by the subtropical monsoon regime. The strong southwest monsoon period prevails from May to September while the weak northeast monsoon period is restricted to the period between December and January. The period between the two monsoons is considered to the transitional or calm period with winds of variable speed and direction. The weather during the inter-monsoon periods is uncertain and short spells of dust storms, dry weather, or a humid cool breeze may prevail for short durations.

**Table 4.1: Seasonal Characteristics of the Climate of Karachi**

| Season | Temperature | Rainfall | Wind |
|---|---|---|---|
| Summer (Mid-March to Mid-June) | The summer is hot with temperature increasing from 26.2 °C in March, rising up to 40 °C in June. | There are less frequent rain showers in summer with no more than 1 or 2 rainy days in summer. Average total amount of rain in summer is around 10 mm | The wind speed in summer is variable. It is around 2.5 m/s in March and rises upto 18 m/s in April and drops to 4 m/s for the rest of the season. The direction mostly remains blowing from West |
| Monsoon (Mid-June to mid-September) | The temperature in monsoon remains high but relatively lower than summer and oscillates around 32°C. | Almost 80 % of the yearly rain occurs in the monsoon with July and August being the wettest month. | The wind direction in the monsoon is mostly blowing from East. |
| Post-Monsoon Summer (Mid-September to November) | The average temperature post monsoon drops and average min temperature may reach 12 °C in November. | The post-monsoon period remains mostly dry and rainfall in November is around 1.8 mm. | The wind speed in September is around 3.7 m/s and drops to 1.4 m/s in November. |
| Winter (December to mid-March) | The winter is mild with January being the coolest month where average minimum temperature falls to 6 °C. | Like the other seasons, except monsoon, there is little occasional rainfall. The rainfall in winter is less than 50 mm. | The wiId speed in the winter season increases from 1.4 m/s in December to 2.6 m/s in March. The wind direction for most part winter season is blowing from NE and changes its course to blowing from West in early March |

**i. Temperature**

The air temperature in Karachi Division and its coastal areas are generally moderate throughout the year due to presence of sea. Climate data generated by the meteorological station at Karachi Air Port represents climatic conditions for the region. The mean monthly maximum and minimum temperatures, recorded during the last 20 years in Karachi to describe the weather conditions are shown in Table 4.1(b) and 4.2 respectively.

**Table 4.2(a): Mean Monthly Maximum Temperatures (°C) in Karachi**

| Year | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2001** | 27.2 | 29.6 | 33.1 | 34.6 | 35.1 | 34.9 | 32.2 | 32.3 | 33.1 | 36.0 | 33.5 | 30.4 | 32.7 |
| **2002** | 27.0 | 28.2 | 33.3 | 35.4 | 35.6 | 35.1 | 32.2 | 31.6 | 31.4 | 36.5 | 32.7 | 28.1 | 32.3 |
| **2003** | 27.6 | 28.5 | 32.4 | 36.6 | 35.7 | 34.9 | 34.1 | 32.6 | 32.5 | 37.0 | 32.2 | 28.3 | 32.7 |
| **2004** | 26.6 | 29.9 | 36.2 | 35.4 | 36.8 | 35.6 | 33.8 | 32.7 | 32.8 | 33.7 | 33.1 | 29.4 | 33.0 |
| **2005** | 24.9 | 26.3 | 31.5 | 35.3 | 35.4 | 36.0 | 33.2 | 32.2 | 34.2 | 35.2 | 33.1 | 28.4 | 32.1 |
| **2006** | 26.0 | 31.3 | 31.8 | 34.0 | 34.6 | 35.3 | 33.8 | 31.0 | 34.2 | 35.0 | 33.4 | 26.3 | 32.2 |
| **2007** | 26.9 | 29.4 | 31.4 | 37.7 | 36.0 | 36.4 | N/A | N/A | N/A | N/A | N/A | N/A | 33.0 |
| **2008** | 24.4 | 26.9 | 34.3 | 34.4 | 33.9 | 35.1 | 33.5 | 31.9 | 34.7 | 35.5 | 32.5 | 27.2 | 32.0 |
| **2009** | 26.2 | 29.8 | 33.0 | 36.0 | 36.8 | 35.7 | 34.5 | 33.0 | 32.8 | 35.9 | 33.0 | 28.6 | 32.9 |
| **2010** | 27.5 | 29.2 | 34 | 35.7 | 36.5 | 34.7 | 34.6 | 33.2 | 34.5 | 35.9 | 32.7 | 28 | 33.0 |
| **2011** | 26.9 | 28.5 | 33.2 | 35.8 | 35.3 | 35.3 | 34.2 | 32.8 | 32.9 | N/A | N/A | N/A | N/A |
| **2012** | 25.7 | 26.9 | 31.7 | 35.1 | 35.5 | 34.6 | 33.2 | 32.7 | 33.2 | 35.0 | 32.7 | 28.2 | 32.0 |
| **2013** | 26.7 | 28.0 | 33.3 | 34.0 | 35.1 | 36.5 | 33.8 | 32.1 | 33.0 | 35.7 | 32.3 | 28.3 | 32.4 |
| **2014** | 25.5 | 28.0 | 31.7 | 35.1 | 35.9 | 36.5 | 34.0 | 33.7 | 33.8 | 36.3 | 32.9 | 28.7 | 32.7 |
| **2015** | 26.3 | 28.9 | 31.5 | 35.9 | 36.0 | 37.7 | 34.1 | 32.3 | 34.6 | 35.8 | 33.0 | 28.6 | 32.9 |
| **2016** | 27.8 | 30.3 | 33.3 | 34.7 | 35.7 | 36.1 | 33.6 | 33.0 | 32.9 | 34.0 | 33.3 | 31.0 | 33.0 |
| **2017** | 25.4 | 30.2 | 32.8 | 35.5 | 36.2 | 36.3 | 33.1 | 33.8 | 33.4 | 36.6 | 32.3 | 28.2 | 32.8 |
| **2018** | 28.5 | 30.4 | 34.4 | 36.2 | 38.7 | 35.4 | 33.8 | 31.9 | 32.6 | 36.8 | 33.8 | 28.2 | 33.4 |
| **2019** | 26.3 | 26.8 | 31.3 | 35.4 | 36.0 | 37.2 | 34.7 | 32.5 | 35.7 | 35.8 | 31.5 | 27.1 | 32.5 |
| **2020** | 24.3 | 30.1 | 31.2 | 36.2 | 36.6 | 37.3 | 36.7 | 34.6 | 35.0 | 36.2 | 31.4 | 28.1 | 33.1 |
| **2021** | 26.6 | 31.3 | 34.6 | 37.3 | 37.5 | 36.1 | 34.5 | 32.6 | 36.3 | 34.8 | 34.0 | 27.6 | 33.6 |

***Source:*** *Pakistan Meteorological Department*

**Table 4.2(b): Mean Monthly Minimum Temperatures (°C) in Karachi**

| Year | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2001** | 11.5 | 14.9 | 19.6 | 23.8 | 28.1 | 29.0 | 27.1 | 26.5 | 25.9 | 24.4 | 18.6 | 15.8 | 22.1 |
| **2002** | 12.8 | 13.8 | 19.5 | 23.9 | 27.0 | 28.2 | 29.6 | 25.6 | 24.8 | 22.5 | 17.7 | 14.9 | 21.7 |
| **2003** | 12.7 | 16.9 | 19.8 | 24.2 | 26.5 | 28.2 | 23.6 | 27.0 | 25.3 | 20.9 | 15.2 | 12.0 | 21.0 |
| **2004** | 12.9 | 14.5 | 19.1 | 24.8 | 27.3 | 28.8 | 27.5 | 26.3 | 25.3 | 22.4 | 18.0 | 15.4 | 21.9 |
| **2005** | 12.3 | 11.3 | 20.3 | 23.0 | 26.4 | 28.3 | 27.2 | 26.6 | 26.6 | 22.9 | 18.9 | 13.0 | 21.4 |
| **2006** | 11.7 | 18.1 | 19.6 | 24.5 | 27.5 | 28.5 | 28.3 | 26.3 | 26.8 | 25.7 | 19.4 | 14.0 | 22.5 |
| **2007** | 13.0 | 17.3 | 19.7 | 24.7 | 27.6 | 28.6 | N/A | N/A | N/A | N/A | N/A | N/A | 21.8 |
| **2008** | 10.1 | 11.1 | 19.6 | 24.0 | 27.3 | 29.1 | 27.9 | 26.8 | 26.6 | 23.8 | 17.6 | 14.9 | 21.6 |
| **2009** | 14.7 | 16.5 | 20.8 | 23.8 | 27.6 | 28.7 | 28.1 | 27.5 | 26.5 | 22.6 | 17.0 | 13.9 | 22.3 |
| **2010** | 12.2 | 14.7 | 21.3 | 25.1 | 28 | 28.2 | 28.3 | 27.2 | 25.8 | 23.9 | 17.4 | 11.1 | 21.9 |
| **2011** | 11 | 14.5 | 19.7 | 23.1 | 27.1 | 28.8 | 27.8 | 28.6 | 26.5 | N/A | N/A | N/A | N/A |
| **2012** | 11.2 | 11.9 | 19.1 | 24.5 | 27.2 | 28.0 | 27.9 | 26.9 | 26.4 | 22.7 | 18.6 | 14.2 | 21.5 |
| **2013** | 11.6 | 15.1 | 19.2 | 24.2 | 27.1 | 29.3 | 28.0 | 26.6 | 25.5 | 25.4 | 18.1 | 13.0 | 21.9 |
| **2014** | 9.9 | 13.1 | 18.9 | 24.4 | 27.0 | 29.2 | 28.3 | 27.1 | 26.8 | 23.3 | 19.5 | 13.1 | 21.7 |
| **2015** | 12.6 | 16.4 | 19.2 | 25.7 | 27.7 | 29.8 | 28.4 | 26.9 | 26.3 | 24.9 | 18.6 | 12.6 | 22.4 |
| **2016** | 14.8 | 14.9 | 21.7 | 24.6 | 27.9 | 27.9 | 28.1 | 27.1 | 26.4 | 24.0 | 17.1 | 15.5 | 22.5 |

| Table 4.2(b): Mean Monthly Minimum Temperatures (°C) in Karachi | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Annual** |
| **2017** | 12.5 | 18.2 | 20.3 | 24.4 | 27.8 | 29.2 | 27.7 | 27.0 | 26.2 | 23.5 | 16.8 | 13.0 | 22.2 |
| **2018** | 12.9 | 15.8 | 20.9 | 25.3 | 27.7 | 28.8 | 28.1 | 26.3 | 25.5 | 23.0 | 19.3 | 13.1 | 22.2 |
| **2019** | 13.3 | 15.3 | 19.0 | 24.0 | 26.6 | 28.9 | 28.1 | 26.8 | 27.2 | 24.0 | 19.4 | 13.7 | 22.2 |
| **2020** | 10.8 | 15.3 | 19.1 | 24.7 | 27.7 | 29.7 | 29.4 | 28.1 | 27.3 | 22.7 | 16.0 | 12.5 | 21.9 |
| **2021** | 9.2 | 15.0 | 21.6 | 25.1 | 28.9 | 29.6 | 28.5 | 27.4 | 28.0 | 23.1 | 17.6 | 13.9 | 22.3 |
| ***Source:*** *Pakistan Meteorological Department* | | | | | | | | | | | | | |

### ii. Precipitation

The main source of precipitation is rainfall which is received mostly in the months of July to September during SW Monsoon winds. It is very erratic as some years are dry and others are wetter.

Occasional winter rains are also received in the months of December –February as result of NE winds which count 15-25% of total rainfall.

| Table 4.3: Monthly Amount of Precipitation (mm) at Karachi Airport | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Annual** |
| 2001 | 0 | 0 | 0 | 0 | 0 | 10.6 | 73.6 | 16.2 | N/A | 0 | 0 | 0 | 100.4 |
| 2002 | 0 | 2.4 | 0 | 0 | 0 | N/A | N/A | 52.2 | N/A | 0 | 0.5 | 0.4 | 55.5 |
| 2003 | 6.4 | 21.8 | 0 | 0 | 0 | 16.3 | 270.4 | 9.8 | N/A | 0 | 0.2 | 0 | 324.9 |
| 2004 | 13.7 | 0 | 0 | 0 | 0 | N/A | 3 | 5.6 | N/A | 39.3 | 0 | 4.3 | 65.9 |
| 2005 | 6.6 | 12.8 | N/A | 0 | 0 | N/A | N/A | 0.3 | 54.9 | 0 | 0 | 17.1 | 91.7 |
| 2006 | N/A | 0 | N/A | 0 | 0 | 0 | 66.2 | 148.6 | 21.9 | 0 | 3.1 | 61.3 | 301.1 |
| 2007 | 0 | 13.2 | 33.4 | 0 | 0 | 110.2 | N/A | N/A | N/A | N/A | N/A | N/A | 156.8 |
| 2008 | 8 | Trace | 1.1 | 0 | 0 | 0 | 54 | 37.5 | Trace | 0 | 0 | 21 | 121.6 |
| 2009 | 3 | Trace | 0 | Trace | 0 | 2.6 | 159.9 | 44 | 68.9 | 0 | 0 | 1.5 | 279.9 |
| 2012 | 0.2 | 0 | 0 | 0 | 0 | Trace | Trace | 8.1 | 121 | 0 | 0 | 22.8 | 152.1 |
| 2013 | Trace | 20 | 2.8 | 30 | 0 | Trace | 5.5 | 105.4 | 4 | 1.2 | 0 | 0 | 168.9 |
| 2014 | Trace | 0 | 12.4 | 0 | 1.3 | Trace | 1.1 | 9.9 | 1.4 | 0 | 4.6 | 0 | 30.7 |
| 2015 | 0.3 | 2.1 | 2.8 | 0 | 0 | Trace | 46.6 | 1.4 | Trace | 0 | 0 | 0 | 53.2 |
| 2016 | 3.1 | 0 | Trace | 0 | 0 | 65.8 | 1.9 | 96.9 | Trace | 0 | 0 | 0 | 167.7 |
| 2017 | 41.5 | Trace | 0 | 0 | 0 | 58.8 | 33.3 | 65.6 | 26.4 | 0 | 0 | 6.6 | 232.2 |
| 2018 | Trace | Trace | 0 | 0 | 0 | Trace | Trace | 0.8 | Trace | 0 | 0 | Trace | 0.8 |
| 2019 | 39.4 | Trace | 2.2 | 0 | 0 | 1.6 | 66.3 | 204 | 51.7 | 1.2 | Trace | Trace | 367.3 |
| 2020 | Trace | 2.6 | 0.5 | 0 | 0 | Trace | 101.2 | 366.8 | Trace | 0 | 3.1 | 0 | 474.2 |
| 2021 | 0 | 0 | 0 | 0 | 0 | Trace | 45.4 | Trace | 88.3 | 17.2 | 0 | 16.9 | 167.8 |
| *Source: Pakistan Meteorological Department* | | | | | | | | | | | | | |

The wet years have been found to follow a 3-year cycle during the first 9 years of the 3rd Millennium. The year 2010 was among the wettest years since Karachi City had witnessed more than 5 spells of 50 mm each during the month of July, three major spells of 60 to 100 mm in August and two spells of 25 and 10 mm each in the month of September. In July and August 2011 again, there was heavy rainfall all over Sindh. Hyderabad received about 74 to 103 mm rain in 24 hours and the same amount poured in Karachi and the villages in its outskirts. Among the other July 2020 was considered to be the wettest month among the others and the total annual rainfall records in 2020 higher than other past 19 years. The torrential rains resulted in flooding of several villages in Karachi District. The ongoing monsoon season of 2022 has brought more rains in Karachi than in past twenty years.

### iii. Wind Speed & Direction

The wind direction and speed between the summer and winter monsoon seasons are rather unsettled and large variations are noted both with respect to speed and direction. The wind velocity record (2001-2022) indicates that the velocity varies and ranges between 1.0 m/s to 13.7 m/s. The Tables 4.4 and 4.5 show the wind speed and direction respectively.

**Table 4.4: Wind Speed (m/s) at 12:00UTS**

| Year | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2001** | 2.6 | 3.4 | 4.3 | 5.6 | 7.5 | 8.1 | 6.8 | 7.3 | 5.5 | 3.7 | 2.0 | 2.4 | 4.9 |
| **2002** | 3.6 | 3.9 | 4.0 | 6.5 | 8.5 | 8.2 | 9.8 | 7.3 | 7.7 | 3.3 | 2.9 | 3.2 | 5.7 |
| **2003** | 4.0 | 5.0 | 5.4 | 5.2 | 7.7 | 8.8 | 6.7 | 7.1 | 6.0 | 3.2 | 3.1 | 3.0 | 5.4 |
| **2004** | 3.4 | 3.7 | 4.0 | 6.0 | 8.0 | 9.0 | 10.0 | 9.5 | 7.3 | 3.8 | 1.0 | 2.5 | 5.7 |
| **2005** | 3.6 | 4.2 | 4.8 | 5.1 | 7.1 | 7.5 | 9.0 | 6.9 | 6.4 | 3.9 | 2.0 | 1.5 | 5.2 |
| **2006** | 2.0 | 3.0 | 3.0 | 6.2 | 8.0 | 7.7 | 8.3 | 6.2 | 4.7 | 4.2 | 2.2 | 3.0 | 4.9 |
| **2007** | 2.0 | 3.7 | 4.0 | 4.0 | 6.0 | 6.3 | N/A | N/A | N/A | N/A | N/A | N/A | 4.3 |
| **2008** | 4.3 | 7.6 | 8.2 | 10.5 | 12.6 | 7.6 | 11.0 | 9.3 | 8.7 | 6.6 | 5.1 | 3.9 | 7.9 |
| **2009** | 7.0 | 7.2 | 7.9 | 9.3 | 9.8 | 9.7 | 9.5 | 9.3 | 9.1 | 6.1 | 5.0 | 3.9 | 7.8 |
| **2012** | 5.8 | 6.6 | 9.3 | 9.8 | 12.3 | 12.8 | 13.1 | 11.2 | 8.4 | 7.1 | 5.7 | 5.8 | 9.0 |
| **2013** | 5.2 | 6.9 | 9.0 | 10.3 | 11.5 | 10.8 | 12.0 | 11.2 | 10.3 | 7.7 | 5.1 | 4.5 | 8.7 |
| **2014** | 5.9 | 8.9 | 8.6 | 11.5 | 12.4 | 13.4 | 12.8 | 11.6 | 11.7 | 8.3 | 6.0 | 4.5 | 9.6 |
| **2015** | 6.9 | 10.3 | 10.1 | 11.5 | 12.8 | 12.3 | 13.7 | 12.3 | 10.5 | 8.7 | 5.6 | 5.8 | 10.0 |
| **2016** | 7.5 | 8.7 | 4.8 | 1.1 | 13.0 | 11.7 | 11.8 | 10.5 | 12.1 | 9.2 | 5.5 | 5.2 | 8.4 |
| **2017** | 7.0 | 8.0 | 10.8 | 12.1 | 12.8 | 11.5 | 12.1 | 10.3 | 8.7 | 8.5 | 5.4 | 7.4 | 6.9 |
| **2018** | 6.3 | 7.0 | 9.5 | 10.2 | 10.8 | 11.1 | 12.3 | 12.4 | 12.2 | 8.7 | 6.1 | 6.8 | 9.4 |
| **2019** | 6.7 | 8.9 | 10.2 | 11.7 | 12.1 | 11.7 | 13.7 | 9.1 | 8.5 | 8.0 | 6.9 | 7.4 | 9.6 |
| **2020** | 9.0 | 9.4 | 9.0 | 10.5 | 13.3 | 10.9 | 10.1 | 8.9 | 9.4 | 7.3 | 6.2 | 5.5 | 9.1 |
| **2021** | 6.1 | 7.6 | 9.7 | 8.5 | 11.7 | 12.7 | 12.6 | 11.1 | 8.8 | 8.1 | 6.7 | 6.6 | 9.2 |

***Source:*** *Pakistan Meteorological Department*

**Table 4.5: Wind Direction at 12:00UTS**

| Year | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2001** | S54W | S43W | S42W | S45W | S46W | S45W | N52W | S59W | S44W | N56W | S45W | S06W |
| **2002** | S67W | S52W | S51W | S55W | S51W | S42W | S54W | S45W | S48W | S56W | N54W | S41W |
| **2003** | S60W | N50W | S45W | S48W | S45W | S68W | S60W | S47W | S43W | S54W | S50W | S27W |
| **2004** | N27E | S46W | S53W | S49W | S52W | S54W | S54W | S62W | S56W | S47W | S45W | N86E |
| **2005** | N63E | S51W | S50W | S52W | S63W | S48W | S54W | S49W | S87W | S54W | S52W | N23W |
| **2006** | S48W | S62W | S50W | S57W | S64W | S60W | S67W | S78W | S51W | S53W | S49W | N79E |
| **2007** | S30W | S62W | S47W | S55W | S58W | S47W | S41W | S55W | S60W | S48W | S48W | N45E |
| **2008** | N45E | S47W | S54W | S51W | S52W | S39W | S50W | S52W | S46W | S39W | S38W | N |
| **2009** | N45E | S45W | S41W | S58W | S46W | S46W | S56W | S49W | S56W | S42W | S39W | S45E |
| **2012** | S3E | N56E | S62W | S46W | S61W | S51W | S66W | S51W | S53W | S41W | S41W | N9W |
| **2013** | N39W | S54W | S56W | S54W | S61W | S40W | S53W | S52W | S55W | S47W | S17W | N50W |
| **2014** | S72E | S54W | S43W | S46W | S46W | S45W | S54W | S48W | S85W | S45W | S49W | S45E |
| **2015** | S72E | S54W | S43W | S48W | S50W | S40W | S54W | S55W | S50W | S41W | S | S58W |
| **2016** | S43W | S36W | S48W | S54W | S54W | S45W | S48W | S36W | S51W | S45W | S43W | S36W |
| **2017** | S83E | S56W | S51W | S45W | S45W | S44W | S66W | S57W | S48W | S51W | S59W | N45E |

| Table 4.5: Wind Direction at 12:00UTS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| **2018** | S54W | S43W | S42W | S45W | S46W | S45W | N52W | S59W | S44W | N56W | S45W | S06W |
| **2019** | S67W | S52W | S51W | S55W | S51W | S42W | S54W | S45W | S48W | S56W | N54W | S41W |
| **2020** | N31E | S12W | S52W | S55W | S49W | S44W | S47W | S55W | S47W | S38W | S4E | N35E |
| **2021** | S21W | S38W | S44W | S42W | S52W | S53W | S55W | S48W | S40W | S41W | S22E | S40E |
| ***Source:*** *Pakistan Meteorological Department* | | | | | | | | | | | | |

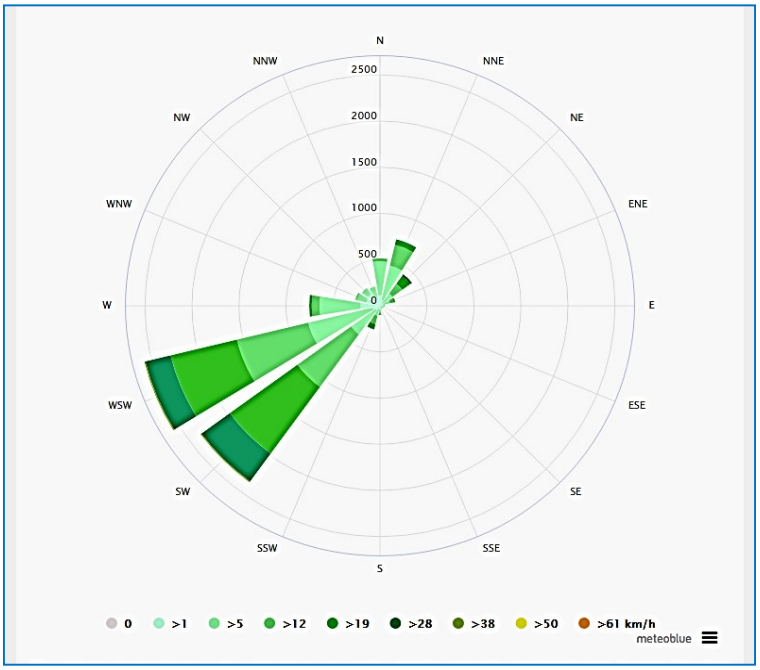



**Figure 4.3**: Wind rose for Karachi[6]

### iv. Humidity

The relative humidity typically ranges from 25% (dry) to 70% (humid) over the course of a year, rarely dropping below 20% (very dry) and reaching as high as 90% (very humid).

| Table 4.6: Mean Monthly Relative Humidity (Mean) at 1200 UTC (%) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Annual** |
| **2014** | 25.0 | 27.0 | 35.0 | 47.0 | 57.0 | 61.0 | 64.0 | 61.0 | 60.0 | 36.0 | 36.0 | 31.0 | 45.0 |
| **2015** | 38.0 | 41.0 | 37.0 | 45.0 | 60.0 | 56.0 | 69.0 | 67.0 | 56.0 | 47.0 | 28.0 | 31.0 | 47.9 |
| **2016** | 46.0 | 25.0 | 41.0 | 47.0 | 60.0 | 60.0 | 68.0 | 70.0 | 63.0 | 57.0 | 34.0 | 38.0 | 50.8 |
| **2017** | 38.0 | 25.0 | 36.0 | 44.0 | 59.0 | 62.0 | 70.0 | 67.0 | 63.0 | 44.0 | 29.0 | 20.0 | 46.4 |
| **2018** | 36.0 | 37.0 | 33.0 | 45.0 | 46.0 | 65.0 | 65.0 | 68.0 | 63.0 | 40.0 | 32.0 | 30.0 | 46.7 |
| **2019** | 40.4 | 33.9 | 36.6 | 48.0 | 55.6 | 58.8 | 64.8 | 72.6 | 67.6 | 41.1 | 34.6 | 29.7 | 48.6 |
| **2020** | 29.9 | 28.1 | 34.2 | 44.4 | 57.1 | 56.8 | 65.0 | 74.8 | 62.4 | 38.1 | 32.9 | 29.1 | 46.1 |
| **2021** | 31.3 | 34.1 | 41.2 | 43.3 | 54.3 | 60.3 | 67.5 | 64.5 | 63.0 | 46.5 | 27.6 | 38.7 | 47.7 |
| ***Source:*** *Pakistan Meteorological Department* | | | | | | | | | | | | | |

[6] *Source:https://www.meteoblue.com/en/weather/forecast/modelclimate/karachi_pakistan_1174872*

**Urban Heat Island (UHI) Effect "**The term "heatat island" describes built environment that are hotter than nearby natural areas. An urban heat island refers to a city or metropolitan area that is significantly warmer than its surrounding natural areas due to human activities. The temperature difference usually is larger at night than during the day and is most apparent when winds are weak. UHI is most noticeable during the summer and winter seasons. It is estimated that the annual mean air temperature of a city with 1 million or above inhabitants can be 1–3°C warmer than its surroundings. In the evening, the difference can be as high as 12°C. The heat island can affect communities by increasing summertime peak energy demand, air conditioning costs, air pollution and greenhouse gas emissions, heat-related illness and mortality, and water quality.

The city of Karachi has bee37xponentng exponentially in terms of urbanization and population growth. The city hosts population of more than 22 million souls with a density of 4,115 persons per kilometer square (km2). The urban area density has increased from 233 km2 in 1947 with a population size of 0.4 million to 3,566 km2 in 2004 with a population size of 14 million (Qureshi et al., 2008). Rapid urbanization and global warming have initiated UHI effect over the city. A strong incidence of UHI is generally associated with a severe heat wave hazard in terms of sensible temperature. UHI effect is the unique feature of the June 2015 heat wave in Karachi. It is expected that with growing global warming incidence and poor coping strategies, UHI would become a major health risk for the vulnerable segment of population in mega-cities around the globe such as Karachi.

Causes of Urban Heat Island Effect: The principal reason for the night time warming is the retention of short-wave solar radiation absorbed during the day time by the building material consisting of concrete and asphalt. These materials are commonly used in urban areas for pavement and roofs that have significantly different thermal and radiative properties compared to the surrounding rural areas. This causes a change in the energy balance of the metropolitan area, often leading to higher temperatures than surrounding rural areas. This energy is then slowly released during the night as a long wave radiation, making cooling a slow process. Because of this phenomenon, the minimum temperatures of Karachi remained extremely high during the heat-wave event.

There are several causes of an urban heat island effect in Karachi.

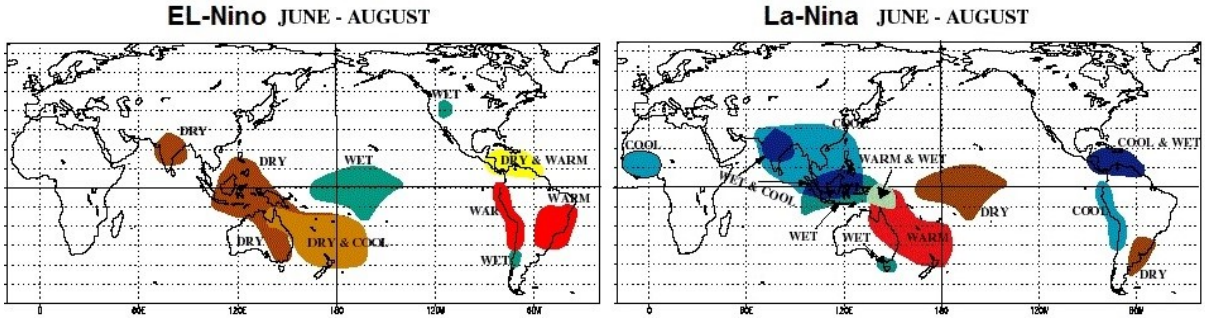
- Reduced and slow process of evapotranspiration due to shrinking green areas and spaces in the city. With a decreased amount of vegetation, the city loses the shade, cooling effect of trees and the removal of carbon dioxide.
- Geometric effects in terms of rising number of tall buildings are a significant contributing factor to urban heat island effect. Over the years, the number of tall buildings within the city has increased that provide multiple surfaces for the reflection and absorption of sunlight, and thus increasing the efficiency with which the city is heated. This is c"lled the "urban can"on effect". Another effect of increased number of buildings is the blockage of wind, which also inhibits cooling by convection and pollution from dissipating.
- Waste heat from automobiles, air conditioning, industry, and other sources also contributes to the UHI. High levels of pollution in urban areas can also increase the UHI, as many forms of pollution change the radiative properties of the atmosphere.

Aside from the effect on temperature, UHI can produce secondary effects on local meteorology, including the altering of local wind patterns and humidity, which have been discussed in the previous section. The UHI effect described above has been one of the major causes of unprecedented large number of heat

related deaths in Karachi. Future climate scenarios suggest that the frequency of this kind of disasters may increase with the rise of temperature in future.

### 4.3.2 Impact of Climaate Change - Karachi

There could be an exceptional changes in the temperatures in Pakistan as a whole in the coming years due to climate change. Karachi may however face the threat of rising sea levels by the year 2100, at about 8 feet below sea level. Climate change could influence monsoon dynamics and cause summer precipitation levels to drop, as well delays in the start of the monsoon season. Impact of climate change in Karachi will deepen by 2030. Due to global warming the coastline of Karachi is likely to be flooded due to rising sea levels. Many seminars and public gathering are held in the city to make the government and public fully aware of global warming, speakers at the seminar have urged the government to prepare long and short-term plans to reduce the impact of global warming on natural resources. Karachi also faces the threat from super cyclones which are said to increase their intensity and momentum in years to come.




**List of cyclones that affected Karachi and the Sindh coast**: Cyclones that form in the Arabian Sea do not usually hit Karachi or the Sindh coast, during 1902, 1907, 1944, 1964, 1985, 1999, 2007 and 2010, cyclones made landfall in the Sindh coast including Karachi. Other cyclones that are listed below caused rains as remnants.

- In May 1985, a cyclonic storm made a landfall in the eastern direction of Karachi. The cyclonic storm in 1985 which was moving towards Karachi actually had weakened over the sea while still a few 100 Kilometers away south of Karachi.
- In November 1993, a category 1 cyclone approached the Sindh-Gujarat border but dissipated due to high vertical shear over open waters.
- In June 1998, remnants of the category 3 Gujarati cyclonee (the 5th strongest cyclone of the Arabian Sea) killed 12 people near and in the city.
- In May 1999, again a category 3 major cyclone (the 4th strongest cyclone of Arabian Sea) hit near the city; this Cyclone killed 700 people in Sindh including Karachi. It is the strongest cyclone recorded in Pakistan.
- In May 2001, the powerful category 3 cyclonee (the 3rd strongest cyclone of the Arabian Sea) hit the Indian border of Gujarat. It caused rain along the Sindh coast, but no damage was reported.
- In October 2004, a severe cyclonic storm, Cyclone Onil, approached the Sindh coast but later recurved back to the sea; it caused heavy rain that killed 9 people in Karachi.
- In early June 2007, super cyclonic storm Gonu (the strongest cyclone in the Arabian Sea) caused strong gusty winds in the metropolis with light rainfall as the storm was moving towards Oman.
- In June 2007, a cyclonic storm, Cyclone Yemyin, passed near the city and killed 200 people before moving towards Balochistan where it killed 380 people.

- In November 2009, remnants of Cyclone Phyan caused gusty winds along the Sindh coast including Karachi. However, six Pakistani fishermen were trapped in the storm later rescued by the Indian Navy.
- In June 2010, Cyclone Phet (the 2nd strongest cyclone in the Arabian Sea), once a powerful category 4 cyclone, made landfall near the city as a weak tropical depression, with a total 14 casualties in and near the city.
- In November 2010, remnants of Cyclone Jal caused drizzle with dusty winds in Karachi while it caused light to moderate rainfall in southeastern Sindh.
- In November 2011, the outerbands of cyclone Keila brought drizzle to the city while moderate showers to the Makran coast.
- List of Notable floods in Karachi: Most of the flooding in Karachi occurs due to the monsoon season. But due to the enhancement of the city's infrastructure flooding has been controlled. But still excessive and irregular rains can lead to major flooding in the metropolis. Following are some of the major floods in the city;
- On 7 August 1953, the city received its record-breaking 24-hour rainfall causing widespread flooding about 278.1 millimeters (10.95 in) rain was recorded.
- On 1 July 1977, Karachi received its third highest rainfall of 207 millimeters (8.1 in) in 24 hours, it caused massive flooding in the city and killed 248 people in the city.
- In 2003, massive flooding during monsoon season devastated the Sindh, two days of rainfall of 284.5 millimeters (11.20 in) created havoc in the city.
- In 2006, after two year of drought period heavy rainfall lashed the city during the monsoon season, but the city came to standstill on 17 August when widespread rainfall of 77 millimeters (3.0 in) created flood-like situation in the city killing 13 people and submerging roads, low-lying areas and underpasses with rainwater.
- In 2007, almost all the rains that occurred in this monsoon season brought flooding with it, During the month of June Cyclone Yemyin created havoc in the city from 21 June to 26 June 2007 110.2 millimeters (4.34 in) of heavy downpour was recorded which killed 228 Karachiites on 23 June, then from 9 August to 11 August a strong tropical depression brought massive flooding in the city with 191 millimeters (7.5 in) of rain killing 21 people and submerging low-lying areas and underpasses. While on 22 August a monsoon depression once again flooded the city with 80 millimeters (3.1 in) of rainfall killing 10 people.
- On 18 July 2009, there was severe flooding due to a tropical depression, in which city's second highest rainfall of 245 mm (9.6 in) occurred in just 4 hours, killing 20 and injuring 150 people. Another flooding event occurred on August 31, 2009 when a well-marked low pressure was present over Sindh, the rainfall was recorded to be around 147 mm (5.7 in).
- On September 13, 2011, life was crippled in the city due heavy rainfall that caused urban flooding in the city. The rainfall was recorded to be around 145 mm (5.7 in).
- In Aug & Sep 2019, life in the city was crippled due to multiple spells of heavy rain that caused urban flooding and loss of life and property.
- 6 – 9 Jul 2020, spells of heavy rain caused urban flooding in several areas of city, causing loss of life and property, mainly due to electrocution.
- The hours-long spell, which began before sunrise and continued till night, broke previous records of rainfall recorded in the city during August 2020. The Met department said that Karachi had received 345mm of rainfall so far in August, breaking the previous record of 298mm reported in August 1984.
- Rains of September 2021 and July & August 2022 caused substantial urban flooding in karachi.

**List of droughts in Karachi**: Drought-like conditions in the city are not common but if the Monsoon season fails to deliver rains then drought emerges. Following are some of worst drought in Karachi city.

- The major drought in Karachi as well as for whole Pakistan was from 1996 till 2002, peaking from 1998 till 2001. While in 2002 drought conditions started to dissipate. The drought of 1998-2001 was considered worst in 50 years.
- In 2004, no rain occurred in the city as well as in Sindh province but during the month of October heavy downpour lashed different parts of Sindh due to Cyclone Onil.
- In 2005, the drought conditions continued, but a post-monsoon low pressure dumped heavy rains during 12 and 13 September.
- In 2009, drought conditions emerged during the summer season in suburban areas of Karachi, due to El Nino phenomenon and caused drought during the winter season but the monsoon rains of 2009 were above-normal.

## 4.4 Ambient Air & Noise Level

An ambient air monitoring study and noise monitoring were conducted in the microenvironment of the proposed project site. The results of ambient air quality and noise monitoring are presented below:

| Parameter | Unit | Monitoring Duration | Average Obtained Concentration | SEQS | LDL-Limits | Methodology/Instrument |
|---|---|---|---|---|---|---|
| **Carbon Monoxide (CO)** | mg/m$^3$ | 08 Hours | **2.0** | 5.0 | 0.0 | Non-Dispersive Intra Red (NDIR) |
| **Nitrogen oxide (NO)** | µg/m$^3$ | 24 Hours | **25.4** | 40.0 | 0.0 | Chemiluminescence |
| **Nitrogen Dioxide ($NO_2$)** | µg/m$^3$ | 24 Hours | **38.4** | 80.0 | 0.0 | |
| **Sulphur Dioxide ($SO_2$)** | µg/m$^3$ | 24 Hours | **35.4** | 120.0 | 0.0 | Ultraviolet Fluorescence Method |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Ozone ($O_3$)** | µg/m³ | 01 Hour | **18.4** | 130.0 | 0.0 | Non-Dispersive UV Absorption Method |
| **Particulate Matter ($PM_{10}$)** | µg/m³ | 24 Hours | **127.8** | 150.0 | 10.0 | β Ray Absorption Method |
| **Particulate Matter ($PM_{2.5}$)** | µg/m³ | 24 Hours | **63.3** | 75.0 | 2.5 | |
| **Suspended Particulate Matter (SPM)** | µg/m³ | 24 Hours | **341.2** | 500.0 | 1.0 | |

Results of monitoring show that average concentration of pollutants are within SEQS limits.

| Meteorological Parameters | | | | | | |
|---|---|---|---|---|---|---|
| **Lead (Pb)** | µg/m³ | 24 Hours | **ND** | 1.5 | - | ASS Method |
| **Wind Speed (m/s)** | **(m/s)** | 24 Hours | **2.7** | - | 1.0 | (Haz-Scanner) EPAS |
| **Wind Direction (Deg)** | Degree | 24 Hours | **231.0** | - | 1.0 | (Haz-Scanner) EPAS |
| **Air Temperature (°C)** | **(°C)** | 24 Hours | **29.6** | - | - | Thermometer |
| **Humidity (%)** | (%) | 24 Hours | **64.6** | - | 1.0 | (Haz-Scanner) EPAS |

Noise monitoring was conducted at project site. Results are in compliance with the SEQS Limits.

| **NOISE TEST REPORT** | | | | | |
|---|---|---|---|---|---|
| **S.NO.** | **LOCATION/SOURCE** | **SEQS Limits : *75dB(A) *Leq** | | | |
| | | **Noise Level Readings** | | | |
| | | **Coordinates** | **Minimum** | **Maximum** | **Average** |
| 1 | Right Corner of the project Area (Front Side)-N1 | **24 59 37.'-N 66" 57' 38.1"E** | 66.8 | 67.4 | 67.1 |
| 2 | Left Corner of the project Area (Front Side)-N2 | **24 59 58.'-N 66" 57' 45.5"E** | 64.5 | 66.3 | 65.4 |
| 3 | Right Corner of the project Area (Back Side)-N3 | **25 00 00.'-N 66" 57' 36.8"E** | 59.7 | 61.1 | 60.4 |
| 4 | Left Corner of the project Area (Back Side)-N4 | **25 00 01.'-N 66" 57' 44.4"E** | 60.8 | 62.4 | 61.6 |
| 5 | Near the Proposed Road Side. M-10 | **24 59 57.'-N 66" 57' 41.9"E** | 63.3 | 64.6 | 63.9 |

**Figure 4.6: Pictorial Evidence of Ambient Air & Noise Monitoring at Project Site**

## 4.5 Geology and Sub-Surface Characteristics

**Geology**: Karachi is the part of major synclinorium stretching from Ranpathani River in the east to Cape Monze in the west, Mehar and Mole Jabal (Mountains) in the north. Within the synclinorium a number of structures such as Pipri, Gulistan-e-Jauhar, Pir Mango and Cape Monze are exposed. The presence of concealed structures under the Malir River valley, Gadap and Maripur plains can fairly be deduced.

Rock aggregates, sand, limestone and clay are some of the potentials for gainful utilization. Gulistan-e-Jauhar member of the Gaj formation offers groundwater potential for limited use. The area is underlain by rocks of sedimentary origin ranging in age from Eocene to Recent. Major structural trends and the basin axis strike generally south but with a "bulge" to the east also called Karachi Arc (Bender and Raza 1995).

**Geomorphology of Karachi:** Karachi is located in the south of Sindh, on the coast of the Arabian Sea. It covers an area of approximately 3,600 km2, comprised largely of flat or rolling plains, with hills on the western and northern boundaries of the urban sprawl. The city represents quite a variety of habitats such as the sea coast, islands, sand dunes, swamps, semi-arid regions, cultivated fields, dry stream beds, sandy plains, hillocks. Classified according to physiographic features, Karachi City District can be divided into three broad categories: Hilly Region (Mountain Highland), Alluvial Plain (Piedmont Plain) and Coastal Areas (Valley Floor). The metropolitan area is divided by two non-perennial river streams

namely Lyari and Malir Rivers. The Malir River flows from the east towards the south and centre, and the Lyari River flows from north to the south west. Gujjar and orangi are the two main tributaries of the Lyari River while Thaddo and Chakalo are the main tributaries of the Malir River. The dry weather flow of both rivers carries urban sewage that is ultimately drained in the Arabian Sea. Among the various physiographic features, low flat-topped parallel hills devoid of vegetation, interspersed with widespread plains and dry riverbeds are the main topographic characteristics of the city.

The greatest height of the region is 250 ft. that gradually decreases to 5 ft. above mean sea level along the coastline. The Karachi Harbor is a sheltered bay to the south-west of the city, protected from storms by the Sandspit Beach, the Manora Island and the Oyster Rocks.

The Arabian Sea beach lines the southern coastline of Karachi. Dense mangroves and creeks of the Indus delta can be found towards the south east side of the city. Towards the west and the north is Cape Monze, an area marked with projecting sea cliffs and rocky sandstone promontories.

### 4.5.1 Topography

Karachi may be broadly divided into two parts; the hilly areas in the north and west and an undulating plain and coastal area in the south-east. The hills in Karachi are the off-shoots of the Kirthar Range. The highest point of these hills in Karachi is about 528 m in the extreme north. All these hills are devoid of vegetation and have wide intervening plains, dry river beds and water channels. The topography of Karachi includes the large shallow intertidal and sub-tidal areas spreading out to 1-5 km with a very gentle surface gradient of about 1:50. The Cape Monze cliff that projects into the Arabian Sea is part of the 3 to 9-meter contour that characterizes the coastline up to the Rann of Kutch. In the sand mass along the coastline there are 30 to 60m high cliffs that have been undercut by storm surges. Intense erosion resulted in cliffs, sea caves, arches and blow holes that can be observed on the coastline from Hawkes Bay to Manora Channel and onwards to Korangi Creek.

The coastal region of the synclinorium is seismically active and has been undergoing continuing uplift. The uplift has already resulted in the formation of rocky headlands and in exposing portions of continental shelf. Protected pocket bays and lagoons between the nearly formed headlands have been rapidly filled by alluvial and fluvial deposits. The material brought to the coast was taken over by currents and wind for the formation of wide sandy beaches, and migrating sand dunes.

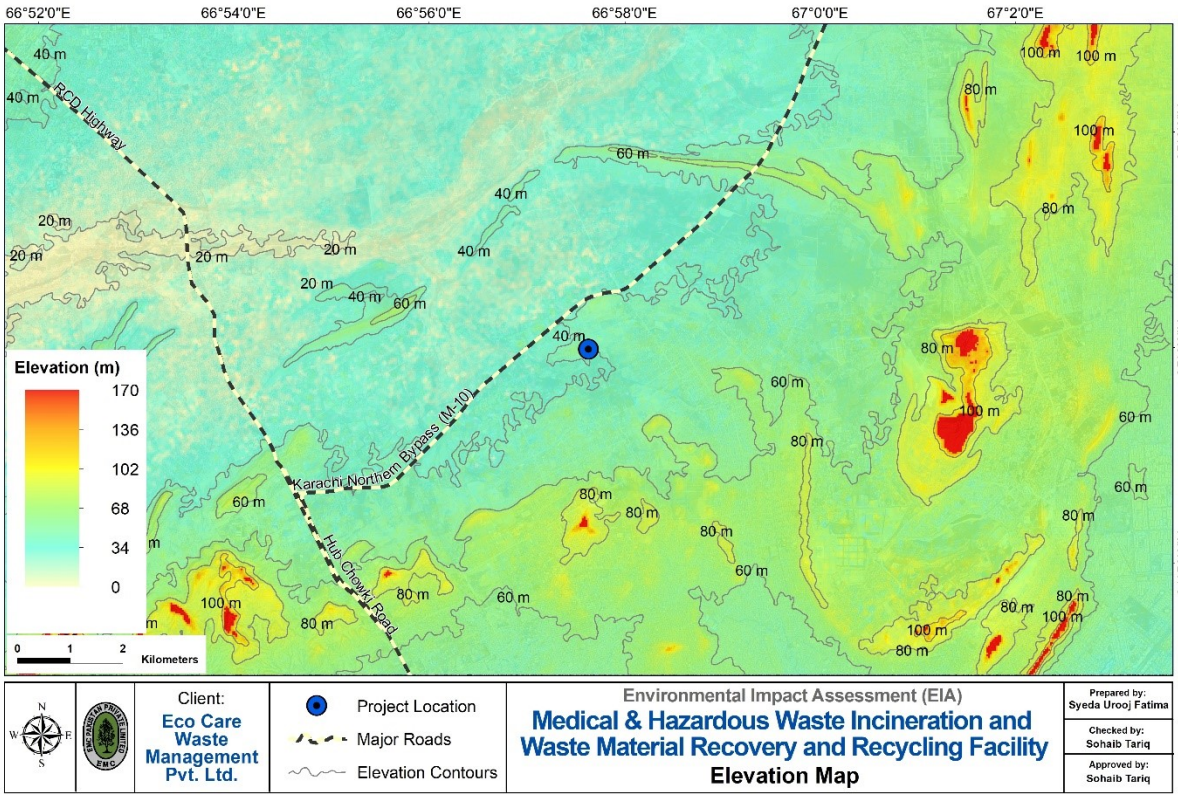



**Fig 4.4: Elevation map of Project Area**

### 4.5.2 Seismicity

The Seismotectonic study for macroenvironment of Project site aims at elucidating the impact of tectonic movement induced seismicity on the microenvironment. Seismicity in the Karachi region is related to the pressure potential being built at the convergence of the three lithospheric plates: Indian, Arabian, and Eurasian at the Triple Junction (Figure 4.5 & 4.6) formed by the intersection of Owen fracture zone, the Makran subduction zone and the Ornach-Nal fault. The Murray Ridge extends northward into Pakistan, to unite the Ornach-Nal-Chaman Fault system onshore, displaying a strike-slip boundary between the major tectonic plates of India and Eurasia[7].

[7] (Baloch, S.M. & Quirk, D.G., Mesozoic to Neogene Tectonism and Evolution of Murray Ridge, Pak. Jour. of Hydrocarbon Research, Islamabad, 13).

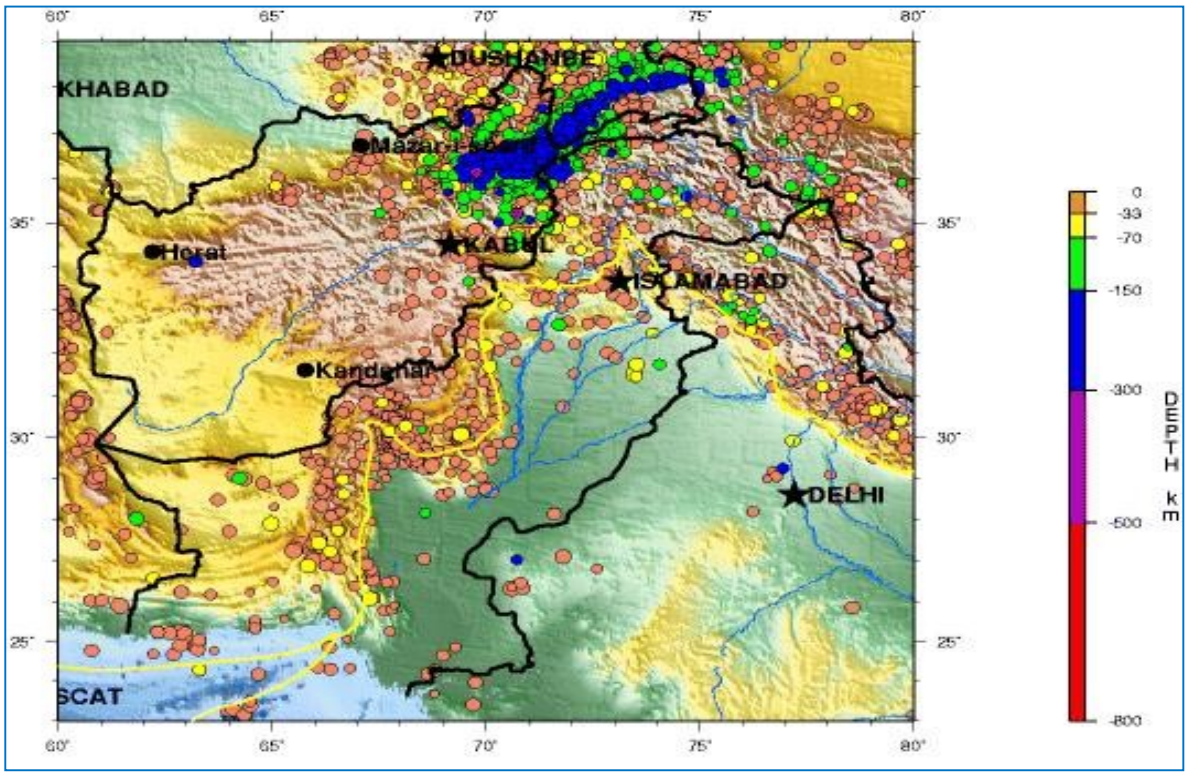



**Figure 4.5: Seismicity & Natural –isasters - Pakistan, 1990-2000**

Karachi and its environs fall in the synclinorium, described earlier as being part of Indus deltaic region. Recession of the delta and its retreat towards the southeast dried up its numerous channels, estuaries and creeks that characterize the synclines and are part of the active faults. Tectonic instability of this region can be attributed to this large number of reverse and tear faults and the recently described wrench faults.[8]

[8] (Riding the mobile Karachi arc, Pakistan: Understanding tectonic threats Ghulam Sarwar and Anwar Alizai, Journal of Himalayan Earth Sciences 46(2) (2013) 9-24).

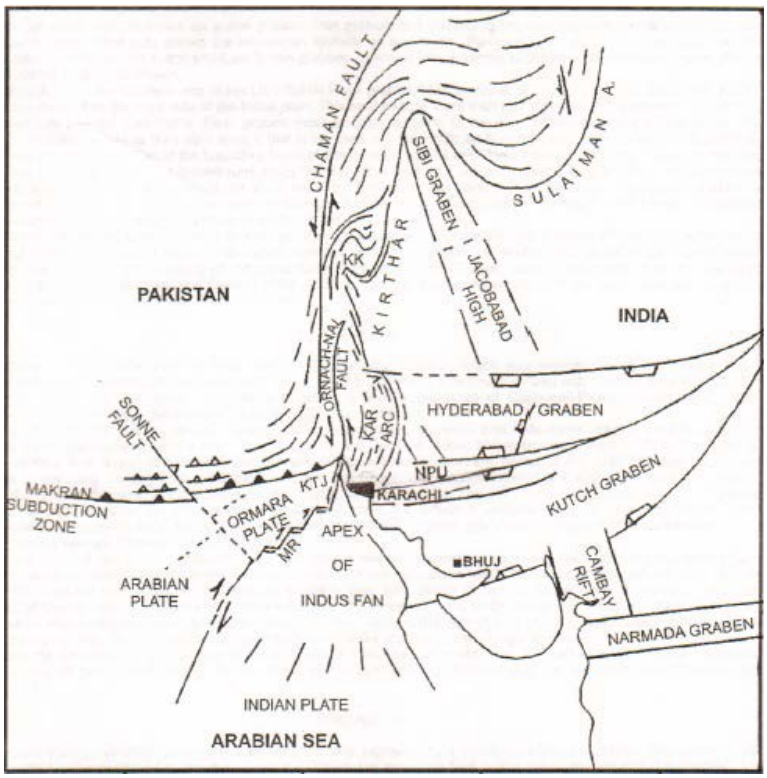



**Figure 4.6: Schematic plate tectonic sketch map showing the Karachi Arc and its regional tectonic framework**

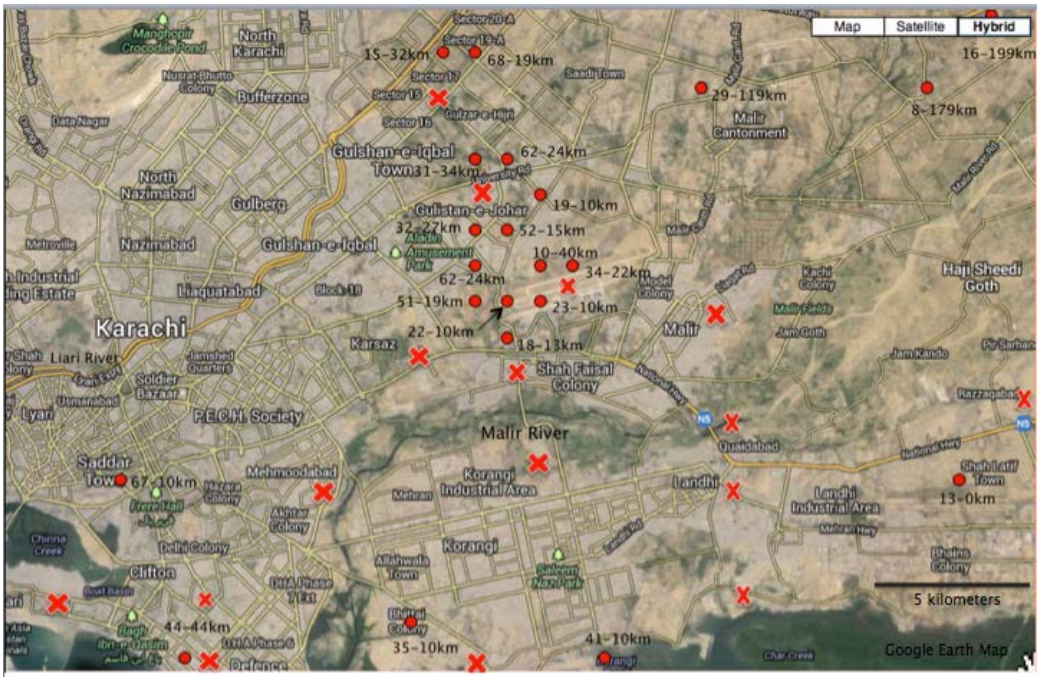



**Figure 4.7: Earthquake epicenter plots for the time period 1902-2013**

The first number refers to the list numbers whereas the second number represents depth of hypocenter in kilometers. The Red Crosses represent neighborhoods plagued by recurrent seismic activity, usually of low magnitude.[9]

Sarwar and Alizai have compiled a list of earthquakes during the 1902-2013 period and also produced the above map that gives a distribution of hypocenters of earthquakes during the same period. From the distribution of hypocenters, it has been inferred that the entire Karachi Arc and surrounding areas are seismically active with hypocenters ranging in depth from 0-500 kilometers. From the depth of hypocenters, it is inferred that active deformation has taken place at multi-levels ranging from shallow too deep in the basement. Quite a few of the recent epicenters are found within or in close proximity to parts of Karachi that have faced recurrent earthquake activity.

Seismic activity in the region is the result of the triple junction as well as the Karachi Arc, located in southeastern Pakistan, as a large fold and thrust belt that shows Neogene thin-skinned eastward movement (Sarwar and DeJong, 1979; Schelling, 1999). Seismic activity in and around the region shows that the Karachi Arc has been active since long in prompting the eastward movement of the delta. It is possible that the movement is related to the rebound that takes place after mass shift. Sarwar has suggested that the eastward creep of Karachi Arc is directly related to active subsidence of the Hyderabad graben that underlies it and also defines the northern and southern limits of the Karachi Arc.[10]

It may be added that sub"iden'e such as that on Southern coast of Sindh, occurs naturally as a result of plate tectonic activity above active faults, and in places where fluid is expelled from underlying sediments and is common at river deltas that may have receded. Earthquakes arise and result from the release of the force along the growth fault plane. As a result, many different growth faults are created as sediment loads shift basinward and landward.

**Earthquakes:** Historically the coastal region has suffered a number of earthquakes. A list of earthquakes that have affected Karachi and its vicinity has been compiled by the Meteorological Department and listed by Sarwar and Alizai.

Some of the events are listed in Table 4.7.

**Table 4.7: List of Earthquake in Indus Deltaic Region and surrounding**

| Date | Lat-N | Lat-E | Magnitude | |
|---|---|---|---|---|
| | | | Depth (km) | Richter Scale |
| **26-09-1977** | 25.4 | 68.2 | 33 | 4.5 |
| **25-11-1982** | 25.6 | 67.9 | 33 | 4.9 |
| **17-12-1985** | 24.9 | 67.4 | 33 | 4.9 |
| **24-12-1985** | 24.8 | 67.6 | 33 | 4.7 |
| **10-09-1991** | 24.4 | 67.7 | 33 | 4.8 |
| **19-09-1991** | 24.3 | 68.7 | 33 | 4.7 |
| **23-04-1992** | 24.3 | 68.8 | 33 | 3.7 |
| **24-12-1992** | 25.2 | 67.7 | 33 | 3.6 |
| **05-02-1993** | 24.6 | 68.9 | 33 | 4.3 |
| **26-01-2001** | 23.4 | 70.3 | 17 | 7.6 |

[9] (Source: Pakistan Meteorological Department, June 2013 & Ghulam Sarwar and Anwar Alizai, Journal of Himalayan Earth Sciences 46(2) (2013) 9-24)

[10] (Sarwar, G., 2004. Earthquakes and the Neo-Tectonic Framework of the Kutch-Hyderabad-Karachi Triple Junction Area, Indo-Pakistan. Pakistan Journal of Hydrocarbon Research, 14, 35-40).

**Seismicity of the Site:** According to the Uniform Building Code (1997), Karachi and its adjoining areas fall in Seismic Zone-2B.

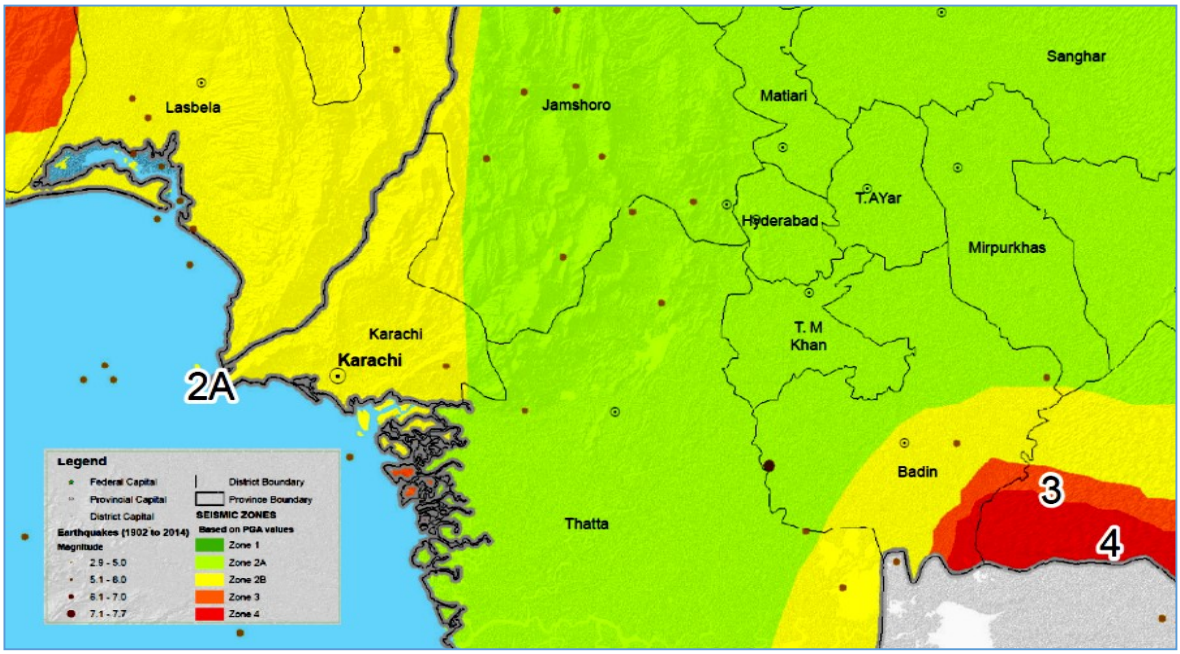
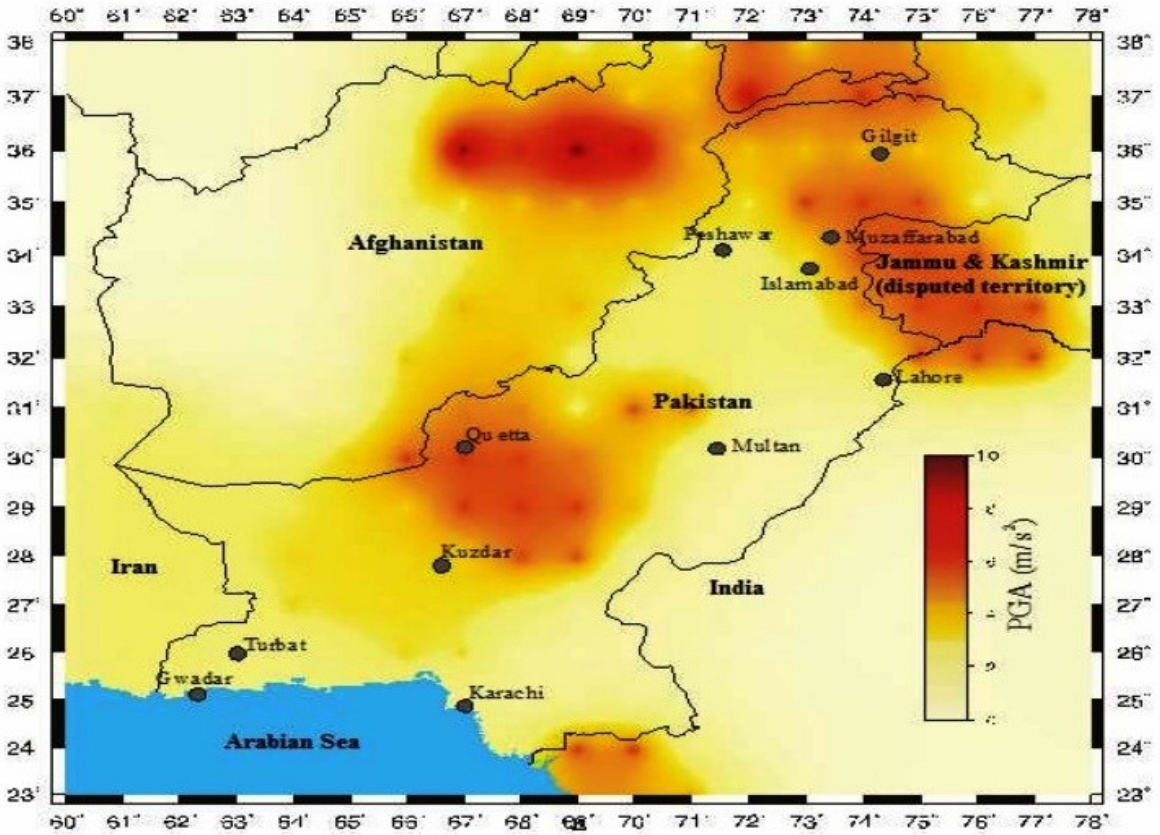



**Figure 4.8:** Seismic Zones in Karachi[11]




[11] Map data source(s): PMD, GSP, Pakistan Engineering Council – Prepared by Al Hasan Systems Private Limited

**Figure 4.9:** Seismic Hazard for Pakistan in terms of Peak Ground Acceleration (PGA)[12]

### 4.5.3 Liquefaction Features Caused by Earthquake

Liquefaction is a total loss of strength due to undrained restructuring. Disturbance, by shearing or vibration, destroys soil skeleton, with loss of grain contact and decrease of porosity, soil load is transferred to pore water, water pressure>normal stress=0, and soil acts as a liquid. Drainage reduces pore water pressure, allows grain contact and thixotropic recovery of strength (Waltham, 2002). Strong shaking produces liquefaction in the fine sands and silts during the earthquake. This causes the mineral grains to settle and expel their interstitial water to the surface. If the pore-water pressure rises to a level approaching the weight of overlying soil, the granular layer behaves as a viscous liquid rather than a solid and leads to collapse of even engineered structures. Liquefaction has been abundant in areas, where groundwater lies within 10 meters of the ground surface (Husain et al., 2004). Investigators typically have designated sites as "Liquefied" on the basis of the presence of surficial liquefaction features, such as venting of sediment to the surface (i.e., sand boils), ground cracking associated with liquefaction (e.g., lateral spreading), or surface settlements. Other evidence of liquefaction includes tilting or settling of overlying structures and floating of underground structures (Olson et al., 2002). Mahmood and Shaikh (2008) investigated the "sinking" of a water tower in 2006 near Clifton area and speculated about liquefaction due to mild earthquakes.

### 4.5.4 Hydrology of Karachi

Hydrogeologically, the city of Karachi lies in the Hub River Basin and the Malir River Basin. The Malir River Basin is drained by the Malir River and the Lyari River. The aquifer of Karachi is, therefore, mainly recharged by seepage from Hub River, Hub Dam as well as the Malir and the Lyari Rivers. The Hub River lies on the western frontier of Sindh and for some distance the boundary between Sindh and the Baluchistan provinces. It located about 30 km to the west of Karachi, along the Karachi- Lasbela boundary. It falls into the Arabian Sea near Cape Monze, with a total drainage course length of 336 km. During the past several years, a number of pumping wells have been installed to meet requirements for the irrigation-water supply (to raise vegetables, fruits, dairy and poultry) and drinking-water supply for Karachi. Excessive pumping of groundwater and continuous lowering of water-table is likely to result in intrusion of seawater into the Malir Basin under natural seepage conditions and under artificially induced conditions of recharge of saline seawater in the coastal aquifer(s) of Karachi.

**Recharge Sources:** Five possible water-sources are contributing to the groundwater recharge in Karachi. The first possible source is the rainfall. As the city of Karachi suffers from deficit of precipitation (only rainfall), the contribution to shallow groundwater storage from rain is very little. However, rainfall in the hinterlands and other areas surrounding Karachi may significantly contribute to the groundwater flow-system. The two freshwater sources are the Hub Lake/Hub Dam and the Indus River. Water from Hub Dam and the Indus River is piped to various residential zones in Karachi for drinking and irrigation purposes. The spring water discharges into Malir River and Lyari River and the municipal/industrial waste effluents added to these rivers are also contributing to groundwater storage as a fourth recharge source. Seawater intrusion along Karachi coast is the fifth possible source.

[12] PMD Seismic Monitoring and Early Tsunami Warning Centre - http://seismic.pmd.gov.pk/seismicnew/map2.html

**Water Supply and Sewerage System:** The water supply and sewerage system is managed by Karachi Water Supply & Sewerage Board (KW&SB). Present water supply system of Karachi City has a supply capacity of about 650 MGD. As of 2019, Karachi receives about 580 MGD, well below the demand of over 1,100 MGD.

**Table 4.8: Description of Water Supply Schemes for Karachi Bulk Water Supply**

| S. No | Description of Water Supply Schemes | Rated Supply (MGD) | Actual Supply (MGD) |
|---|---|---|---|
| 1 | Haleji Scheme | 30 | - |
| 2 | Greater Karachi (GK) Bulk Water Supply Scheme Stages I to IV | 280 | 280 |
| 3 | K-ll Scheme | 100 | 100 |
| 4 | Additional Water Supply from GK BWS System | 40 | 40 |
| 5 | (To) Pakistan Steel | 26 | 26 |
| 6 | (To) Port Qasim Authority | 7.5 | 7.5 |
| 7 | K-III Scheme | 100 | 100 |
| 8 | Hub Dam | 100[13] | 70[14] |
| Total | | 683 | 623[15] |

*Source: EA/KW&SB, Express Tribune, Wapda*

The Karachi had been allotted 650 MGD from River Indus through Keenjhar-Gujjo Water Supply System. However, they actual supply is below 580 MGD. KW&SB had planned to revive Haleji Lake to supply 65 MGD to Karachi or to tap this capacity from Keenjhar-Gujjo canal system for supply to Karachi. So far no substantial work on either of the projects have been reported. To meet the Karachi water demand, K-IV project was conceived in 2007 to supply 650 MGD additional water to Karachi. The project has been delayed several times, and the Phase-I of the project which was to supply about 260 MGD water to Karachi is yet to be completed.

As mentioned in the table above, the given water supply of 653 MGD may further be curtailed to about 406 MGD due to considerable losses in the water supply system[16][17].

The existing sewerage catchment area which covers 18 towns in Karachi city is divided into three districts, namely: respective catchment area of T.P-1, T.P-2 and T.P-3. KW&SB formulated the Master Plan of the water supply and sewerage system in cooperation with JICA in 2008. However, most of the projects for rehabilitation and augmentation proposed in the Master Plan study, etc. have not been carried out due to financial constraint of KW&SB. Due its negligence to maintain and operationalize the treatment plants, not only municipal effluent but industrial effluent also is directly going into sea destroying marine life. It is estimated that the city's sewage (about 470MGD) and industrial waste (about 90MGD) are being dumped into the sea largely without treatment[18].

[13] http://www.wapda.gov.pk/index.php/projects/water-sector/o-m/hub-dam

[14] Perpetual issue: Leaks in the system create water crisis in Karachi By Syed Ashraf Ali Published: September 15, 2019 in Express Tribune. https://tribune.com.pk/story/2056804/1-perpetual-issue-leaks-system-create-water-crisis/

[15] Losses unaccounted for.

[16] Water woes: Karachi goes thirsty as its water goes to waste By Syed Ashraf AliPublished: July 29, 2019 Express Tribune. https://tribune.com.pk/story/2023808/1-water-woes-karachi-goes-thirsty-water-goes-waste/

[17] Perpetual issue: Leaks in the system create water crisis in Karachi By Syed Ashraf AliPublished: September 15, 2019 in Express Tribune. https://tribune.com.pk/story/2056804/1-perpetual-issue-leaks-system-create-water-crisis/

[18] Panacea for Karachi's water woes? By Kazim Alam. Published in Dawn on Sep 09, 2019. https://www.dawn.com/news/1504238/panacea-for-karachis-water-woes

In January 2018, the Supreme Court appointed Honorable Justice Amir Hani Muslim, a retired Supreme Court judge, the new head of the water commission with a mandate to 'implement" the recommendations of the previous commission that the apex court had formed in December 2016 and which delivered its final report in February 2017 and was head by Justice Mohammad Iqbal Kalhoro. Treatment of sewage, a much-neglected issue, saw a revival under the commission. As of February 2017, all the three sewerage treatment plants of Karachi were dysfunctional, each had a capacity of about 50MGD. A fourth treatment plant has been planned to be set up in Korangi. Commission under Justice Amir Hani Muslim lasted till January 2019. In terms of sewage disposal and treatment, following achievements can be credited to the efforts of commission[19][20][21];

- Rehabilitation work on TP-1 (SITE) was planned as the government planned to increasing its capacity to 150MGD.
- TP2 (Mehmoodabad) is permanently closed because of a land-related dispute, so the government planned setting up a 180MGD plant in Korangi instead (TP4).
- TP3 (Mauripur) stopped functioning post heavy downpours in 2020. GoS plans to revive the plant[22].
- Five industrial effluent treatment plants are scheduled to be built in the SITE, Trans-Lyari, F.B, Landhi and Superhighway areas.

Private sector has also sprang into action, for instance, HUBCO has submitted an unsolicited proposal to the Sindh Public-Private Partnership Unit (PPPU) to set up a wastewater recycling plant at TP-1 (SITE) of 50MGD capacity[23].

**Water Quality:** Report of commission of inquiry of February 2017 indicated that all the 7 filter plants of KW&SB are malfunctioning. The clarifiers at all the Filter Plants, which were acting as circular sedimentation tanks are non-functional. The water which was full of all contamination that includes turbidity, color, odor & taste, TDS, Hardness, Calcium, Sodium, Potassium, Chloride, Sulfate, Fluoride, Nitrate and Iron etc. in high volume was being supplied to the people of Karachi.

The analytical data compared with WHO and NEQS water quality standards demonstrated that out of 84 drinking water samples, 08 (10%) water samples were found unsafe for drinking due to presence of turbidity values beyond the safe limits (5 NTU). The maximum value for turbidity was measured as 24.4 NTU. One sample (1.2%) was found unfit for drinking due to presence of color, 09(11%) water samples were found unsafe due to presence of Total Dissolved Solids (TDS) contents beyond permissible limit (1000mg/l). Maximum concentration for TDS was recorded 3846 mg/l. 07 water samples (8%) were found unsafe for drinking purpose due to presence of hardness values beyond WHO permissible limit (500mg/l). The highest value for hardness was measured as 1100mg/l whereas 30mg/l as lowest. Eleven water samples (13%) were found unfit for human consumption due to presence of sodium content beyond the maximum permissible limit (200mg/l) recommended by WHO for human consumption. The highest value for sodium was measured as 835mg/l. Seven samples (8%) were found unfit for human consumption due to presence of sulfate content beyond the safe limit recommended by WHO (250mg/l). The highest value for sulfate was measured 440mg/l. Eight water samples (10%) were

[19] Ibid
[20] Judicial commission submits its fifth report in SC by Mohammad Hussain Khan. Published in Dawn 12, 2018. https://www.dawn.com/news/1450835
[21] Water commission records improvement, wants stakeholders to tap into its success. Express Tribune Dec 13, 2018. https://tribune.com.pk/story/1865552/1-water-commission-records-improvement-wants-stakeholders-tap-success/
[22] https://tribune.com.pk/story/2304449/govt-to-revive-karachis-three-sewage-treatment-plants
[23] Panacea for Karachi's water woes? By Kazim Alam. Published in Dawn on Sep 09, 2019. https://www.dawn.com/news/1504238/panacea-for-karachis-water-woes

found unfit for human consumption due to presence of chloride ion concentration beyond maximum permissible limit (250mg/l) recommended by WHO for human consumption. The highest value for chloride was measured as 1483mg/l.

Fluoride content was found exceeding WHO limit (1.5mg/l) in 03 (2%) water samples. The highest concentration for fluoride was measured as 2.23mg/l. Two water samples (2%) were found contaminated with nitrate–nitrogen content beyond the safe limit (10mg/l) recommended by WHO for safe drinking water. The highest concentration for nitrate nitrogen was recorded 20.45mg/l. One sample (1.2%) was found polluted with iron content beyond the safe limit recommended by WHO (0.3mg/l).

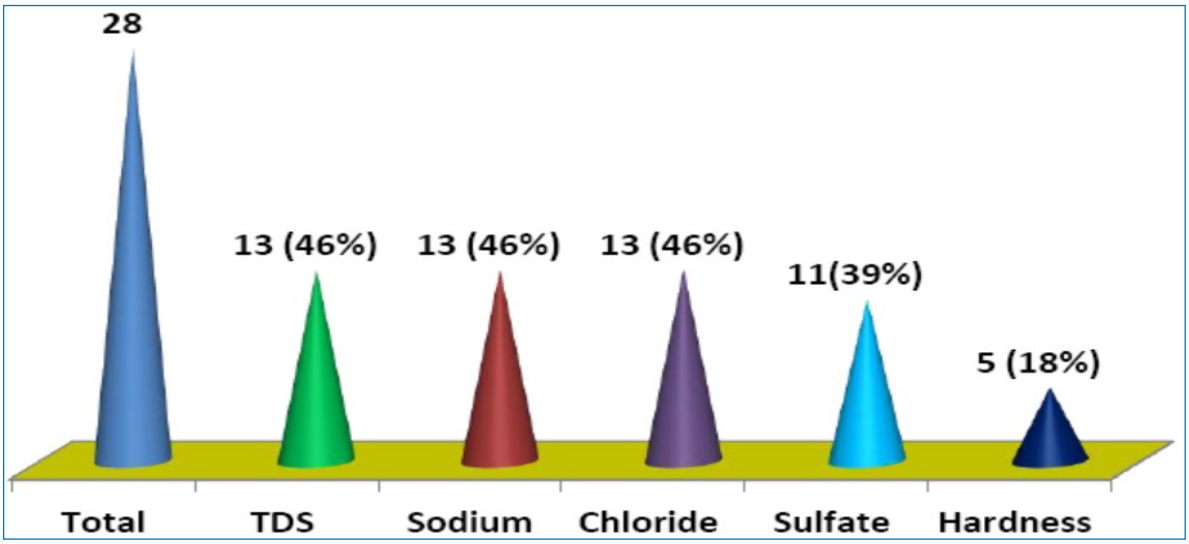



**Figure 4.10: Percentage samples beyond permissible limit for different parameters in Karachi.**

Sixty-seven out of 84(80%) drinking water samples collected from surface and subsurface (ground water sources) used for drinking purpose were found unsafe for human consumption due to presence of Total coliforms (bacteriological contamination) beyond the WHO recommended values (0/100ml). 30(36%) water samples were found fecal contaminated i.e. presence of E. coli. The E. coli concentration lies in the range of 01 too numerous to count cfu / ml exceeding WHO limit recommended for drinking water (0/100ml). While, only seventeen water samples (20%) were found bacteriological safe for drinking purpose.

Overall data shows that out of 84 samples 67(80%) were found unsafe for drinking purpose, while only 17(20%) samples were found fit for human consumption for analyzed parameters under prescribed standards.

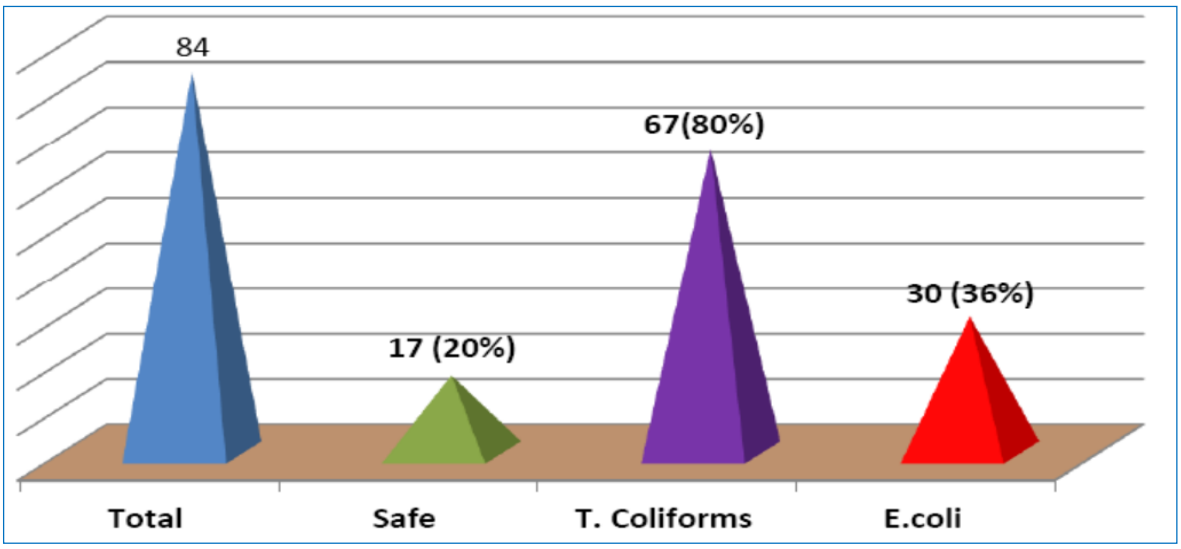



**Figure 4.11: Percentage samples beyond permissible limits for bacteriological contamination in Karachi**

As per the fifth interim report of implementation commission, rehabilitation of filter plants was expecte to be at an advance stage of procurement and work orders were expected to be issued[24].

Financed by Worldbank, The Karachi Water and Sewerage Services Improvement Project (KWSSIP) aims to improve access to safe water services in Karachi and to increase Karachi Water and Sewerage Board's financial and operational performance. This first project includes basic infrastructure and support for the reform plan of the Karachi Water and Sewerage Board. The project includes Bulk Water Supply Scheme and K-IV Augmentation Scheme for Karachi.

**Surface Water Drainage and Flooding in Karachi City:** The problem of urban flooding is quite significant in Karachi which is the industrial and business hub of Pakistan. Karachi had experienced severe floods which occurred periodically. In 1977 severe flood occurred in the flood plains of the Malir River and the Lyari River killed 267 people, more than 30,000 were homeless and 100,000 were temporarily dislocated. Houses were destroyed and roads were damaged. The total loss was estimated about 5 billion rupees (KDA, 1981). In the monsoon season of 2020, several spells of heavy downpour lashed the city, breaking records and causing substantial urban flooding and loss of life and property.

Urban flooding is caused by heavy rainfall overwhelming drainage capacity. The primary cause of flooding in Karachi city is torrential rainfall due to tropical storm and monsoon which saturate soil and create huge surface runoff. Floods in urban conditions are flashy in nature and occur both on built up surfaces like roads and streets, parking lots, yards, parks etc. and creeks of urban areas like the Lyari, the Gizri, and the Korangi creek.

[24] Judicial commission submits its fifth report in SC by Mohammad Hussain Khan. Published in Dawn 12, 2018. https://www.dawn.com/news/1450835

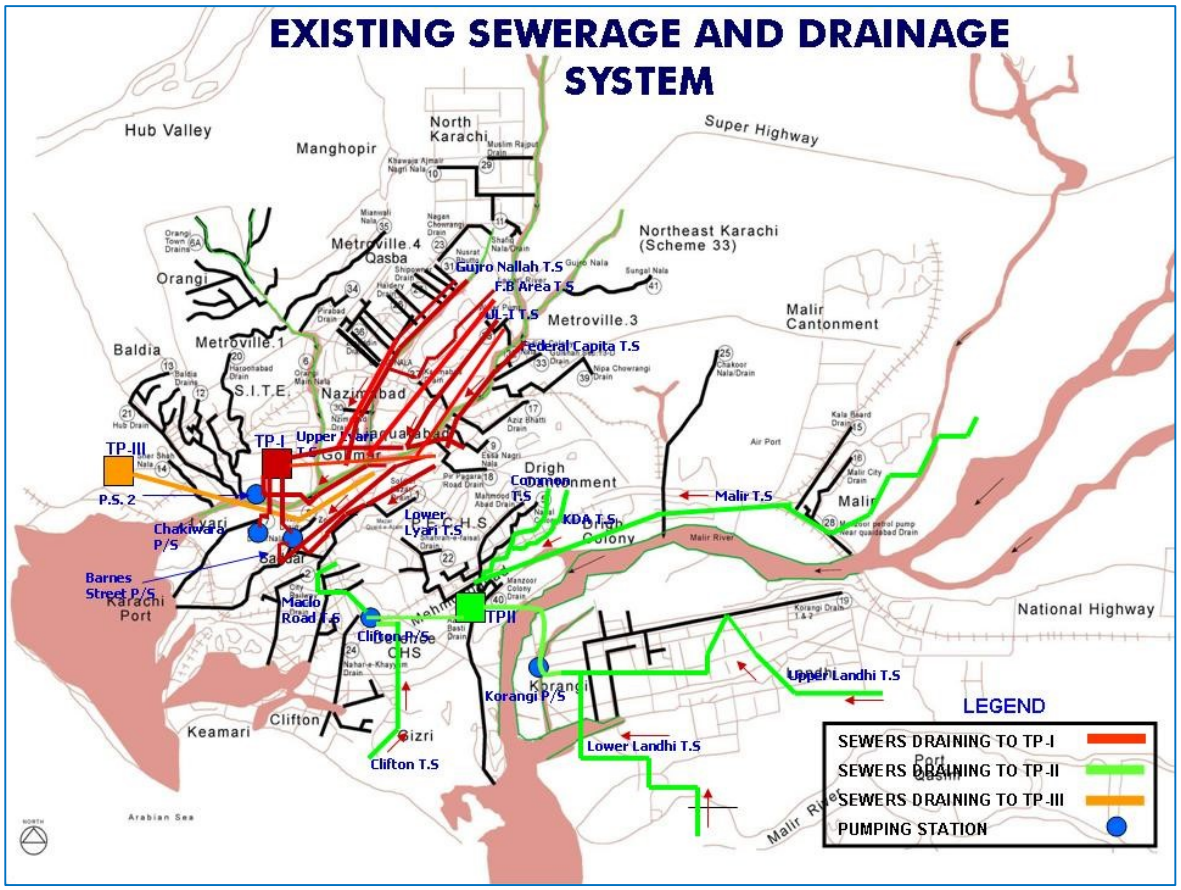



**Figure 4.12:** Existing Sewerage System of Karachi

| Table 4.9: Drainage characteristics of River Basins of Karachi | | | | |
|---|---|---|---|---|
| **River Basin** | **Length of Streams (km)** | **Basin Area Sq.km** | **Branching Ratio** | **Drainage Density km/sq.km** |
| Malir River Basin | 725 | 2167 | Dendritic | 3.4 |
| Lyari River Basin | 180 | 578 | Dendritic | 5.6 |
| Budnai Basin | 46 | 95 | Dendritic | 5.7 |

### 4.5.5 Storm Water Drainage

Following Table outlines stormwater drainages and nallahs under each township administration. Drainages are artificial water channels for stormwater drainage; on the contrary, nallahs are natural water channels. Many drainages are connected to nallahs and some drainages connected to river directly; Nallahs discharge into rivers such as Lyari River and Malir River receiving stormwater. As sewage collection system in Karachi City is not enough and its maintenance is not satisfactory, stormwater drainage and nallahs have to receive sewage all year long in addition to stormwater in rainy season.

| Table 4.10: Town-wise Stormwater Drainage/Nallah Length | | | |
|---|---|---|---|
| **Town** | **Depth (m)** | **Width (m)** | **Length (km)** |
| 1. Keamari Town | 1.21 | 0.91~3.04 | 7.62 |
| 2. SITE Town | 2.13 | 3.65 | 16.08 |

| Table 4.10: Town-wise Stormwater Drainage/Nallah Length | | | |
|---|---|---|---|
| **Town** | **Depth (m)** | **Width (m)** | **Length (km)** |
| 3. Baldia Town | 1.22 | 2.43 | 11.77 |
| 4. Orangi Town | 1.52 | 2.43~3.65 | 34.1 |
| 5. Lyari Town | 1.37 | 0.6~13.7 | 19.4 |
| 6. Saddar Town | 1.37 | 3.05 | 11.14 |
| 7. Jamshed Town | 1.5 | 2.43 | 33.8 |
| 8. Gulshan -e- Iqbal Town | 3.64 | 2.4~15.2 | 28.0 |
| 9. Faisal Town | 1.22~4.57 | 1.52~24.0 | 20.1 |
| 10. Landhi Town | 1.22 | 2.43 | 35.36 |
| 11. Korangi Town | 1.52 | 2.74 | 36.4 |
| 12. North Nazimabad Town | 1.22 | 2.4 | 30.7 |
| 13. North Karachi Town | 1.22 | 2.4 | 45.1 |
| 14. Gulberg Town | 1.37 | 2.4 | 22.1 |
| 15. Liaquatabad Town | 1.52 | 3.65 | 19.5 |
| 16. Malir Town | 1.22 | 3.04 | 6.15 |
| 17. Bin Qasim Town | 1.22 | 3.64 | 14.63 |
| 18. Gadap Town | 1.22 | 3.65 | 24.43 |
| **Total** | | | **416.38** |
| **Source:** KWSB | | | |

Roadside drains are cleaned by KMC/KW&SB one to two months before monsoon season comes every year. Removed and collected silt/garbage is conveyed to designated solid waste disposal sites. However, roads are cleaned afterwards by town administration and silt/garbage is transferred to drains again. This is said to be how inundation is caused. In addition to above mentioned administrative issues, many drains and nallhas have been already encroached on by illegal houses and buildings. Strong enforcement of building code and other relevant laws is expected.

Another major issue with malfunctioned drains/nallahs is that garbage is easily and routinely dumped to these facilities, which leads to their reduced sections. Comprehensive solid waste management system has to be introduced.

## 4.6 Disposal of Solid Waste

Karachi is the largest and most populated city of Pakistan, located in south Asia. The daily MSW production in the city is over 12,000 tons, with about 52% organic fraction. Currently, there is no prevalence of proper waste management system in Pakistan. Particularly in large urban areas like Karachi, where massive amount of MSW is produced and mishandled resulting in critical environmental and public health problems. Overall, 60% of MSW generated in Karachi is being collected and openly dumped in so-called landfill sites located out of the city. Whereas, remaining 40% of the waste is left on the street and roadsides creating detrimental environment for the public. Like other major cities of Pakistan, Karachi has industrial zones wherefrom a significant amount of MSW is generated with a

huge potential for energy production. However, due to paucity of proper waste handling and control, this resource is being wasted.[25]

Waste is an unavoidable by-product of most human activity. Economic development and rising living standards in the city have led to the increase in the quantity and complexity of generated waste, whilst industrial diversification and the provision of expanded health-care facilities have added substantial quantities of industrial hazardous waste and biomedical waste into the waste stream with potentially severe environmental and human health consequences. The city is unable to manage hospital waste by applying scientific methods. Hospital waste is simply mixed with municipal waste in roadside collection bins and disposed of similarly which is not acceptable. Hazardous, hospital and industrial waste are being treated as ordinary wastes.[26]

There is no scientifically designed sanitary landfill site for the safe and final disposal of waste. Most of garbage is dumped at Jam Chakro site near Surjani Town; Gond Pass (near Hub Chowki) and Mehran Town near Korangi. As no public health procedures are applied, open dumping causes enormous problems.

Financed by Worldbank and executed by Sindh Solid Waste Management Board (SSWMB), the Solid Waste Emergency and Efficiency Project (SWEEP) aims to improve solid waste collection, transportation and disposal: one of the most acute service needs and a top priority for Karachi residents. By reducing the volume of waste openly dumped in Karachi, SWEEP will improve public health conditions and overall livability, as well as reduce urban flooding and environmental degradation risks linked to inadequate handling of solid waste.

## 4.7 Incinerators in Karachi

A few incinerators are functional in Karachi. There are two functioning incinerators installed in SITE area and owned by Karachi Metropolitan Corporation (KMC) with estimated capacity of 20 tons per day. The estimated capacity of installed and upcoming incineration plant is 20 tons per day. It burns medical and other hazardous waste. Other incinerators mainly belong to private entities such as Geolinks in Port Qasim, Agha Khan University Hospital, etc. Medical waste incinerators of about 100 kg/hr capacity are to be installed at various Government hospitals in Karachi, such as Jinnah Post Graduate Medical Centre, National Institute of Child Health, etc. as planned by Health Department, Government of Sindh[27].

## 4.8 Biological Environment

The ecology of microenvironment and macro environment of the project area has completely changed as a result of continuous emergence of urban areas. Ecological risk of high order has been induced by land clearance and removal of natural vegetation from the plains during the urban sprawl to make room for industrialization and urbanization. This has degraded the physical environment as quantified in the

[25] *Sohoo, I., Ritzkowski, M., Heerenklage, J., & Kuchta, K. (2021). Biochemical methane potential assessment of municipal solid waste generated in Asian cities: A case study of Karachi, Pakistan. Renewable and Sustainable Energy Reviews, 135, 110175.*

[26] *Mahesar, M. A. (2020). Subject: Submission Of Research Paper On Municipal Solid Waste Management: A Case Study Of Metropolitan Karachi With Lesson For Jacobabad Final Version Developed Under Lgsa Project, Msdp.*

[27] http://www.epasindh.gov.pk/pressrelease.htm dated 12-06-2019

above section & the biological environment in the sense that the entire macro environment has lost its biodiversity. During the survey, no endangered or vulnerable faunal and floral species were found.

Vegetation at Project Site

## 4.9 Socio-economic Status of the Macroenvironment

The social baseline chapter provides a comprehensive review of the socio-economic conditions of the project area. This socio-economic profile is based on a desk study of literature and several primary data gathering activities including site visits, sample socio-economic survey of stakeholders in the area, and consultations with primary and secondary stakeholders. This social baseline provides an overview of the socio-economic conditions of the people who reside and work in the project vicinity. It also includes an assessment of the public utilities and social services (education and health facilities) in the area.

International best practice for EIA studies demands an alignment of the proposed project components with the applicable Sustainable Development Goals (SDGs) adopted by all UN Member States in 2015. The SDGs provide broad universal targets for reducing poverty, environmental degradation, injustice and important pillars of social upheaval that must be achieved by 2030. In March 2017, the global indicator framework was developed and agreed upon by the Inter-Agency and Expert Group on SDG Indicators (IAEG-SDGs) to monitor progress towards achievement of these indicators. Moreover, all member states, including Pakistan have developed national indicators linked to the global targets that provide the basis for a national effort of monitoring progress towards fulfillment of the indicators. The

proposed project should be aligned with Goal 03 of the SDGs which ensures healthy lives and promote well-being for all.

The social baseline chapter helps in understanding the existing socioeconomic conditions of the project area. The data in this chapter will be used for the development of a Social Management Plan to mitigate or improve the social impacts arising from the proposed development. The social baseline is divided into the macro and microenvironment of the project area.

The macro-environment covers the administrative setup, demography, education, and health profile of the area. The immediate neighborhood of the project area has been considered as the micro-environment of the project. The microenvironment covers the land use, education, health, and utility profile of the area. Project falls in District West, Karachi, in Mango Pir sub-division.

### 4.9.1 Macro Environment

#### Administrative Context

Karachi City and capital of Sindh is located on South-Eastern tip of the country. It is the country's largest city, principal seaport and major industrial area. There have been a lot of changes in the administration. Previously, there was The Karachi Division and each division had five districts. This Division system was abolished in 2000 and five districts of Karachi were merged in City District Karachi. The City District Karachi was divided into 18 Towns and 178 union councils. On 11 July 2011, Sindh Government restored 5 districts of Karachi division and abolished City District Government Karachi. In November 2013, a new District Korangi was formed by splitting District Karachi East. Furthermore, on 04 September 2020, a new district (7$^{th}$) was formed by splitting District West. Now Karachi Division has District Central, District East, District Malir, District South, District Korangi, District West and District Kemari. These districts form the Karachi Division now. All districts have subdivisions. There are also six military cantonments, which are administered by the Pakistan Army.

**Table 4-1: Area, Density and Population of Karachi's Districts (2017)**

| Name | Area (Sq. km) | Density (2017) Sq. km | Population Census (2017) |
|---|---|---|---|
| District Malir | 2,160 | 891 | 1,924,346 |
| District West | 370 | 5,614 | 2,077,228 |
| District East | 139 | 20,686 | 2,875,315 |
| District Korangi | 108 | 23,866 | 2,577,556 |
| District South | 122 | 14,502 | 1,769,230 |
| District Kemari | 559 | 3273 | 1,829,837 |
| Central District | 69 | 43063 | 2,971,382 |
| Source: Pakistan Bureau of Statistics Govt. of Pakistan | | | |

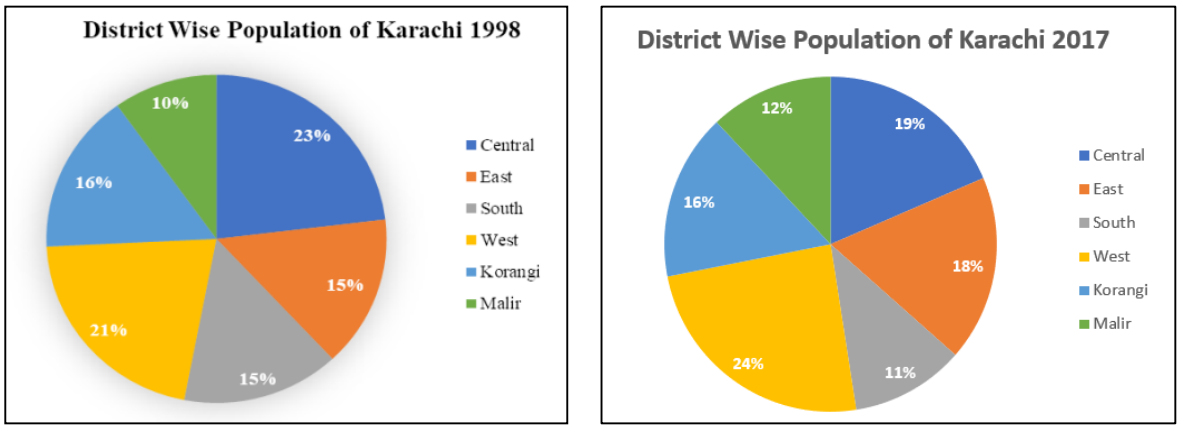
#### Demography

Karachi City is rich with multicultural ethnicities. People from all over the country migrate to Karachi for better income and good opportunities. The districts comprise people from several ethnic groups including Pakhtuns, Seraikis, Sindhis, Urdu Speaking, Memon, Punjabi and Balouchis. Karachi also hosts illegal immigrants from Bangladesh, Burma, and Afghanistan. The total population of Karachi in

1998 was 9,856,318. An increase of 62.9% has been seen since last census in 2017 which concluded the population of Karachi to 16,054,988.

The following table provides a comparison of population of districts between 1998 and 2017 census. All districts show significant increase in population.

**Figure 4.1: Comparative Analysis of Population (1998, 2017)**




Karachi is the largest city of Pakistan in terms of area and population. A surge in population has been seen in recent years. There are several coinciding reasons for the population shift to urban areas of Karachi-social, political and economic. The above figure shows the district wise population increase. District Central will be excluded as it is not part of project area. District East, West, and Malir shows an increase of 3%. Likewise, District South has shown an increase of 4%. Meanwhile, District Korangi has shown a decrease of 1%.

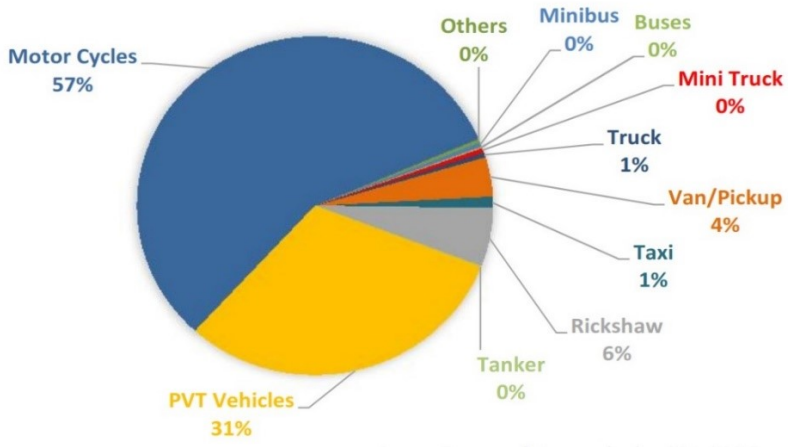
### Transportation

Karachi ranks as having the worst public transport system globally. It serves about 42% of Karachi's commuters, relying on decades-old, overcrowded buses that use the roof as a second deck for passengers at times. Roads are filled with potholes, not all traffic signals are automated, and it's common to see drivers running red lights. Traffic jams, congested roads are part of daily lives. Karachi is constantly evolving, but unfortunately, the city has failed in planning the infrastructure. There are no low-cost transport facilities in the city for working class. There are more than 4 million registered vehicles on Karachi roads. The number of vehicles registered in Karachi has increased by 1.13Mn or 38% since 2013 with rickshaws rising sharply by 76% to 229,826, motorcycles by 50% to whopping 2.34Mn and private vehicles by 18% to 1.28Mn in 2016[28].

According to the Research Report of KCCI, August 2017, the ratio of the registered motorcycles is highest (57 %) and private vehicles are 31 %. The following graph shows the share of vehicles which have been registered in Karachi in 2017.

**Table 4-2:** ***Registered Vehicles in Karachi by Vehicle-Type in 2017***

[28] Research & Development Department, KCCI, August 2017: *Karachi Traffic Chaos, Jamming the wheels of Economy INFOANALYSIS*




*Source: Transport & Communication, KDA; KCCI Research Report 2017*

According to 2007 reports of CDGK and MGPO, Karachi has a network of roads of only 9,764 km for around 3 million registered vehicles. Karachi has 20 million population, yet the city only has 93 pedestrian bridge and 42 flyovers and under passes as reported by Urban Resource Centre in 2015. The following table shows the distance between pedestrian bridges. The long distance between these bridges, coupled with inaccessible for elderly population and many without maintenance and incapacitated to use cases pedestrians to walk unnecessarily. According to "Walkability" report in 2009, in Karachi almost 21% of the trips are made on foot and almost 66% commute through public transport and also walk in between the transits or towards their destination.

**Table 4-3: Karachi, Pedestrian Bridges Distance**

| S.No. | Location | Distance |
|---|---|---|
| **1.** | Nursery to Lal Khoti | 1 km |
| **2.** | Lal Khoti to Fortune Centre | 1 km |
| **3.** | Fortune Centre to Tipu Sultan | 0.7 km |
| **4.** | Day Inn to Tipu Sultan | 1.2 km |
| **5.** | Awami Markaz to Days Inn | 0.6 km |
| **6.** | Awami Markaz to Karsaz | 0.8 km |
| **7.** | Qayyumabad to Iqra University | 1 km |
| **8.** | Iqra Univerity to Eidgah | 1 km |
| **9.** | Eidgah to Gujjar Chowk | 1 km |
| **10.** | Gujjar Chowk to Shaheed-e-Millat | 3 km |
| Source: Urban Resource Centre, 2015 | | |

The impact of the transport crisis on people's lives is enormous. Travelling in environmentally degraded conditions for long hours results in physical and mental health problems. This effects family and social life and limits people's choice of livelihoods (especially for women) since they wish to work in areas that they can easily access through the existing transport system. The availability of transport and its quality are also the determining factors of where people would like to live.

## Education Facilities

The literacy rate in Karachi now stands at almost 80%, according to a survey and as such there is still room for quality institutions to cater to the needs of teeming high-school students passing out every year from Karachi.

At present, there are about 300 colleges and universities in Karachi imparting education in many disciplines. With an estimated 103 million people, or 63% of the population, falling under the age of 25 years, Pakistan is blessed with a great potential of human resource which needs to be equipped with education and training to put the country on the path of prosperity.

District East, West, South, Korangi, Kaemari and Malir have many educational institutions ranging from public to private sector schools and universities.

**District wise Number of Schools, Enrollment and Staff in Karachi (2016-17)**

| District | No. of Schools | | | | Enrollment | | | Teacher | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Boys | Girls | Mixed | Total | Boys | Girls | Total | Male | Female | Total |
| Central | 117 | 141 | 348 | 606 | 44,822 | 58,510 | 103,332 | 1,803 | 4,996 | 6,799 |
| East | 51 | 64 | 163 | 278 | 23,022 | 29,106 | 52,128 | 870 | 2,271 | 3,141 |
| South | 70 | 87 | 173 | 330 | 26,122 | 35,824 | 61,946 | 1,079 | 2,496 | 3,575 |
| West | 128 | 101 | 340 | 569 | 38,562 | 45,454 | 84,016 | 1,443 | 1,909 | 3,352 |
| Malir | 136 | 113 | 414 | 663 | 34,548 | 32,333 | 66,881 | 1,540 | 1,148 | 2,688 |
| Korangi | 97 | 94 | 220 | 411 | 35,192 | 46,918 | 82,110 | 1,025 | 3,082 | 4,107 |

Source: Sindh Education Management Information System (SEMIS) Census 2016 – 2017

**Table: District-wise Basic and Advance Facilities in Schools of Karachi**

| Districts | Schools | Electricity | Washroom | Drinking Water | Boundary Wall | Lab | Library |
|---|---|---|---|---|---|---|---|
| Central | 607 | 447 | 484 | 507 | 529 | 121 | 56 |
| East | 264 | 223 | 241 | 219 | 238 | 59 | 25 |
| South | 482 | 383 | 426 | 356 | 432 | 49 | 49 |
| West | 363 | 232 | 301 | 256 | 340 | 82 | 27 |
| Korangi | 550 | 397 | 431 | 391 | 509 | 46 | 37 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Malir | 591 | 240 | 398 | 302 | 479 | 56 | 21 |

Source: SEMIS Census 2016 – 2017

## Health Facilities

There are several public and private healthcare facilities in the Karachi Districts of South, East, West, Malir and Korangi. The following tables shows the names and locations of medical facilities available in different districts of Karachi.

**Table 4-4: List Of Major Public Hospitals In Karachi**

| S. No. | Name of Hospital | Location | District |
|---|---|---|---|
| **1** | PNS Shifa | Main Korangi Rd | South |
| **2** | Civil Hospital | Mission Rd | South |
| **3** | Jinnah Postgraduate Medical Center | Rafiqui, Sarwar Shaheed Rd | South |
| **4** | National Institute of Cardiovascular Diseases | Rafiqi, H.J. Shaheed Road | South |
| **5** | Abbasi Shaheed Hospital | Block 3, Nazimabad | Central |
| **6** | National Institute of Child Health | Rafiqui Sarwar Shaheed Rd | South |
| **7** | Sindh Institute of Urology & Transplantation (SIUT) | New Labour Colony Nanakwara | South |
| **8** | Sindh Services Hospital | Jamia Cloth Market | South |
| **9** | Sindh Institute of Skin Diseases | Regal Chowk, Saddar | South |
| **10** | Sindh Social Security Hospital | Manghopir Road, (S.I.T.E) | West |

Source: https://pk.usembassy.gov/wp-content/uploads/sites/76/2016/12/List-of-Hospitals-in-Karachi.pdf

**Table 4-5: List of Major Private Hospitals In Karachi**

| S. No. | Name of Hospital | Location | District |
|---|---|---|---|
| **1** | Aga Khan University Hospital | National Stadium Rd | East |
| **2** | Liaquat National Hospital | National Stadium Rd | East |
| **3** | Baqai University Hospital | Block 3, Nazimabad | Central |
| **4** | Dr. Ziauddin Hospital | Block 6, Clifton | South |
| **5** | Hamdard University Hospital | M.A Jinnah Rd, Lines Area | South |
| **6** | National Medical Centre | D.H.A. Phase I | South |
| **7** | Patel Hospital | Block 4, Gulshan-e-Iqbal | East |
| **8** | South City Hospital | Shahrah-e-Firdousi, Clifton | South |
| **9** | Tabba Heart Institute | Azizabad, Block 2 Gulberg | Central |
| **10** | Altamash General Hospital | Block 1 Clifton | South |

Source: https://pk.usembassy.gov/wp-content/uploads/sites/76/2016/12/List-of-Hospitals-in-Karachi.pdf

The next table shows the number of health practitioners, there are 324 doctors in South District, 245 in East, 356 in West, 234 in Malir and 252 in Korangi.

| Table 4-6: District wise Government Medical and Paramedical personnel in Karachi 2017 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| District | Doctors | Nurses | L.H.V | Dispensers/Dressers | X-Ray Technicians | Lab Technicians | O.T Technicians | X-Ray Assistants | Lab. Assistants | O.T. Assistants | Midwives |
| Central | 579 | 207 | 15 | 82 | 12 | 17 | 25 | 0 | 3 | 12 | 26 |
| South | 324 | 115 | 4 | 51 | 14 | 23 | 33 | 0 | 8 | 8 | 2 |
| East | 245 | 18 | 22 | 26 | 4 | 0 | 3 | 0 | 4 | 1 | 6 |
| West | 356 | 83 | 19 | 67 | 12 | 14 | 22 | 5 | 12 | 15 | 19 |
| Malir | 234 | 25 | 14 | 53 | 9 | 4 | 6 | 0 | 10 | 5 | 18 |
| Korangi | 252 | 90 | 38 | - | - | - | - | 0 | 8 | 8 | 25 |
| Source: - Directorate General of Health Services, Hyderabad.<br>Source: - BOS, Government of Sindh (Development Statistics of Sindh-2018). | | | | | | | | | | | |

The table below shows the number of health facilities available to cure different kinds of diseases in Karachi District. The public health facilities in Karachi are highly centralized in a few locations and cannot cater to a large part of the population. The private sector is too expensive for lower class and not all public hospitals provide high quality health care facilities on nominal rates.

| Table 4-7: District wise Government Health Facilities with Bed Capacity in Karachi 2017 | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| District | Hospital | | Hospital Beds | | Dispensaries | | R.H Centers | | T.B. Centre | | B.H. Units | | M.C.H.C. | |
| | Teaching | Civil, Specialized & Taluka | Teaching | Civil, Specialized & Taluka | No. | Beds | No. | Beds | No. | Beds | No. | Beds | No. | Beds |
| Central | - | - | 3,150 | - | 5 | - | - | - | 8 | - | 2 | - | 3 | 6 |
| South | 2 | 4 | - | 960 | 5 | - | - | - | 10 | 5 | - | - | - | - |
| East | - | - | 361 | - | 5 | - | - | - | 5 | 97 | 4 | - | 4 | - |
| West | 1 | 1 | - | 248 | 14 | 15 | 4 | 20 | 8 | - | 7 | 14 | 5 | 6 |
| Malir | - | 1 | - | 48 | 7 | - | 2 | 8 | 4 | - | 14 | 22 | 6 | - |
| Korangi | - | 7 | - | 724 | 8 | - | - | - | 7 | - | 8 | 16 | 4 | 41 |
| Source: - BOS, Government of Sindh (Development Statistics of Sindh-2018). | | | | | | | | | | | | | | |

### 4.9.2 Micro Environment

The proposed site is located in a relatively under-developed area of Karachi, in the vicinity of Itehad Town, Muhammad Khan Industrial Area having industrial units such as A.H. Steel, D.M Steel, Mashallah Steel, Aari Sayen Steel and Wasim Properties in its surrounding neighborhood.

**Social Services/Amenities**

There are no educational institutes nearby in the project area. The area is basically an industrial zone therefore having no residential developments and educational facilities are located within the industrial area.

There are no medical facilities located inside the industrial zone, medical facilities are available outside the industrial zone that includes Charitable Hospital (2.89 km), New Qatar Hospital Ghaiziabad (2.83 km) and Kamal Hospital (4.08 km). The factory workers prefer to go to Murshid Hospital which is located approximately 8 kilometers away in Baldia Town.

**Utilities**

The water supply in the area falls under the jurisdiction of Karachi Water & Sewerage Board (KWSB). The water supply in the area is adequate for industrial use therefore the industrialists rely on water tankers. It was also observed that the drainage system is unsatisfactory in the project area. The sewerage system in the area is also unsatisfactory, there is an open nala through which industrial waste is disposed.

The condition of solid waste in the project area is unsatisfactory. There is no proper infrastructure for solid waste management. The industrialists usually dump their waste directly in empty plots in the surroundings by themselves and then later set on fire. The area residents are satisfied with electricity supply which is provided by K.Electric. Gas supply is not available in the area.

**Traffic Conditions**

The project site is accessible through Karachi – Northern Bypass (M-10), but the road inside the industrial zone is unpaved and has plenty of damps which is not suitable for the heavy trucks. There is an immediate need to develop proper roads inside the industrial zone for the smooth flow of industrial traffic.

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# Chapter 5 PUBLIC CONSULTATION

The participation of project stakeholders in project planning, design and implementation is now universally recognized as an integral part of environmental & social impacts assessment. Local communities, their representatives, government departments, national and international NGOs and the civil society at large may all be able to contribute to and benefits from, the dialogue directed at identified and resolving key project-related issues. Stakeholder consultation has become an important requirement of the EIA study after the enactment of the guidelines for public consultation under the Pakistan Environmental Protection Act (PEPA) 1997. After the 18th Amendment to the constitution, the Government of Sindh passed the Sindh Environmental Protection Act 2014, which also stresses the importance of engaging with the concerned primary and secondary stakeholders during the EIA Study.

While in the short-term, the impacts might be felt only in the microenvironment of the project, in the long-term, the impacts may also spread to other nearby neighborhoods and activities including traffic management, the swift passageway for fire tenders and ambulance and stress on existing utilities. Instead of these perceived impacts, meaningful engagement with the project stakeholders has been carried out to identify the potential positive and negative impacts, assess the magnitude of these impacts from a social perspective and prescribe solutions that identify for the construction and operations phase of the proposed project.

## 5.1 Stakeholder Mapping

In order to better understand several stakeholder groups for this project, a stakeholder mapping exercise has been carried out whereby different stakeholder clusters and their interests in the project are discussed in this section:

**Local People/Neighborhood:** Individuals or groups in the locality of the project site are apprised about the project background and context. Due to their proximity to the project site, they are often utmost vulnerable stakeholders, and thus, consultations with these stakeholders are directed throughout the project phase. The consultation exercise provides an opportunity to appraise the stakeholders regarding the consultation process, identify likely project impacts, and record concerns of local communities. Moreover, intensive stakeholder engagement during the planning stage of the project provides a basis for reducing the trust deficit and encourages confidence-building.

**Proponents:** The main aim of the project proponent is to accomplish the objectives of the project through cost-effective and sustainable project activities. To this end, the project proponent has to recognize that strong associations and responsive relations with stakeholders would go a long way to achieve the project objectives. Therefore, the proponent has to strive to engage stakeholders at all levels from the outset; inform them regarding project goals, design, and alternatives. Moreover, they have to keep trying to create public understanding and acceptance of the proposal through a commitment to implement the promised objectives. They have to accomplish the project through general acceptance of the design and keep improving through the use of public inputs on alternatives and mitigation measures.

**Government Agencies:** The government agencies involved in the EIA (Environmental Impact Assessment) process is mandated to have their policy and regulatory responsibilities addressed in impact analysis and mitigation consideration. For the competent authority, an effective public involvement program will have to be ensured regarding project proposal that effectively incorporates environmental and social concerns. Moreover, in line with international standards, SEPA (Sindh Environmental Protection Act) stresses the proponent for evidence of CSR (Corporate Social

Responsibilities) activities in the past and proposals for CSR activities in the project vicinity. All through the EIA review primary concern for SEPA is a transparent public consultation process and an efficient stakeholder engagement plan that can address the concerns and suggestions of all stakeholders.

**NGOs/Interest groups:** Comments from NGOs and specific interest groups often provide a useful policy perspective on the project's methodology and implementation mechanisms. For example, due to the vast exposure of certain NGOs and interest groups, alternative measures for reaching the project goals may be advised that are more eco-friendly and socially acceptable. Their insights are also helpful in developing CSR activities and later in monitoring and evaluations.

## 5.2 Primary and Secondary Stakeholders

Primary stakeholders are those who have a direct interest in the project which includes residents, commercial entities, and institutions falling in the immediate environs of the project area. Secondary stakeholders include the relevant government agencies and public interest groups which may indirectly influence or be influenced by the project. The concerns and input from both primary and secondary stakeholders are important to identify the issues arising from the construction and/or operation phase of the project and propose mitigation measures that minimize the negative project impacts and enhance the positive ones.

Within the project vicinity, the primary stakeholders are the nearby factories including Wasim Properties, Aari Sayen Steel, Mazar Shah Steel, Mashallah Steel, Crush Plant, A.H. Steel, D.M. Steel, Rock Crushing & Rock Crusher. The secondary stakeholders for this project include the utility companies that provide gas; electricity and water in the area including K-Electric, SSGC, and KWSB. Furthermore, the regulatory authorities mandated to ensure environmental protection in the city that falls under the remit of SEPA and compliance with building and construction laws which is looked after by SBCA. The complete list of the primary and secondary stakeholders for Incinerator has been stated in the table below:

**Table 5.1: Primary Stakeholders for Incinerator**

| | |
|---|---|
| **Neighborhood** | *Commercial Interests*<br>• *Wasim Properties*<br>• *Aari Sayen Steel*<br>• *Mazar Shah Steel*<br>• *Mashallah Steel*<br>• *Crush Plant*<br>• *A.H. Steel*<br>• *D.M. Steel*<br>• *Rock Crushing*<br>• *Rock Crusher* |
| **Proponent** | • M/s Eco Care Waste Management Company Pvt. Ltd |
| **Government Agencies & Other Service Providers** | • Sindh Environmental Protection Agency (SEPA)<br>• Karachi Water & Sewerage Board (KWSB)<br>• K-Electric |

| | |
|---|---|
| | • Sui Sothern Gas Company (SSGC)<br>• District Municipal Corporation |
| **NGOs/Interest groups** | • The Urban Resource Center (URC)<br>• Shehri-CBE<br>• National Forum for Environment & Health (NFEH)<br>• Citizens for Environment |

## 5.3 Consultation Approach & Methodology

### 5.3.1 Consultation with Primary Stakeholders

A Neighbourhood Survey was conducted to identify commercial interests in the surrounding that may face direct impacts from the proposed development. The survey was conducted in two stages. In the first stage, several site visits were made to identify all stakeholders that either reside or work in the project environs and conducted an initial identification of potential positive and negative effects. Relevant public service institutions directly involved in service provision in the ranges were also identified.

During the second stage, a social survey field team from EMC Pakistan used a pre-designed semi-structured template to engage the commercial interests, and public service institutions. Those stakeholders, who were not available at the first attempt, were re-visited on the same day or followed-up for their comments during the next few days. During each meeting, the project team introduced the project to the stakeholders, recorded their concerns, and provided contact details to enable stakeholders to share further comments over email or in writing. A 'Project Brief' providing the salient features of the project were also handed over to the available stakeholders as part of the information disclosure process.

Moreover, the team inquired about the current situation of the area such as the status of utilities, security and law and order situation in the project area from the residents near the project site. Several open-ended questions were also included in the questionnaire to ensure that the respondents could openly share their opinions and suggestions relevant to the study. The following table shows the stakeholders that were approached during the Neighbourhood Survey.

**Table 5.2: Consultations with Primary Stakeholders**

| S. No | Respondents | Stakeholder | Stakeholder Type | Date |
|---|---|---|---|---|
| 1 | Mr. Sameullah (Chowkidar) | Wasim Properties | Commercial | 01-10-2021 |
| 2 | Mr. Saki Mohammad (Security Guard) | Aari Sayen Steel | | |

| | | | | |
|---|---|---|---|---|
| 3 | Mr. Bashir Ahmed (Worker) | Mazar Shah Steel | | |
| 4 | Mr. Majeed (Factory Worker) | Mashallah Steel | | |
| 5 | Mr. Misal Khan (Daily wage Laborer) | Crush Plant | | |
| 6 | Mr. Shahbaz (Chowkidar) | A.H. Steel | | |
| 7 | Mr. Maratib Ali (Manager) | D.M. Steel | | |
| 8 | Mr. Gul Meer (Daily Wager) | Rock Crushing | | |
| 9 | Mr. Qurban (Laborer) | Rock Crusher | | |
| 10 | Mr. Atif (Labor Union Head) | Mohammad Khan Industrial Area | | |

## 5.4 Consultation Feedback

The comments, concerns, and suggestions received from stakeholders during the neighborhood survey have been collated in this section. The comments solicited from stakeholders were helpful in the screening of the potential environmental & social aspects of the project. The social team from EMC initiated consultations in the project area during the week of September.

The following major issues and concerns were raised by the primary stakeholders:

- The respondents expressed their positive views regarding the proposed project and told that in this Industrial area many steel manufacturers will be facilitated to remove the material waste which they have to burn in the open space.
- The respondents expressed their concerns that the proposed inclinator will emit the heat and hazardous emissions into air and will create noise pollution in the area.
- The respondents suggested to install the air pollution control equipment such as wet scrubber system to minimize the fumes and emissions that will produce form the incinerator during the operation.

- They further suggested to dispose the ash and residue of incinerator with a SEPA certified contractor at Gond Pass Land Fill Site – Karachi.
- Some of the laborers working in the neighborhood points that the new incineration plant will create new job opportunities and increase the property value of the industrial area.
- They further pointed out that new developments like this will attract more industrialists in the area and also brings the attention of government towards the infrastructure development of the area such as roads.

| **Consultation Pictures of Primary Stakeholders** | |
|---|---|
| | |
| Consultation with Chokidar, A.H. Steel | Consultation with Manager, D.M Steel |
| | |
| Consultation with Security Guard, Aari Sayen Steel | Consultation with Factory Worker, Mashallah Steel |

| | |
|---|---|
| | |
| Consultation with Daily Wage Laborers, Crush Plant | Consultation with Factory Workers, Mazar Shah Steel |
| | |
| Consultation with Security Guard, Wasim Properties | Outside a factory |

# Chapter 6 SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS & THEIR MITIGATION MEASURES

This section of the report screens the potential impacts imposed upon the physical, biological and socio-economic environment due to the waste generated by the project. The screening process has through review of literature, primary as well as secondary baseline data, and expert judgment made assessment of the potential impacts of said activities on the physical, biological, and socioeconomic environment of the Project.

Guidelines have been reviewed for classification of polluted and unpolluted sites with respect to their airshed, watershed and land use; sensitivity of ecosystem including flora, fauna, wildlife, aquatic life, historical and archeological sites and their values, and the sensitivity of the site.

The review / screening provides the assessment of impacts of different activities before the start of construction, during construction as well as installation of machinery and the resulting emission of gases, solid waste and wastewater discharges during operation of "Incinerator Plant". The impacts considered are those, which may occur at regional and local level or the macroenvironment and at the site or the microenvironment.

The earlier description in Section-4 of this report has already provided a classification of macroenvironment and microenvironment of the site, based on assessment of impacts using both primary and secondary data on emissions of pollutants, solid waste and wastewater discharges and other impacts from operation of "Incinerator Plant" on its microenvironment. The hazards encountered during the implementation of the proposed project will prove to be guidance for proposing appropriate mitigation measures. Mitigation measures have been proposed to reduce, minimize or compensate for the identified potential negative impacts and their adoption has been recommended. Enforcement of the recommended mitigation measures would minimize and eradicate the negative impacts, in all such cases where the levels of emission and discharges exceed the Sindh Environmental Quality Standards (SEQS), while enhancing in the positive outcome i.e. sustainable development.

The sources of pollution are first identified and then their impacts are noticed at each stages of the proposed project i.e. pre-constructed, construction and operational phase. Impacts of the project can be of short or long-term, temporary or permanent, acute or chronic, positive or negative in nature.

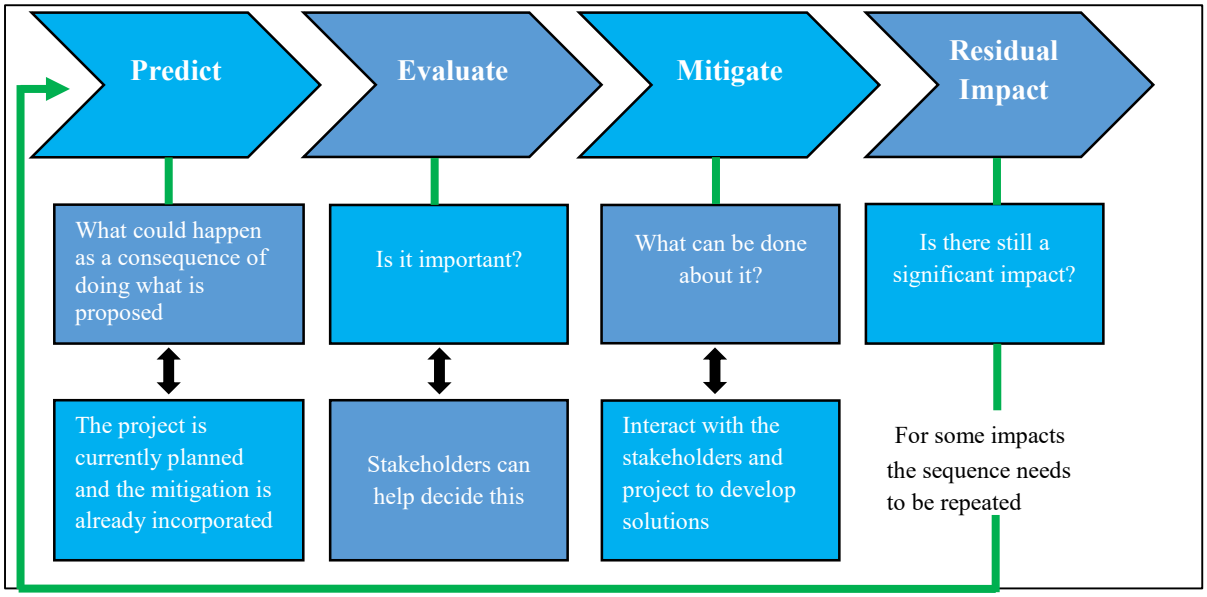



Fig 6.1: Impact Assessment Methodology

## 6.1 Impact Assessment Methodology

Potential environmental impacts of the proposed Project on different features of micro and macroenvironment pertain to construction and operation phase.

The screening process proceeds by identifying the potential environmental aspects of siting the project, identifying the potential environmental impacts at pre-construction, construction and operational stages of the project and identifying the residual impacts after adoption of mitigation measures that may be needed at the outset of activities. The impacts on environmental resources from the proposed project will be short-term and temporary in nature.

A systematic strategy was developed to provide an assessment of the likely impacts on the micro and macroenvironment of the Project site. The strategy included:

- Review of General Guidelines;
- Identification of potential environmental impacts by conducting survey, public consultation;
- Assessment of the intensity and significance of potential impacts by obtaining expert opinion and carrying out environment analysis;
- Defining mitigation measures to reduce impacts to as low as practicable;

Guidelines and checklists were used for the verification of permissible levels of environmental parameters during project operation and classification of the site with respect to its pollution status, soil, and ecology.

The environmental aspects of the project were identified by situation analysis related to present land use, damage to vegetation, noise and other forms of nuisance during construction at site, air pollution due to fugitive dust emission and operation of equipment during construction, air pollution due to burning of wastes.

Site Visits have been carried out prior to proceeding with impact assessment to get a better understanding of the area.

Assessment of impact of different activities, and of the resulting emission gases, and wastewater discharges during construction and subsequent operation of the proposed project are addressed in this section. The entire screening procedure was designed in such a way so as to provide a complete assessment of the impacts on the macro-environment and of the project. The project site has no protected area such as game reserve, wild life, national parks, archaeological sites or cultural heritage in its neighborhoods. Impacts may arise during different stages of project phases which are described below.

## 6.2 Screening of Potential Impact during Pre-Construction Phase

### 6.2.1 Facility Siting and Layout

- The proposed location is located in a developing Industrial area, hence the proposed development is in line with the existing land use.
- The site is located at at UC8 Manghopir off-Northern Bypass (M10), providing accessibility from different areas of Karachi. The site is away from the densely populated areas of the city.
- The waste disposal site of Gond Pass is approximately 3km from the project site and that may provide feasible option for ash disposal.
- Electricity and other supplies are available in the proposed project area to meet the energy requirements of the Proposed plant.
- The land for the proposed project has already been acquired by Proponent.

### 6.2.2 Safe Design

National standards for equipment design and operation where they exist should be implemented and be the subject of inspection by the Management. Wherever possible, the design of equipment within facility should be to industry good accepted practice and incorporate learning from relevant incidents.

The design of proposed incinerator will ensure compliance with environmental exhaust emission standards (i.e., SEQS).

## 6.3 Screening of Potential Impact during Construction/Installation Phase

The activities that take place during the construction phase of the project are leveling of site, construction and erection of building, truss, shades etc. and associated equipment. The potential primary and secondary impacts on the environment due to these activities and their mitigation measures are discussed as under:

### 6.3.1 Creation of Employment Opportunities

Employment opportunities are expected to be created for construction workers during the construction phase of the project.

**Mitigation Measures**

- Unskilled labor should be preferred from the neighborhood to avoid community issues.
- Project management should be careful about hiring the construction staff and shall consider workers' behavioral aspects as well.

### 6.3.2 Provision of Market for Supply of Construction Materials

The project will require supply of considerable quantities of construction material, most of which will be sourced locally. This provides market for material suppliers such as brick works, hardware shops and individuals with such materials. It is also a positive aspect of the project in terms of local economic activity.

### 6.3.3 Soil Erosion

Excavation works for construction/installation of proposed project will expose soils in the affected areas, leaving them vulnerable to erosion by surface run-off during moderate to heavy rainfall. It is important to conserve the "topsoil" wherever possible for later restoration. However, excavations are not expected to be deep for project activities and potential of soil erosion is expected to be low.

**Mitigation Measures**

To minimize the impacts that could arise during the construction phase following measures will be adopted

- Minimize the area of exposed soil at any given time and to wet, compact and resurface the disturbed areas during the construction phase.
- Removal of topsoil with vegetation in it (rather than cutting off the vegetation) so that the vegetation helps to hold and enrich the soil.
- Exposed surface will be regularly wetted to effectively keep airborne dust levels to minimum
- Stockpiles of fine material will be wetted or covered with tarpaulin especially during windy conditions until concreting and landscaping is complete.

### 6.3.4 Soil Contamination

During the construction stage, the contamination of soil may occur due to unchecked chemicals or fuel spillage during handling, transportation and storage.

The sources of spills are:

- During refueling, the transfer of fuel from one container to the other
- Maintenance of vehicle and machinery
- Filling of fuel to Generators sets
- Leakage from the container
- Vehicular Accident

**Mitigation Measures**

Actions necessary to manage the risk from soil contamination will depend on factors such as the level and location of contamination, the type and risks of the contaminated media, and the intended land use. However, a basic management strategy will include:

- Washing of vehicles and equipment should be carried out in the designated area.
- Vehicles and equipment maintenance will take place at specified area.
- Construction vehicles and equipment will have periodic maintenance.
- Removal of oil and contaminated soil around the fuel and oil storage areas will be made possible by the availability of appropriate implements i.e. shovels, plastic bags and absorbent materials.
- Contaminated medium will be managed with the objective of protecting the safety and health of laborer at the site, the surrounding entities, and the environment.
- Plans and procedures will be prepared, to respond to the discovery of contaminated media to minimize or reduce the risk to health, safety, and the environment.

### 6.3.5 Construction Waste

Certain amount of construction waste will be generated during construction phase which includes concrete, metal cuttings, rejected materials, surplus materials, surplus oil, excavated materials, paper bags, empty cartons, empty paints and solvent containers, broken glass, steel, wooden scaffolding, cement bags, excavated soil, wood remains etc. this waste will predominantly be non-hazardous. Improper disposal of waste may cause clogging of drains and may affect aesthetics of surrounding environment and will cause nausance.

**Mitigation Measures**

The mitigation measures laid down as under will help to mitigate the impacts posed due to the constructional phase of the proposed project:

- A comprehensive waste disposal plan will be developed to effectively manage these wastes.
- The construction waste which will be sent for recycling like damaged pipes, left over steel, wooden and plastic pieces. While, the rest of the left-over non-hazardous waste will then be taken away to the approved dumping site(s) for disposal.
- Various waste containers for different types of waste will be deployed, in order to segregate the waste at source.
- The waste bins will be properly marked for each type of waste produced during the construction activities.
- Use of materials that have minimal packaging to avoid the generation of excessive packaging waste.
- Use of durable, long-lasting materials that will not need to be replaced as often, thereby reducing the amount of waste generated over time.
- Hazardous waste will be disposed through EPA certified waste contractor.

### 6.3.6 Impact on Water Quality, Consumption & Conservation

Water requirement for construction phase will be met by water tankers to fulfill the required quantity.

Potential sources of impacts on the hydrology and ground water quality during the construction phase are as follows:

- Soil runoff from the site leading to off-site contamination (particularly during rainy season).
- Improper disposal of construction debris leading to off-site contamination of water sources.
- Spillage of oil and grease from the vehicles and wastewater stream generated from onsite activities such as vehicles washing, workshop etc.

**Mitigation Measures**

To mitigate these impacts precautions and preventive measure shall be taken at the site during construction to avoid any ground and surface water contamination. Following mitigation measures shall be adopted as conservation.

- Provision of adequate storm water diversion channels to divert storm runoff from flowing over the construction areas.
- Regular monitoring of water consumption
- Use of leak proof storage tanks.

### 6.3.7 Dust Emissions

The principle source of dust may arise from construction activity is fugitive type. Temporary dust nuisance, measurable as total suspended particulates and respirable suspended particles, may generate as a result of construction activities during the construction phase.

Among all construction activities, excavation and foundation laying has the highest potential of causing dust nuisance.

**Mitigation Measure**

In order to cater above impacts, following mitigation measures have potential to reduce the dust formation:

- water sprinkling at construction sites at regular intervals or when and where required. It can reduce or suppress the dust formation by approx. 50% if sprinkling is conducted upto 3 times in a day.
- Allocate specific timings during normal daytime working hours for movement of earth moving equipment.
- Develop schedule for movement of dump trucks that may be used for hauling or excavation soil.
- Use of proper roads for transportation means during construction work.
- Stockpiles of fine material should be wetted or covered with tarpaulin especially during windy weather conditions.
- Site workers and drivers should wear dust mask and safety goggles especially during dry and windy weather conditions to avoid injuries and health risk due to dust.
- Good housekeeping practices will also reduce dust emission.

### 6.3.8 Exhaust Emissions

Major sources of exhaust emissions are stand-by diesel generators, vehicles and exhaust from construction machinery/earth moving equipment. Exhaust emissions predominantly may comprise of CO, CO2, SOx, NOx and particulates.

These emissions are injurious to human health if in high concentration and may also cause vegetation damage by clogging the photosynthesis process in plants. Emissions of greenhouse gases from combustion of fossil fuels are associated with the global warming, triggering climate change.

**Mitigation Measures**

Controlling the exhaust emissions by adopting preventive measures is the best possible way to reduce these emissions in the ambient air. The measures given below may assist management and construction contractor in the reduction of exhaust emission during construction work:

- Where possible use of newer generators with lower emissions.
- Generators shall be kept away from walking areas and at safe place where worker access is limited.
- Equipment, vehicles and generators should be properly tuned, serviced and monitored on regular basis.
- Ensure that the vent of the generator exhaust is at adequate height.
- Fuel of low emission content will be utilized for generators.

### 6.3.9 Wastewater Generation

During the construction phase, the wastewater is generated from the project site is mainly due to the municipal activities, run-off from the project site during the precipitation, washing of construction vehicles etc. The undeterred and untreated wastewater release may deteriorate the groundwater resources near the project site as it may contain oil and grease.

**Mitigation Measures**

The following are the recommendations to reduce and control the wastewater generated during the constructional activities:

- Wastewater will not be disposed of directly into the environment, but first be treated through septic tank and then will be discharged in allocated drain.
- Wastewater generation will be minimized by controlling the pollutant at the source.
- Monitoring of the wastewater generation will be taken into consideration.
- Adequate portable or permanent sanitation facilities serving all workers will be provided.

### 6.3.10 Noise

As part of the construction, noise is also one of the aspects which may cause hearing impacts on workers associated with construction activities if the noise levels are persistently high. It is anticipated as like the construction will be of short period therefore; the impacts associated with the noise are temporary and low. Following are major activities which may generate noise:

- Construction and installation works such as earth moving equipment, piling works, welding, cuttings, drilling, grinding etc.
- Diesel generators used for power supply during construction works.
- Material loading/unloading vehicles and other transport used by employees.
- Use of pressure horns.

Noise level during construction phase may pose health issues to the workers if not wearing proper PPE. Regular exposure to high noise may result in hearing impairment or hypertension.

**Mitigation Measures**

The following measures are adopted in order to keep the noise within the limits as prescribed in SEQS:

- Noise control devices can be used such as temporary noise barriers and deflectors for impact activities.
- Construction equipment will be kept in good condition to reduce noise generation.
- Generators and equipment can be installed and placed in enclosures to minimize ambient noise levels.
- Generator and other noisy equipment will be regularly monitored.
- Develop schedule for movement of trucks that will be initially used for hauling of excavated soil.
- Minimize night time activities as practically possible.
- Carry out noise monitoring on regular basis especially during heavy machinery operation.
- Site labor working in high noise area such as where noise level exceeds 90 dB (A), should wear earmuffs.

### 6.3.11 Biodiversity

The survey of the project area, it was revealed that there is no significant flora and fauna of biological importance present within the project area as the project site is located in a developing designated industrial area at Northern Bypass. Therefore, there are no major threats imposed upon the flora and fauna of the proposed project area.

### 6.3.12 Traffic Flow

The site is located with offset from Northern Bypass which provides primary access to the project site. The likelihood of increase in traffic on M10 during construction is very limited as the proposed construction activity is very limited and will not cause any major traffic increase during construction phase.

**Mitigation Measures**

- The proponent will put in place measures to address such concerns by ensuring that construction vehicles preferably deliver materials during off-peak hours when traffic volume is low.
- Impacts from the traffic flow will be minimized through proper planning of the transportation of materials to ensure that vehicle fills are increased, in order, to reduce the number of trips done or the number of vehicles on the road.

- Truck drivers will be sensitized to avoid unnecessary racing of vehicle engines at loading/offloading areas and to switch off or keep vehicle engines at construction site.

### 6.3.13 Occupational Health & Safety Issues

Over-exertion, and ergonomic injuries and illnesses, such as repetitive motion, overexertion, and manual handling, are among the most common causes of injuries in construction site. Overexertion is a major cause of the inflammation of joints and ligaments that results from excessive physical effort.

**Mitigation Measures**

Recommendations for their prevention and control include:

- Workers will be trained with lifting and materials handling techniques before the construction of the project, including the placement of weight limits above which mechanical assists or two person lifts are necessary.
- Work site layout will be planned to minimize the need for manual transfer of heavy loads.
- Tools will be selected and work stations would be designed to reduce force requirements and holding times, which promote improved postures, including, where applicable, user adjustable work stations.
- Administrative controls, such as job rotations and rest or stretch breaks will be implemented into the work processes.

#### (1) Slip and fall

Slips and falls on the same elevation associated with poor housekeeping, such as excessive waste debris, loose construction materials, liquid spills, and uncontrolled use of electrical cords and ropes on the ground, are also among the most frequent cause of lost time accidents at construction site.

**Mitigation Measures**

Recommended methods for the prevention of slips and falls from, or on, the same elevation include:

- Good house-keeping practices, such as the sorting and placing loose construction materials in established areas away from foot paths, would be implemented.
- Excessive waste debris and liquid spills will be cleaned up regularly.
- Electrical cords and ropes will be located in common and marked areas.
- Slip retardant footwear will be used.

#### (2) Work at Height

Falls from elevation associated with working with ladders and scaffolding are among the most common cause of fatal or permanent disabling injury at construction site. If fall hazards exist, a fall protection plan will be in place which includes one or more of the following aspects, depending on the nature of the fall hazard. Many work activities during construction phase involve working at height. Working from ladders, scaffolds and platforms are common examples.

**Mitigation Measures**

Training and use of temporary fall prevention devices, such as rails or other barriers able to support a weight of 200 pounds, when working at heights equal or greater than two meters or at any height if the risk includes falling into operating machinery, into water or other liquid, into hazardous substances, or through an opening in a work surface.

- Training and use of personal fall arrest systems, such as full body harnesses and energy absorbing lanyards as well as fall rescue procedures to deal with workers whose fall has been successfully arrested.
- Use of control zones and safety monitoring systems to warn workers of their proximity to fall hazard zones.

### (3) Struck by Objects

Construction activities of the project may pose significant hazards related to the potential fall of materials or tools, as well as ejection of solid particles from abrasive or other types of power tools which can result in injury to the head, eyes, and extremities.

**Mitigation Measures**

Techniques for the prevention and control of these hazards include:

- Maintaining clear traffic ways to avoid driving of heavy equipment over loose scrap. Temporary fall protection measures in scaffolds and out edges of elevated work surfaces would be used, such as hand rails and toe boards to prevent materials from being dislodged.
- Appropriate PPE such as safety glasses with side shields, face shields, hard hats, and safety shoes, would be wore.

### (4) Moving Machinery

Vehicle traffic and use of lifting equipment in the movement of machinery and materials on a construction site may pose temporary hazards, such as physical contact, spills, dust, emissions, and noise.

Heavy equipment operators have limited fields of view close to their equipment and may not see pedestrians close to the vehicle. Center-articulated vehicles create a significant impact or crush hazard zone on the outboard side of a turn while moving.

**Mitigation Measures**

Techniques for the prevention and control of these impacts include:

- The location of vehicle movement, equipment operation, walking areas, and controlling vehicle movement will be planned.
- The visibility of personnel will be ensured through the use of high visibility vests when working in or walking through heavy equipment operating areas as well as training of workers to verify eye contact with equipment operators before approaching the operating vehicle.

- Inspected and well-maintained lifting devices will be used that are appropriate for the load, such as cranes, and securing loads when lifting them to higher job-site elevations.

## 6.4 Impact Associated with the Operational Phase of Incinerator Plant

The operation of the project is expected to produce the following impacts, which should be taken into consideration:

- Air Quality
- Noise level
- Soil Contamination
- Waste Water
- Transporting, Storage and Handling of Incinerable Hazardous Waste
- Odor Management
- Impact due to Waste Disposal
- Fire Hazard
- Occupational Health and Safety
- Natural Disaster
- Occupational Health and Safety
- Social Impact

### 6.4.1 Air Emissions

The major source of air pollution from the proposed project during operations, are emissions from incineration of medical and hazardous waste. To smaller extent, emissions from standby-generators and vehicles may also be the potential sources of air pollution. Pollutants potentially emitted from waste incinerators include;

- Various organic compounds (e.g. dioxins and furans, chlorobenzenes, chloroethylene and polycyclic aromatic hydrocarbons [PAHs]), can be generated during combustion and post-combustion processes;
- Hydrogen chloride (HCl) and fluorides, and potentially other halogens-hydrides (e.g. bromine and iodine);
- Heavy metals; Mercury, Lead, Cadmium
- Typical combustion products such as sulfur oxides (SOX), nitrogen oxides (NOX), volatile organic compounds (including non-methane VOCs), particulate matter and methane (CH4) and carbon monoxide (CO).

The technologies used in proposed project includes; compete burning of waste in primary chamber, destruction of hazardous chemicals in exhaust gases by providing higher temperature and suitable retention time, air dilution and dilution and cooling of exhaust gases, Chimney Height approx. 35’ and end of pipe treatment i.e., wet scrubber. Wet scrubber is proposed to be integrated part of the project. Hence it is envisaged that impacts on the air quality of the project will be low when the incinerator will be operated as per design specification. However, certain measures are proposed in this section to ensure environmentally safe operations.

The pollutants released into the atmosphere will disperse in the down wind direction. The concentration at ground level will depend upon the strength of the emission source and micrometeorology of the area.

**Mitigation measures**

- Waste segregation and/or presorting to avoid incineration of wastes that contain metals and metalloids that may volatilize during combustion and be difficult to control through air emission technology (e.g., mercury and arsenic);
- Removal of the following items from waste destined for incineration: halogenated plastics (e.g. PVC), pressurized gas containers, large amounts of active chemical waste, silver salts and photographic / radiographic waste, waste with high heavy metal content (e.g. broken thermometers, batteries), and sealed ampoules or ampoules containing heavy metals;
- Follow applicable national requirements and internationally recognized standards for incinerator design and operating conditions
- Introduce wastes into the incinerator only after the optimum temperature is reached in the final combustion chamber.
- Minimize the uncontrolled ingress of air into the combustion chamber via waste loading or other routes;
- Optimize furnace geometry, combustion air injection, and, if used, NOx control devices using flow modeling;
- The pollution control equipments should be regularly checked and maintained to ensure their efficiency.
- Use flue gas treatment system for control of acid gases, particulate matter, and other air pollutants;
- Minimize formation of dioxins and furans by ensuring that particulate control systems do not operate in the 200 to 400 degrees Celsius temperature range; identifying and controlling incoming waste composition; using primary (combustion-related) controls; using designs and operation conditions that limit the formation of dioxins, furans, and their precursors; and using flue gas controls;
- The flue gases from the primary chamber would be combusted completely in the secondary chamber which is further heated up to more than 1100 ˚C by firing additional auxiliary fuel or high calorific value liquid incinerable waste. The secondary chamber and the ducting would be designed in such way as to have minimum of 2 seconds residence time in order to ensure complete combustion. The refractory in secondary chamber will be capable of withstanding around 1400 ˚C.
- Stack height must be kept high enough to disperse the gas effectively.

**Other mitigations for Air Emission Control**

- Regular maintenance and tuning of the incinerator and generators will be carried out.
- For control of VOCs, Dioxins and Furans flue gas should be passed through secondary combustion chamber where these pollutants are burned and destroyed at temperatures between 700º C to 1,300ºC.
- Staff operating the refractory lined dual chamber type incinerator would be required to wear proper PPE. Staff operating the incinerator should be trained to operate the facility in accordance with the SOPs and EIA study requirements.
- In the incinerator; materials to be burnt would be limited to those proposed in incineration manual;
- Incinerator operations guide (including bypass operations) should be developed and maintained.
- All the records of waste processing should be kept and maintained on daily basis.

## Air Dispersion Modeling – Eco Care Waste Management Pvt. Ltd.

In order to comply, the Sindh Environmental Protection Act 2014, the quantitative analysis (simulation) of impact of the expected demission on air quality of the surrounding of the project site has been carried out using the United States Environmental Protection Agency (USEPA) approved regulatory air quality model i.e., AERMOD.

The objective of the current study of air dispersion modeling of emission from the incineration facility proposed by M/s Eco Care Waste Management Pvt Ltd. at UC-8 Manghopir, Off-Northern Bypass is to;

(a) Predict the impact (quantitatively) of the proposed Project on the air quality of the surrounding area
(b) Determine the compliance status to SEQS guidelines for ambient air when proposed plant would be operational.

"AERMOD" (American Meteorological Society/Environmental Protection Agency Regulatory Model) is a steady state regulatory air dispersion plume model developed by USEPA. It assumes the concentrations at all distances during a modeled hour which are governed by the temporally averaged meteorology of the hour. The AERMOD modeling system consists of two pre-processors and the dispersion model (i) AERMET-meteorological preprocessor and (ii) AERMAP for characterizing the terrain and generates receptor grids for the dispersion model. Figure 1 shows the GUI of Web Lakes Environmental 's AERMOD, USA.

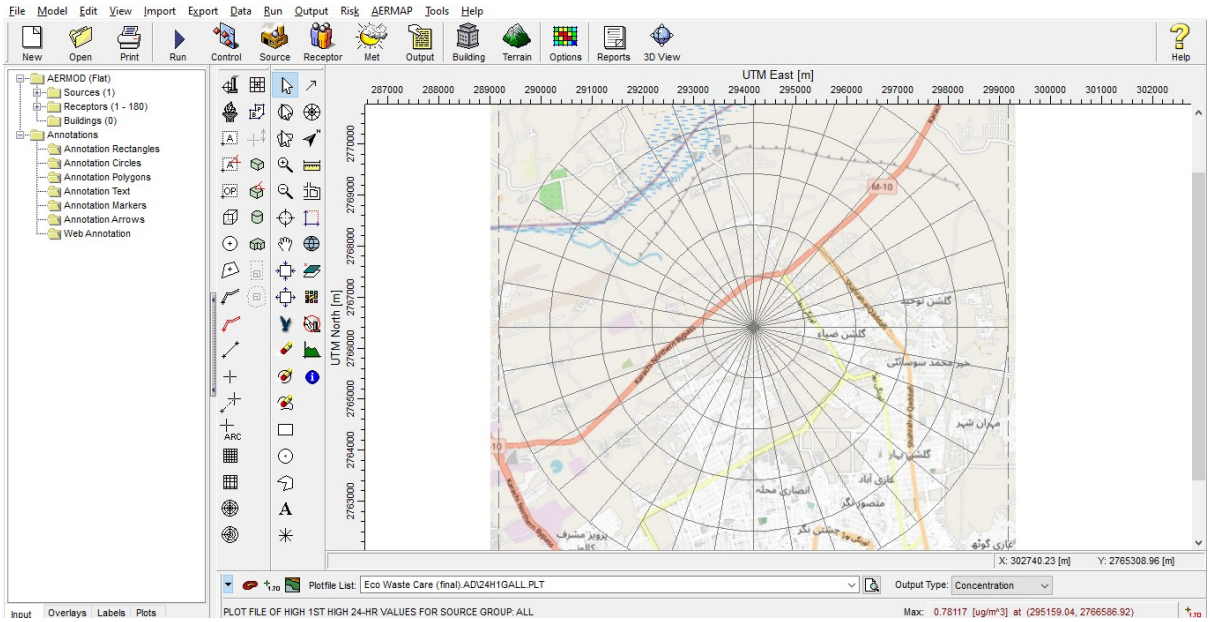



**Figure 1: A GUI of AERMOD Modeling Tool**

### Stack and Emission Data

The stack design (stack diameter, exit temperature, exit velocity, stack height) and emission data (for CO, NOx, $SO_2$, PM10 and SPM) used is given in Table-1 as provided by client.

**Table-1 Stack and Emission Input Data**

| Parameter | Unit | Values |
|---|---|---|
| Temperature | °C | 225 |
| Diameter | m | 0.61 |
| Stack height | m | 10.668 |
| Exit velocity | m/s | 25 |
| CO Emission Rate | g/s | 0.205 |
| NOx Emission Rate | g/s | 0.247 |
| SO2 Emission Rate | g/s | 0.151 |
| SPM Emission Rate | g/s | 0.324 |
| PM10 | g/s | 0.211 |
| Source: Client Data and Emission Factor Documentation for AP-42 Section 2.6 Medical Waste Incineration (for Uncontrolled emissions) | | |

## Meteorological Input Data

The hourly surface meteorological data (in SAMSON format) and Upper Air Met Profiling data (in .fsl format) of Karachi acquired during 2020 was used in the present study. The met analysis indicate that the prevailing dominant wind is blowing from W-SW direction on annual basis.

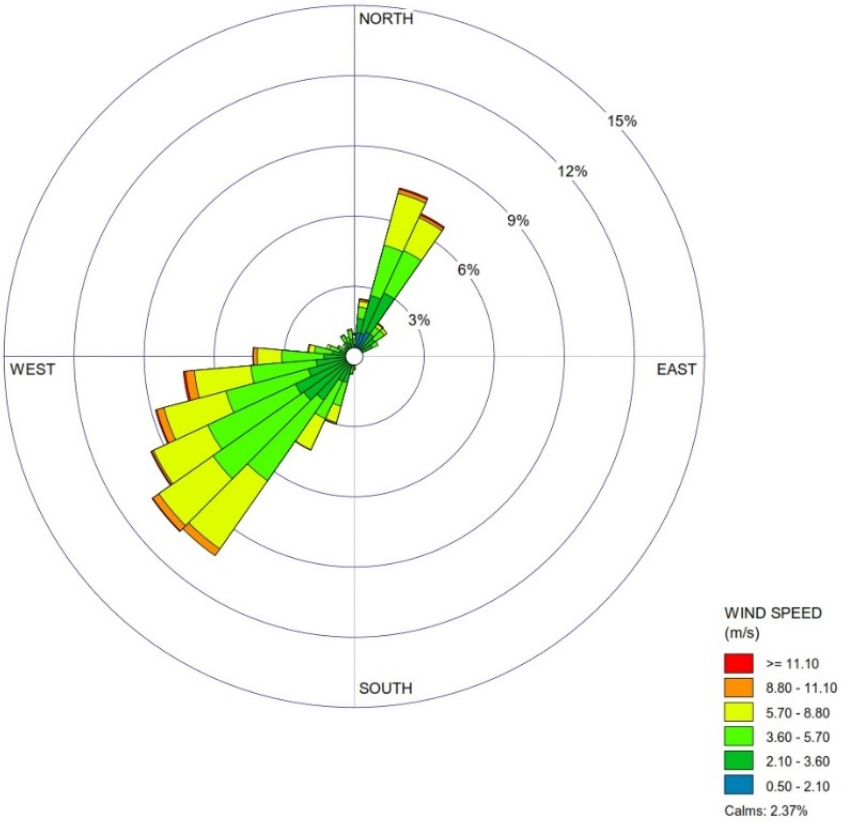



**Figure 2: Wind Plot showing annual wind speed and direction in Y 2020**

**Baseline Air Quality Data**

Baseline ambient air quality data collected by EPA certified lab in the project area is used as input in modeling the study.

**Other Modeling Assumption**

In order to predict dispersion modeling results over the entire modeling area 10 km radius from the project site. The study area was divided into a Uniform Polar Grid Network with total 180 grids and 36 radial directions. The terrain elevation (i.e., DEM) effect in the dispersion was incorporated using AERMAP tool (built in tool of AERMOD suit).

Following are model inputs in each of the assumed scenario;

i. Universal Transverse Mercator (UTM) as projection for zone class of 42 in datum of World Geodetic System 1984 (WGS 84) was used to define the modeling domain
ii. The model output was selected as 1st Highest Ranke values are plotted in form of counters in selected modeling domain (10 km radius from the project site)
iii. Output emissions concentrations are modeled for 24-hrs and annual averaged period for NOx, SO2, PM10 and SPM while 1-hr and 8-hrs averaged for CO.
iv. The Ground Level Concentrations (GLCs) of each pollutant was compared with SEQS for compliance status of the projected emissions in project surroundings localities.

**Modeling Output Data**

The output data of model is present in two forms;

i. In Contour plots of each pollutants showing the Ground Level Concentrations (GLCs) determining the impact area of emissions for 1-hr average, 8-hrs (for CO), 24 hrs and annual average for NOx, $SO_2$, PM10 and SPM whichever is applicable in compliance with Sindh Environmental Act, 2014.
ii. Tabular form showing the source contribution, magnitude of impact and compliance level of SEQS for each pollutant.

Modeling Scenarios;

The impact of emissions from the stacks of proposed waste incineration facility of capacity of 200 kg/hr would operate on gas (normal emissions scenario) and when it would operate on diesel fuel round the clock throughout the year during its life cycle were quantified through dispersion modeling

**Results And Discussion**

In present study, the model predicted the ground level concentrations of CO NOx, $SO_2$, PM10 and SPM as using designed emission, meteorological and baseline ambient quality datasets. The predicted ambient air quality concentrations of these pollutants in/around the proposed project area were determined by sum of concentrations of emissions of these pollutants predicted by model and baseline ambient quality concentrations collected through field survey at the project site.

In next sections, the results were discussed pollutant wise showing the compliance status of predicted ambient ground level concentrations of each of pollutants due proposed project with SEQS in/around the project site. This discussion covers the results of emissions projected to be released into atmosphere from the incinerator with the assumption that emissions are only released from the stacks of the incinerator in the project area. Although model predicted the emission with 24-hrs and annual averaged concentrations of the pollutants, however, the concentrations of 24- averaged are compared with SEQS ambient limits as the baseline data is available for 24 hrly averaged basis in/around the proposed project area. The model depicts that impact (quantitatively) of emissions on ambient air quality from the proposed project when incinerator would be operational with the assumption that it would be operational for 24-hours throughout the year. The predicted concentrations of the pollutants were determined by summing up the (a) incremental concentrations predicted by model using hourly meteorological data of 2020 and (b) measured ambient air baseline data around the plant within radius of 5.0 km.

The model estimated incremental concentrations of emissions of CO, NOx, $SO_2$, SPM and PM10 from the incinerator unit are 0.0011 mg/m$^3$ (8-hr averaged), 3.21 µg/m$^3$ (24-hr averaged), 0.56 µg/m$^3$ (24-hr averaged), 1.2 µg/m$^3$ (24-hr averaged) and 0.781 µg/m$^3$ (24-hr averaged) respectively. This study predicted the ambient concentrations of CO, NOx, SO2, SPM and PM10 when incinerator would be operational are 2.0 mg/m$^3$ (8-Hrs averaged), 34.71 µg/m$^3$ (24-hr averaged), 35.96 µg/m$^3$ (24-hr averaged), 342.4 µg/m$^3$ and 128.58 µg/m$^3$ respectively. The other details are given in Table 3. The spatial distributions of incremental GLCs of CO, NOx, $SO_2$, SPM and PM10 emissions from the project site are shown in below figures.

**Conclusion**

The AERMOD depicted that the predicted ground levels ambient air concentrations of CO, NOx, $SO_2$, PM10 and SPM would be within the SEQS limits of ambient air in the study area which is characterized due to the dilution because of prevailing meteorological conditions and control measure built in the selected incinerator technology by the proponent.

It is concluded that the impact of emission from proposed project to ambient air within domain of 5 km radius is predicted as insignificant with the given prevailing meteorological conditions within modeling domain and comply with SEQS limits for ambient air from the proposed incineration facility by M/s Eco Care Waste Management and will not be impacting residents of Gulshan-e-Tauheed Housing Scheme.

Table 3: Process Contribution and Predicted Ambient Air Concentrations of Selected Criteria Pollutants in/around Proposed Incineration Facility by M/s Eco Care Waste Management.

| Pollutants | Averaging Time | Unit | Model Predicted Concentrations (a) | SEQS | Baseline Concentrations (b) | Predicted Ambient Concentrations (c=a+b) |
|---|---|---|---|---|---|---|
| CO | 8-hrs | mg/m$^3$ | 0.0011 | 5 | 2.0 | 2.0 |
| | 1-hrs | | 0.0029 | 10 | - | - |
| NOx | 24-hrs | µg/m$^3$ | 3.21 | 80 | 31.5 | 34.71 |
| | Annual | | 0.33 | 40 | - | - |
| $SO_2$ | 24-hrs | µg/m$^3$ | 0.56 | 120 | 35.4 | 35.96 |
| | Annual | | 0.08 | 80 | - | - |
| SPM | 24-hrs | µg/m$^3$ | 1.2 | 500 | 341.2 | 342.4 |
| | Annual | | 0.17 | 360 | - | - |
| PM10 | 24-hrs | µg/m$^3$ | 0.78 | 150 | 127.8 | 128.58 |
| | Annual | | 0.11 | 40 | - | - |

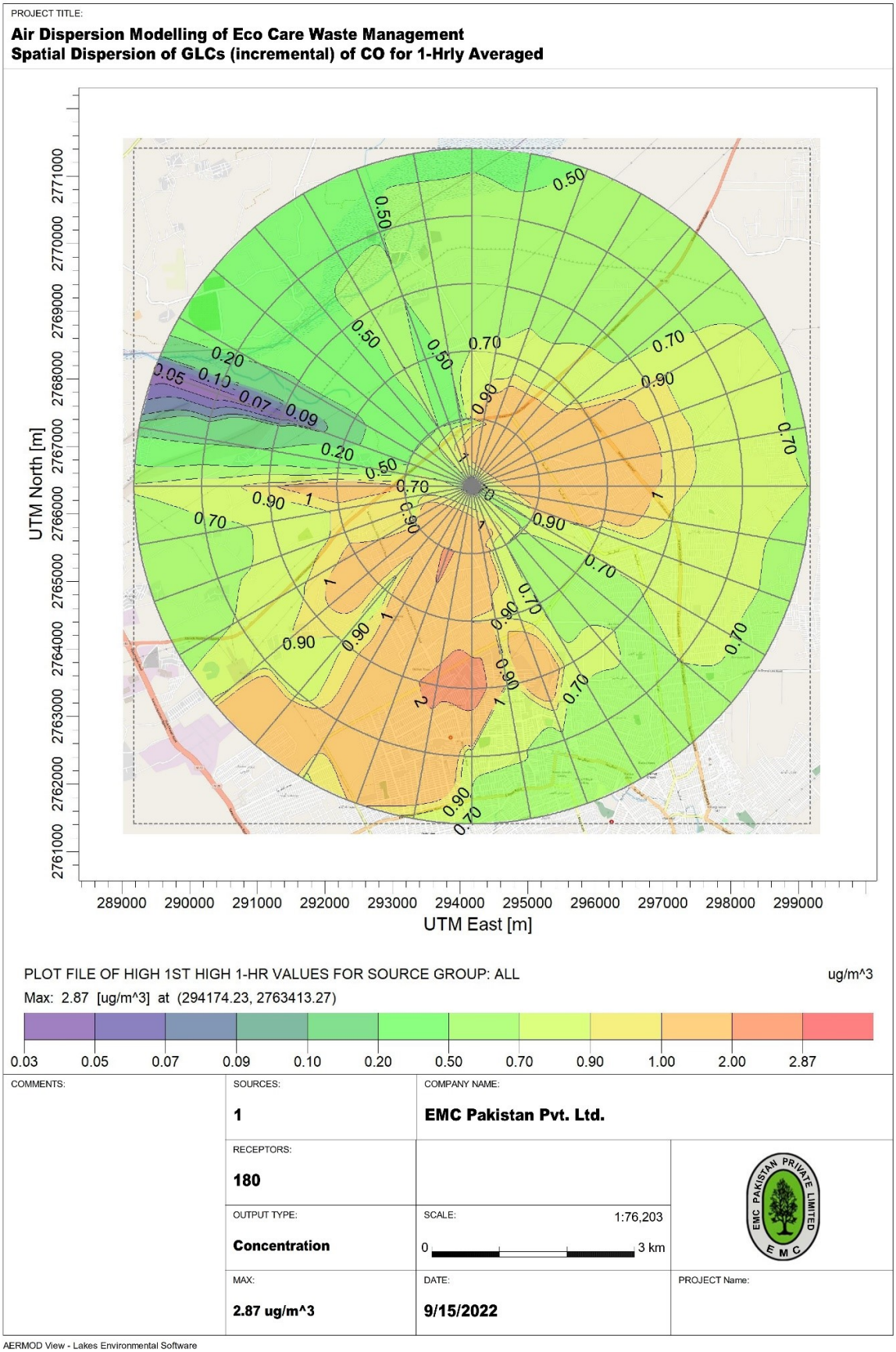



Figure 3: Spatial Dispersion of GLCs (incremental) of CO for 1-Hrly Averaged

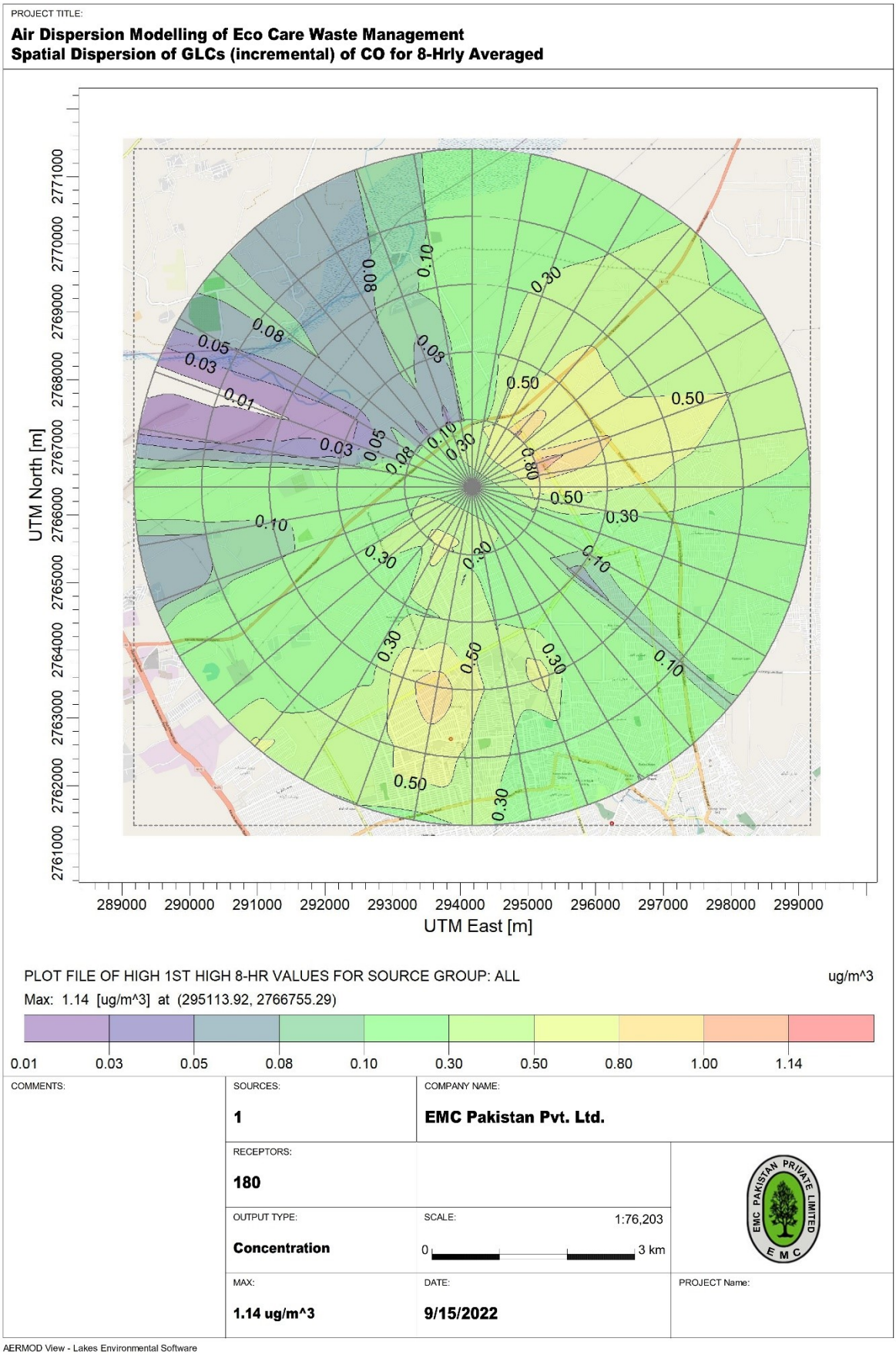



Figure 4: Spatial Dispersion of GLCs of CO for 8-Hrly Averaged

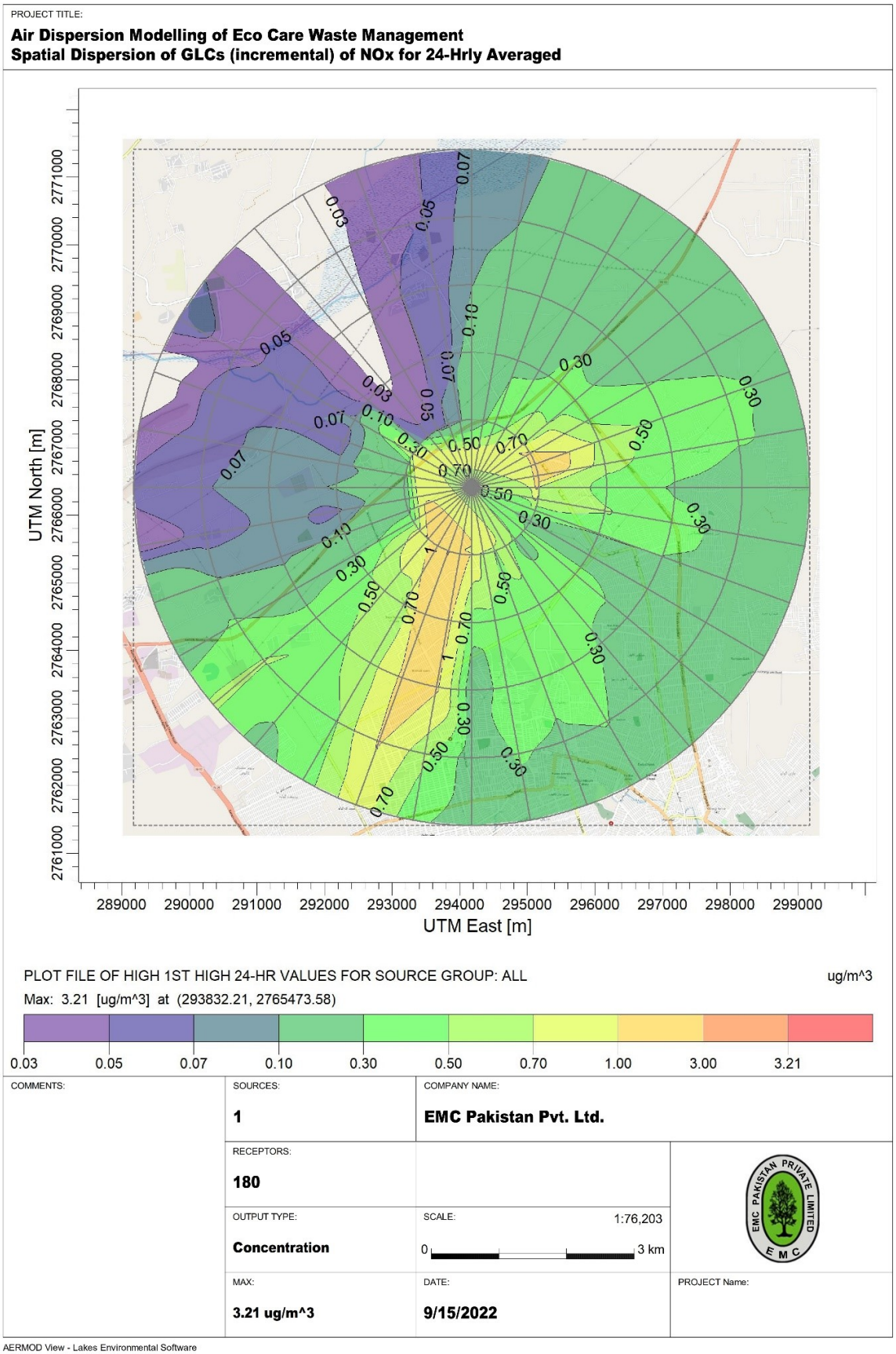



Figure 5: Spatial Dispersion of GLCs of NOx for 24-Hrly Averaged

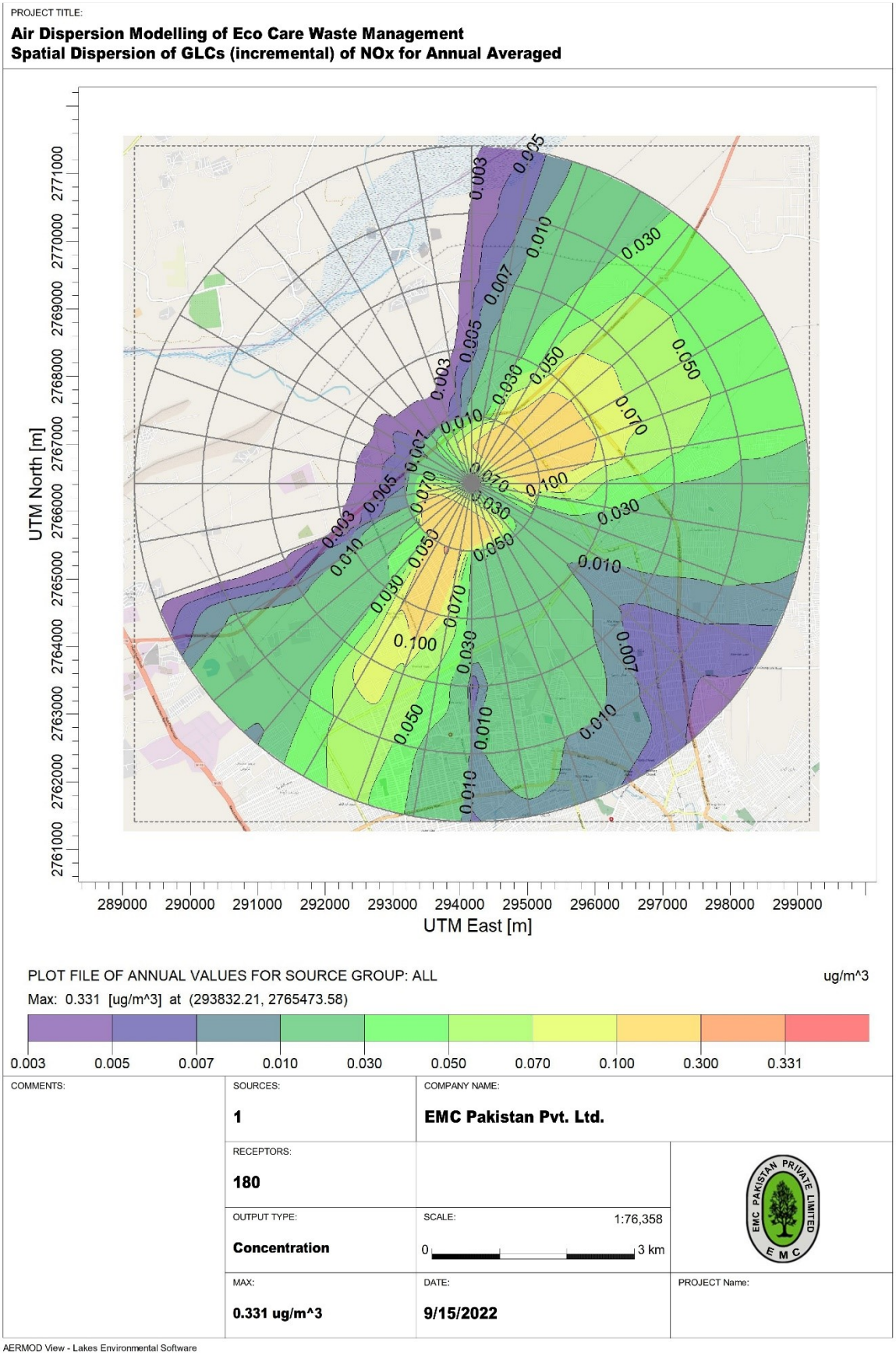



Figure 6: Spatial Dispersion of GLCs of NOx for Annul Averaged

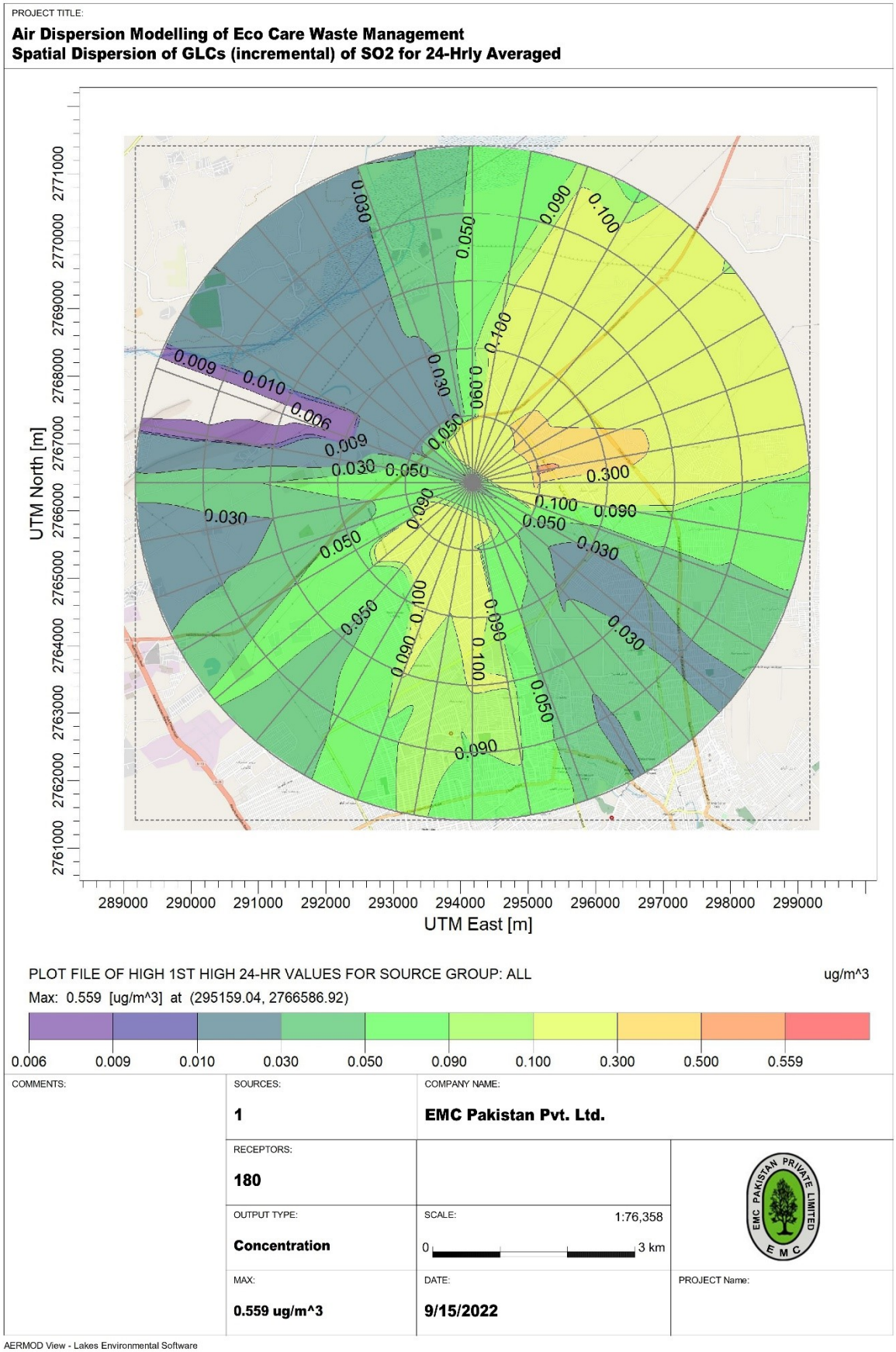



Figure 7: Spatial Dispersion of GLCs of SO2 for 24-Hrly Averaged

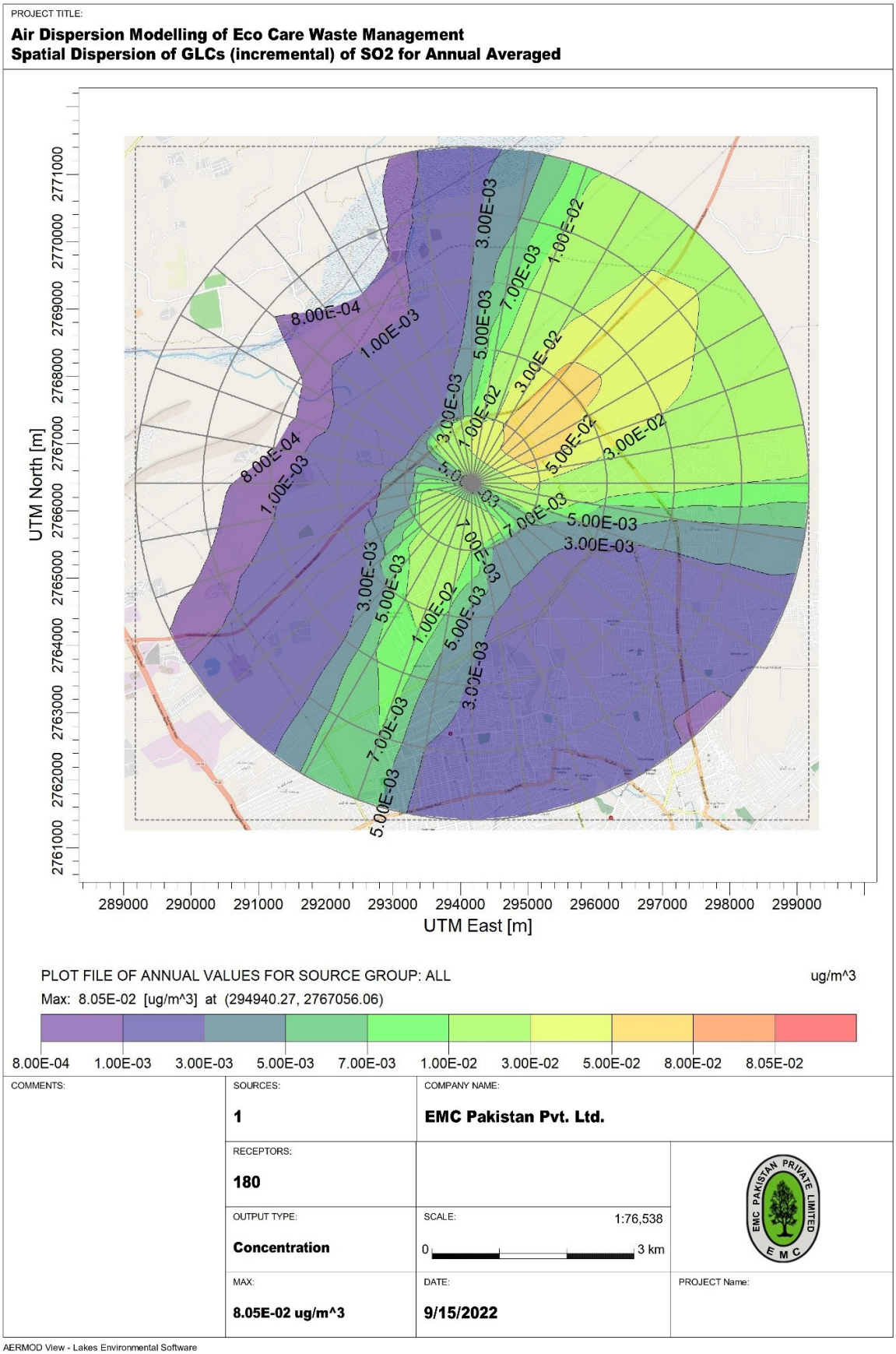



Figure 8: Spatial Dispersion of GLCs of SO2 for Annul Averaged

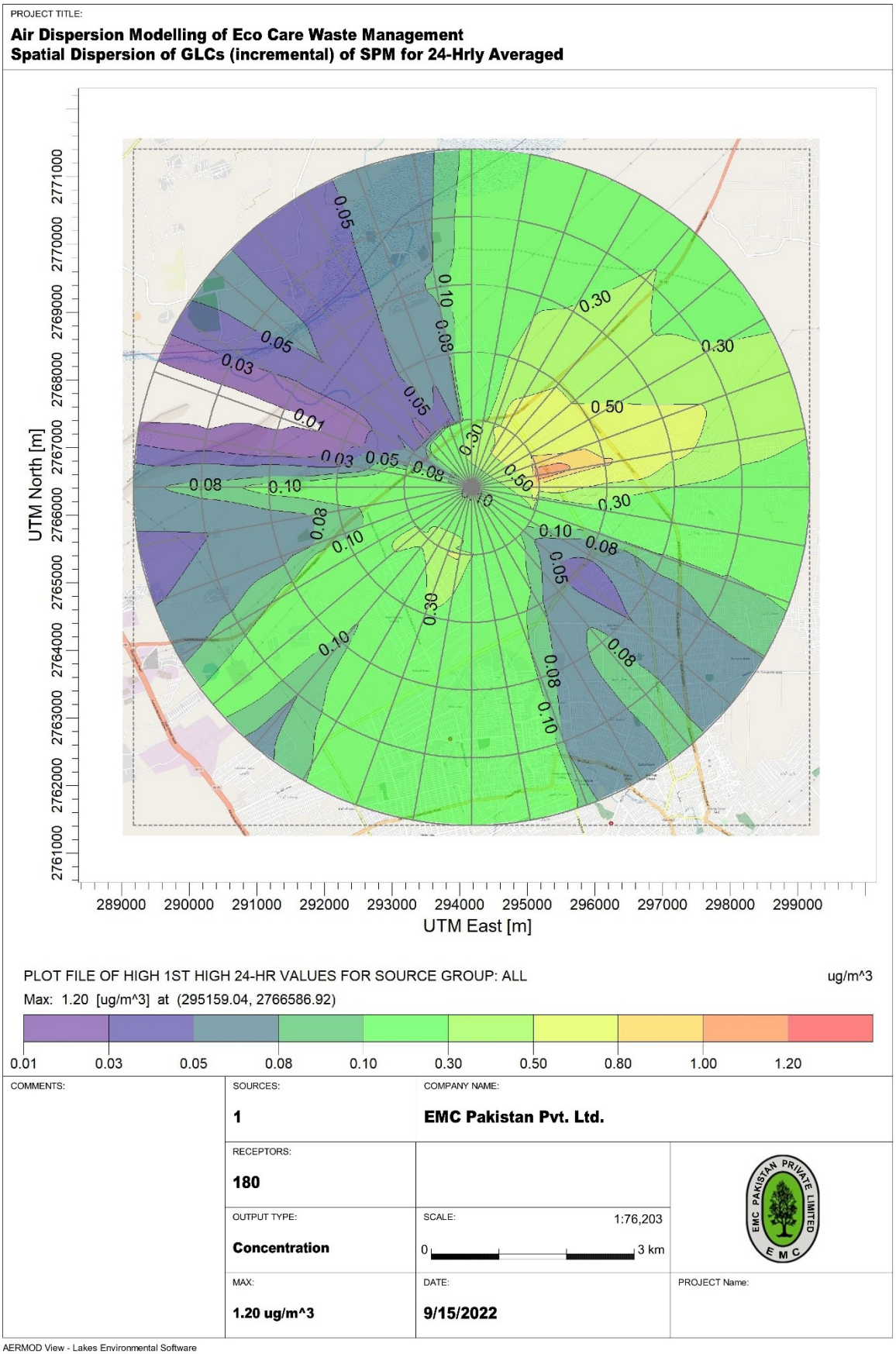



Figure 9: Spatial Dispersion of GLCs of SPM for 24-Hrly Averaged

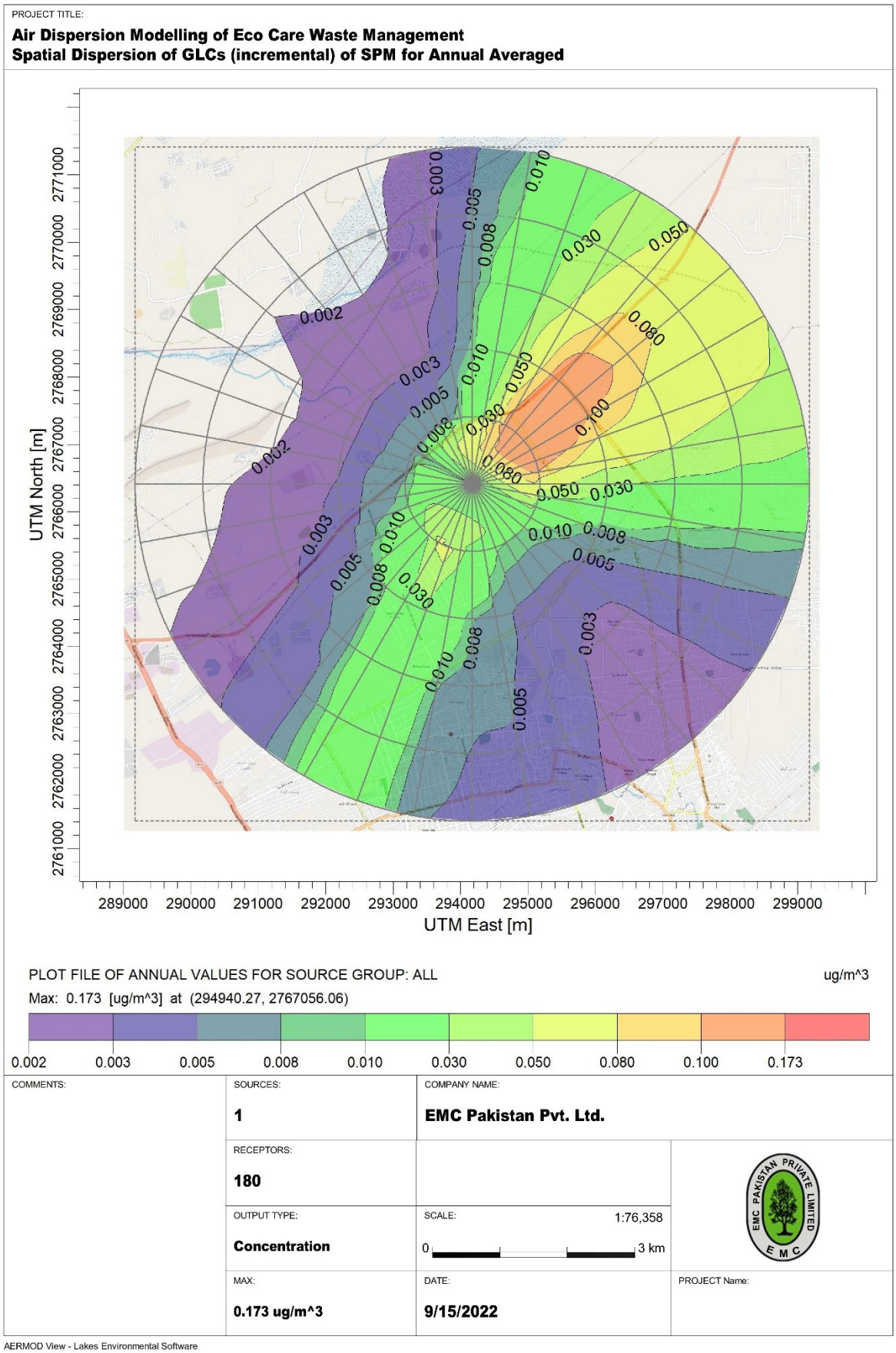



Figure 10: Spatial Dispersion of GLCs of SPM for Annual Averaged

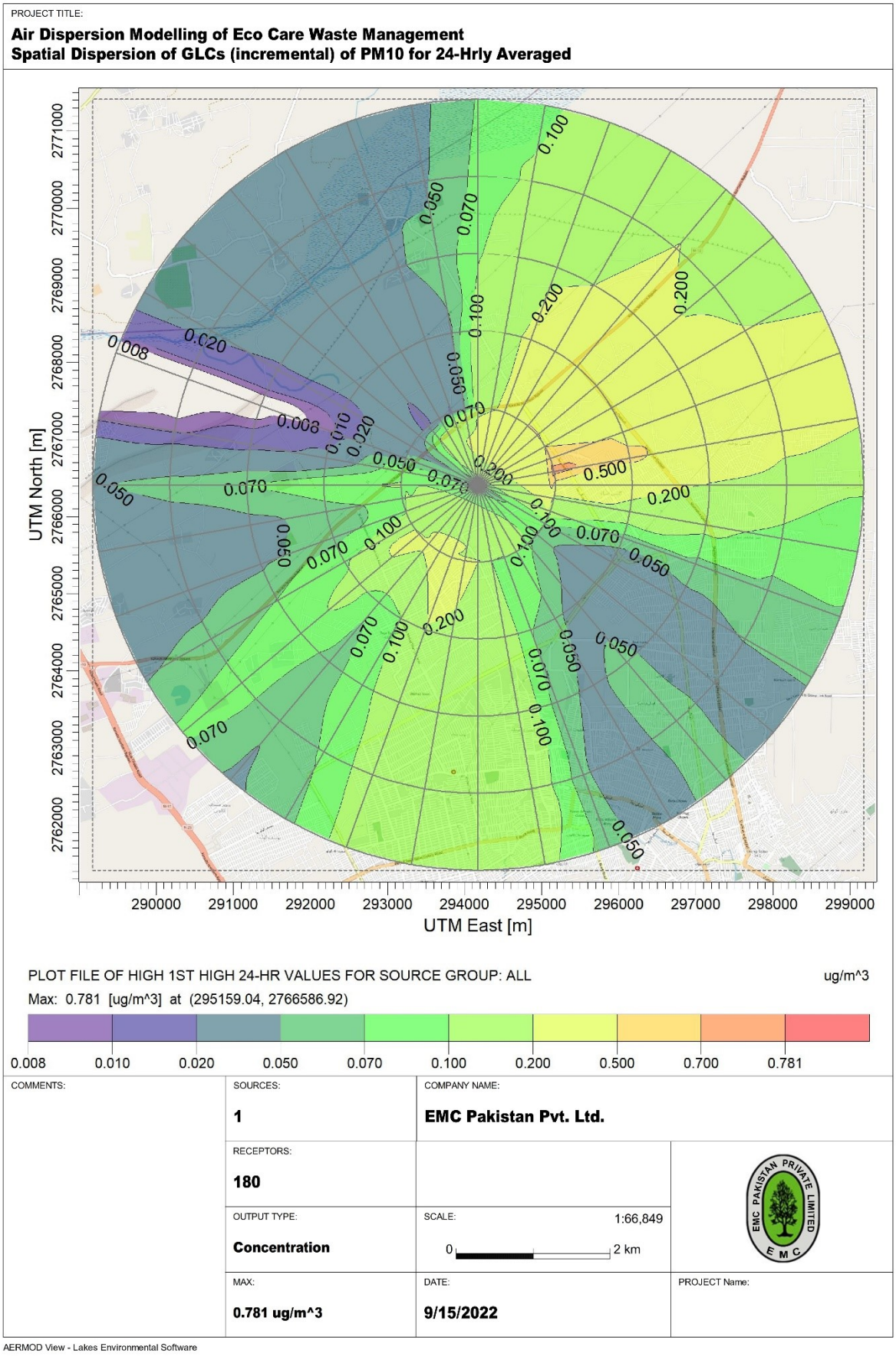



Figure 11: Spatial Dispersion of GLCs of PM10 for 24-Hrly Averaged

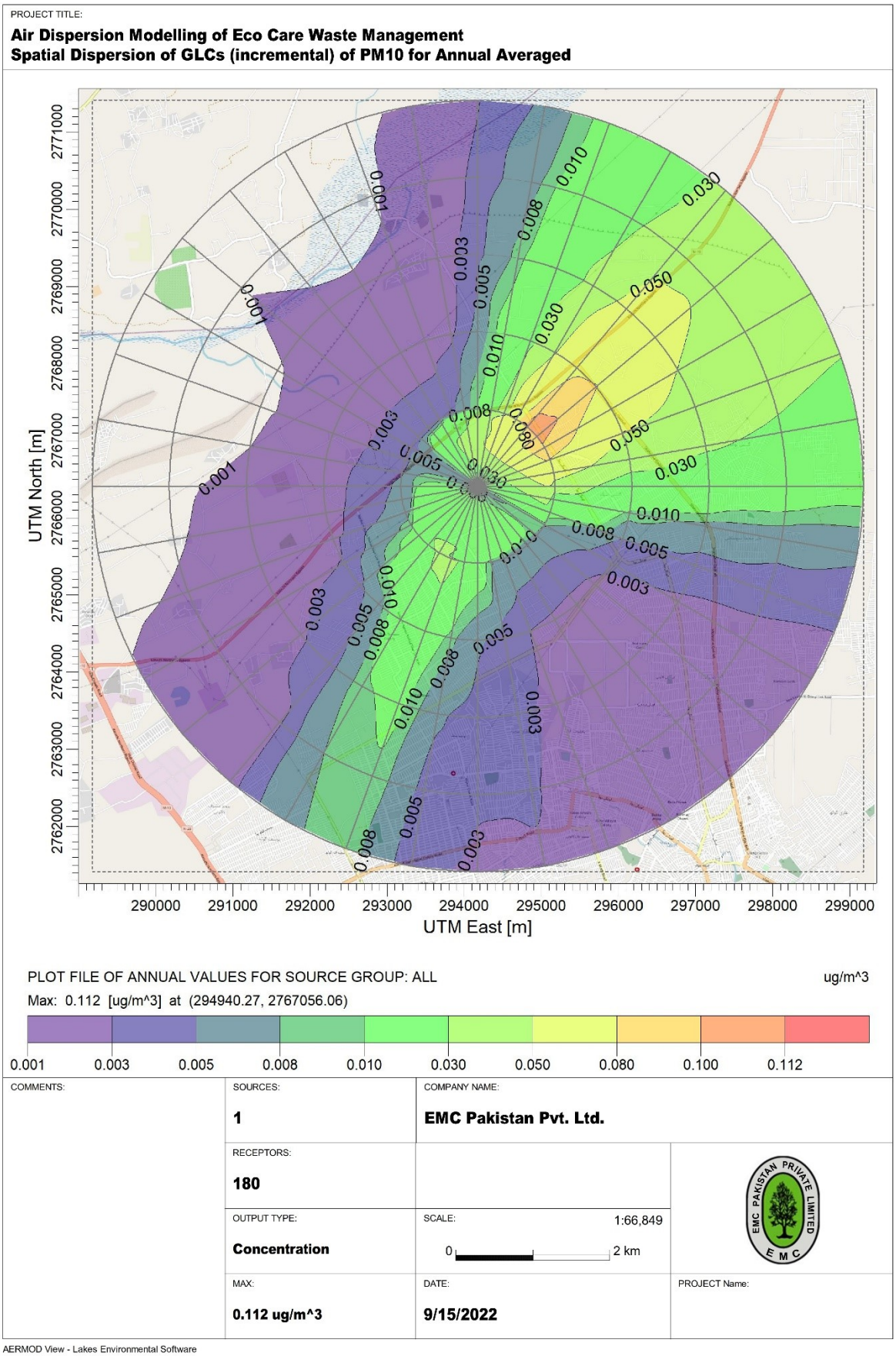



Figure 12: Spatial Dispersion of GLCs of PM10 for Annual Averaged

### 6.4.2 Noise Level

During the incinerator operations, noise will mainly be coming from moving parts such as blowers, pumps, etc. and will mainly be confined in the incinerator room.

**Mitigation Measures**

Followings steps will be taken during operational phase to reduce the noise level impact.

- All equipment including standby generators will be managed and maintained regularly.
- Truck drivers to be advised for turning off the engines when vehicle is in idle state.
- Truck drivers to be restricted to procedures for proper maintenance of vehicles.
- Steps will be taken to reduce the noise at the source level.
- Provision of insulating caps and aids at the exit of noise source on the machinery.
- Provision of earmuffs to the workers and enforcement to its use by the workers will be ensured.

### 6.4.3 Soil Contamination

During operational phase accidental spillage of hazardous waste at the facility can contaminated the soil. To mitigate that risk, it will be ensured that hazardous materials will be placed in proper and designated areas which are lined to minimize the possibility of spillage.

The other activities during the operation phase are storage of solid wastes fuel and material spills which may have following potential impacts:

- During transfer from one container to another or during lifting of waste through forklifts and front-end loaders, etc.;
- During maintenance of facility and vehicles;
- Improper handling of waste including its handling and transfer (due to lack of good housekeeping)

**Mitigation Measures**

- All spills will be cleaned and removed from the site and will be restored back to its original conditions;
- Oils, lubricants, chemicals, and other listed hazardous materials should be placed safely at designated spots and away from any potential source of fire;
- Ash from incineration operations will be disposed in approved disposal site(s). Temporary storage at site should be in lined pits.
- Periodic testing of ash contents is recommended.
- Proponent also plans for an MOU with SSWMB for ash disposal at Gond Pass disposal site.

### 6.4.4 Wastewater

Wastewater will be generated from incinerator flue gas scrubbing process and from domestic source. The domestic wastewater will be handled through septic tank. Scrubber wastewater will be collected, recycled in the process to the extent feasible and is proposed to be treated in Packaged-type Effluent Treatment Plant (ETP) and may be utilized for reuse in wet scrubbing or facility aesthetics purposes.

**Mitigation Measures**

- Waste water discharged to industrial drain must comply with SEQS limits.
- Regular monitoring of waste water to ensure compliance of SEQS.

### 6.4.5 Transporting, Storage and Handling of Incinerable Hazardous Wastes

Handling and transportation of the hazardous waste can cause soil and water contamination, bad aesthetics, odor, health and safety impacts and mixing of hazardous and non-hazardous waste if not carried out properly.

**Mitigation Measures**

- It will be ensured that wastes are packaged in a manner suitable for safe handling, storage and transportation.
- Labeling on packaging should readily be visible and material used for packaging shall withstand physical and climatic conditions. Generator shall ensure that information regarding characteristics of wastes particularly in terms of being corrosive, reactive, ignitable or toxic is provided on the label.
- Upon collection from waste generation site or on receiving of the waste at facility the labeling and packing of waste shall be inspected and inventory of waste received and incinerated must be maintained.
- All hazardous and medical waste shall be handled, transported and stored as per Hazardous Substance Rules, 2014 and Sindh Hospital Waste Management Rules, 2014.
- The transport vehicles shall be designed suitably to handle and transport the hazardous wastes of various characteristics.
- Transporting the wastes in closed containers at all times delivering the wastes at designated points.
- Informing regulatory authorities immediately in case of spillage, leakage or other accidents during transportation.
- Solid waste storage facilities will be properly lined with impervious material.
- Third party contractor will be hired for the disposal of solid waste.

### 6.4.6 Odour Management

The most common odor causing compounds from incinerators are volatile organic acids and methyl mercaptan. These compounds are detectable at low concentrations. The waste combustion process itself is not generally prone to frequent odor problems. Other sources for odor are waste storage area and waste transportation vehicles.

**Mitigation Measures**

- Waste combustion facility will be designed to draw air from the waste receiving and storage areas to be used to provide oxygen to the combustion process. This should create a negative air pressure in these waste handling areas and prevent the escape of odor causing pollutants to outside

surrounding areas. If odors are being emitted, the air pressure should be able to be controlled by closing unused openings to the outside.

- Any leakages should be checked and fixed.
- Proper treatment of flue gas through scrubber shall be ensured.
- Suitable masks should be provided to the workers.
- Good housekeeping shall be ensured.

### 6.4.7 Impacts due to Waste Disposal

The waste generated during the project operation phase will include bottom ash from incinerator and sludge from the scrubber operations and subsequent treatment of wastewater. The bottom ash will be collected and will either be utilized in cement and road making or will be disposed in approved disposal sites. A temporary storage of bottom ash may be required at site. Sludge would be disposed through EPA approved contractor. Onsite incineration is also an option.

Incinerator ash, which may be contaminated with heavy metals like lead and cadmium (if they have not removed substantially from the charged waste) as well as toxic compounds like dioxins, are usually disposed in landfill sites. These pollutants can leach out posing a more immediate threat to ground water and rivers if the landfill sites are not properly designed and managed. Ash residues from the gas cleaning filters of incinerators are classified as hazardous waste and should be disposed of in special landfills.

**Mitigation Measures**

- Site specific waste management plan should be developed.
- Implement stringent waste selection procedures so that only wastes that can be effectively managed are accepted;
- All wastes should be stored separately.
- Incinerator Ash and sludge from the scrubber will be collected and stored at covered designated area and will be sent for environmentally friendly disposal at regular intervals after testing for its contituents.

### 6.4.8 Fire Hazard

Fire is a major hazard due to its potential to severely harm the people in the vicinity and affect the environment. Fires can cause loss of life and property. Risk of fire during operation of the proposed incinerator is low however following measures shall be adopted to prevent and control the any emergency.

**Mitigation Measures**

- There should be clear and visible labeling on ignitable wastes (if any).
- MSDS of chemicals, if used, should be sought form the waste generator and shall be posted at respective waste area.
- Water hydrant system shall be provided to cover the whole facility and hydrant points shall be provided in all potential fire risk areas.
- Fire Extinguishers shall be provided at different locations and on all vehicles.

- Firefighting equipment such as fire extinguishers and hydrant systems will be maintained at strategic locations within the premises.
- Regular inspection and servicing of the extinguishers will be undertaken by a reputable service provider and record of such inspections should be maintained.
- Firefighting training and drills should be conducted on regular basis.
- The facility will possess an emergency response plan that will be regularly drilled to make sure that the responsible staff remains trained at all times.
- Proper grounding to avoid static electricity build up and lightning hazards (including formal procedures for the use and maintenance of grounding connections)

### 6.4.9 Natural Disaster (Earthquake)

The Geological Survey of Pakistan has defined the Karachi region to fall in a Seismic Zone 2B region. This suggests the possibility of moderate to major seismic hazards i.e. probability of earthquakes of intensity VI to VIII MM scale and 5.6 to 6.6 on Richter scale. From the charts published, the peak ground level acceleration (PGA) for this zone is 28%. The seismic risk factor of 0.2 is advisable and will need to be incorporated in the design for constructions and installations in the coastal zone, for operational basis earthquakes (OBE) pertaining to damage due to moderate level earthquakes (MM-VI to VIII).

**Mitigation Measure**

In order to avoid the disastrous situation due to earthquake, it is anticipated that management of proposed project will consider the zoning requirement for building and machinery erection. It is desired that all project structures should be constructed keeping in view the structural and material requirements of Zone 2B projects.

### 6.4.10 Occupational Health and Safety

The workers and incinerator operator can be exposed to hazardous wastes, heat, noise levels and emissions from the project operations. The most significant occupational health and safety impacts typically associated with workers at industrial waste management facilities occur during the operational phase and include:

- Accidents and injuries
- Exposure to hazardous and medical waste

**Mitigation Measures**

- Health and safety Management Plan should be implemented and workers training related to health and safety and waste management should be provided on regular basis.
- Hazardous materials management plan should be incorporated into and be consistent with facility operations.
- Written standard operating procedures should be made available
- Health and safety risks associated with onsite processes would be addressed in procedures developed to guide the safe handling of materials and waste.

- Provide workers with appropriate protective clothing, gloves, respiratory face masks and slip-resistant shoes for waste transport workers and hard-soled safety shoes for all workers to avoid puncture wounds to the feet. For workers near loud equipment, include noise protection. For workers near heavy mobile equipment, buckets, cranes, and at the discharge location for collection trucks, include provision of hard hats;
- Control and characterize incoming waste.
- Provide adequate personnel facilities, including washing areas and areas to change clothes before and after work;
- Annual health screening of workers shall also be ensured.

### 6.4.11 Social Impacts

No direct negative impact are envisaged to income generation of local populace. Positively affecting the local socio-economic conditions of the area by;

- Enhanced employment opportunities for the local community,
- Provide opportunity for waste management of the surrounding area and improving ambiance of the area by minimizing the open dumping or pit burning of waste in the area

**Table 6.1: Characteristics of Environmental Impacts from Construction Activities**

| S # | Environmental Impacts | Impact Characteristics | | | |
|---|---|---|---|---|---|
| | | Nature | Duration | Reversibility | Significance |
| 1. | Employment Opportunity | Beneficial | Short Term | N/A | N/A |
| 2. | Provision of market for Supply of construction material | Beneficial | Short Term | N/A | N/A |
| 3. | Soil Erosion | Adverse | Short Term | Irreversible | Low Significance (if, provided measures are effectively implemented) |
| 4. | Soil Contamination | Adverse | Long term | Irreversible | Low Significance (if, provided measures are effectively implemented) |
| 5. | Construction Waste | Adverse | Short Term | Reversible | Low Significance (if, Provided measures are effectively implemented) |
| 6. | Water Quality | Adverse | Short Term | Irreversible | Low Significance (if, Provided measures are effectively implemented) |
| 7. | Dust | Adverse | Short term | Reversible | Low Significance (if, Provided measures are effectively implemented) |

| Table 6.1: Characteristics of Environmental Impacts from Construction Activities | | | | | |
|---|---|---|---|---|---|
| S # | Environmental Impacts | Impact Characteristics | | | |
| | | Nature | Duration | Reversibility | Significance |
| 8. | Exhaust Emission | Adverse | Short term | Reversible | Low Significance (if, provided measures are effectively implemented) |
| 9. | Waste Water Generation | Adverse | Short Term | Reversible | Low Significance (if, Provided measures are effectively implemented) |
| 10. | Noise Quality | Adverse | Short term | Reversible | Low Significance (if, Provided measures are effectively implemented) |
| 11. | Biodiversity | Adverse | Long term | Irreversible | Low Significance (if, provided measures are effectively implemented) |
| 12. | Traffic Flow | Adverse | Short Term | Reversible | Low Significance (if, provided measures are effectively implemented) |
| 13. | Occupational Health & Safety | Adverse | Long term | Reversible / Irreversible | Low Significance (if, provided measures are effectively implemented) |

| Table 6.2: Characteristics of Environmental Impacts from Operational Phase | | | | | |
|---|---|---|---|---|---|
| S # | Environmental Impacts | Impact Characteristics | | | |
| | | Nature | Duration | Reversibility | Significance |
| 1. | Air Quality | Adverse | Long Term | Irreversible/Reversible | Low Significance (if, provided measures are effectively implemented) |
| 2. | Noise | Adverse | Long Term | Reversible | Low Significance (if, provided measures are effectively implemented) |
| 3. | Soil Contamination | Adverse | Long Term | Irreversible | Low Significance (if, provided measures are effectively implemented) |
| 4. | Impacts on Water Quality | Adverse | Long Term | Irreversible | Low Significance (if, provided measures are effectively implemented) |
| 5. | Hazardous waste Handling and storage | Adverse | Short Term | Reversible | Low Significance (if, provided measures are effectively implemented) |
| 6. | Odour | Adverse | Short Term | Reversible | Low Significance (if, provided measures are effectively implemented) |

| Table 6.2: Characteristics of Environmental Impacts from Operational Phase | | | | | |
|---|---|---|---|---|---|
| S # | Environmental Impacts | Impact Characteristics | | | |
| | | Nature | Duration | Reversibility | Significance |
| 7. | Waste Disposal | Adverse | Long Term | Irreversible | Low Significance (if, provided measures are effectively implemented) |
| 8. | Fire Hazard | Adverse | Short Term | Irreversible | Low Significance (if, provided measures are effectively implemented) |
| 9. | Natural Disaster | Adverse | Long Term | irreversible | Low Significance (if, provided measures provided in chapter 8 are effectively implemented) |
| 10. | Occupational Health & Safety | Adverse | Long Term | Reversible / Irreversible | Low Significance (if, provided measures are effectively implemented) |
| 11. | Socio Economic Impacts | Beneficial | Long Term | N/A | N/A |

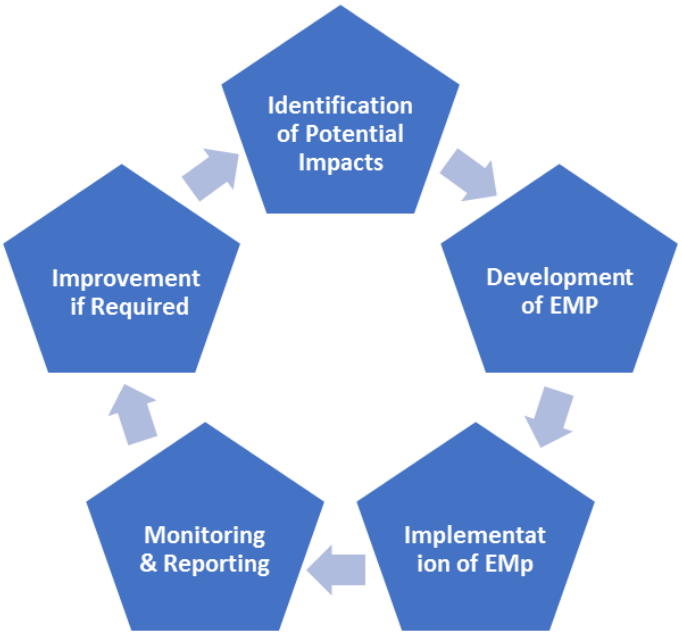
# Chapter 7 ENVIRONMENTAL MANAGEMENT & MONITORING PLAN

## 7.1 Introduction

## 7.2 Introduction

This section of the EIA study details the Environmental Management Plan (EMP) for the work concerning the Project Siting, Construction/Installation and the Operational stages of the proposed incinerator project.

Environmental Management plays a vital role in development of any project to ensure that all the phases of the proposed project are being carried out in environmentally sustainable way. The Environmental Impact Assessment for the proposed project has identified potential impacts that are likely to arise during different phases (siting, construction/installation and operation phases) of the project and mitigation measures, management and monitoring practices, physical controls are recommended to control and minimized the adverse impacts in acceptable limits.




To ensure environmentally sound development an Environmental Managements Plan (EMP) has been prepared and presented in this section. The management measures and site monitoring required to ensure that potential impacts are identified and minimized are presented in EMP. This plan is specific to the pre-construction, construction/installation and operation of the proposed Project.

The factors which require management and monitoring are discussed in the following sections.

## 7.3 Need for EMP

The EMP is meant to provide an overall approach for managing and monitoring environment-related issues and to describe the institutional framework for implementing the EMP.

The previous sections identified the environmental impacts of different activities during the designing, pre-construction, construction and operation stages of the proposed Project and mitigation measures to reduce the severity of the impacts. For successful environmental practices, an essential requirement of the SEPA 2014 is to develop an environmental management plan (EMP) to guide through the procedures to the management and employees of the organization for continual improvement. This EMP will be implemented by proponent of the project. It is essential for Top management to implement this

EMP in letter and spirit and to make changes where required, with information to the Responsible Authority. EMP aims to achieve the following objectives:

- Outlining measures to be taken during the implementation and operation of a project to eliminate or offset adverse environmental impacts, or reduce them to acceptable levels.
- The actions needed to implement these measures such as defining roles and responsibilities of the project proponent for the implementation of EMP and identifying areas where these roles and responsibilities can be shared with other stakeholders.
- Defining the requirements for communication, documentation, training & management and implementation of the mitigation measures.
- Actions required assessing the effectiveness of the mitigation measures employed such as guide through the monitoring mechanism and identifying related parameters that will be required for confirming the effective implementation of the mitigation measures.

## 7.4 EMP Process

The EMP comprises of the following areas & defining the methods and procedures of implementation.

- Organizational structure and roles and responsibilities of project personnel.
- Specific requirements for the implementation of the EMP.
- Mitigation or impact management matrix.
- Monitoring plan with the emphasis on specific parameters to monitor.
- The preparation of this plan has involved an extensive and detailed program of investigation to the processes involve and with consultation the issues concerned. Therefore, this network will provide a structure to assist in the implementation of the management plan accordingly.
- The proponent establishes environment, health & safety (EHS) department which handles the entire environment related concerns and issues. The EHS manager is the Incharge of EHS department and liable to report Managing Director. EHS department will appoint EHS officer who will coordinate with the contractor during construction process and also monitor during the operations of incinerator.

## 7.5 Management Approach

Management will undertake overall responsibility for compliance with the EMP. It will ensure that all the activities that the management executes comply with positive environmental sensitivities as well as it will cooperate with the concerned regulatory agencies such as Sindh Environmental Protection Agency (SEPA). The dynamic approaches that are followed towards successful implementation of the environmental management plan listed below:

- Compliance with the relevant legislative and regulatory requirements of the project.
- Developing appropriate monitoring indicators in order to assess the performance as well as magnitude of impact on the environment.
- Regular review of the project activities and assessing their impacts on the environment.
- Setting project's key environmental concerns and addressing issues through public support, awareness and publicly reporting its progress.

- Communicating broadly with internal & external stakeholder on issue of environmental concerns.

## 7.6 Maintenance of the EMP

EMP needs to be revised on periodic basis to maintain up-to-date environmental management requirements with the changing physical and regulatory constraints. Therefore, outlining and defining the responsibilities of personnel and activities under the project's operation execution, implementation, mining, operation & monitoring and decommissioning phase are integral part of maintenance of the EMP. Dissemination of reviewed and revised EMP need to be notified to all stakeholders particularly, relevant government and municipal agencies so that their modified role is also redefined and re-established in the overall environmental management process.

## 7.7 Health, Safety and Environment Management System

Health, Safety and Environment Management System is essential and integral component of the environmental management system for the safe and secure working environment assuring sustained development, dependent on health associated performance of human resources. EHS issues and aspects are outlined in EMP with mitigation measures based on principles of best management practices. EHS management system undertakes carrying out a complete assessment, evaluating, monitoring, identifying and control measures (mitigation) of all potential hazards and risks arising during the construction, and operation phases of the proposed project. It needs to ensure that the Health and Safety Plan (HSP) along with the Health and Safety Rules is established, documented and enforced. The plan also outlines roles, responsibilities and expected outcomes of proper implementation with respect to the environment, health and safety management of various phases of the project. These measures should be implemented to ensure that no significant adverse, health and safety impacts occur due to proposed activities associated with the project.

## 7.8 Risk Assessment

### 7.8.1 Identification of Environmental and Social Aspects of Project

Potential environmental and social aspects from the development and operation of the proposed project include the following key activities:

- Siting the proposed project
- Construction and installation the project
- Water consumption and wastewater generation
- Construction waste generation and disposal
- Incinerator operations
- Air Emissions from incinerator
- Handling and management of waste during operations
- Emergency situations

Risk assessment of the abovementioned project activities identifies the following environmental liabilities which would require mitigation/control measures to be implemented to reduce the environmental impacts to an acceptable level.

- Air and noise emissions
- Possible contamination of water, soil and land from discharge of effluents including oily waste and seepage to land and water
- Solid waste including excavated material, hazardous and non-hazardous wastes
- Traffic issues during construction and operation phase
- Resource consumption
- Emergency case scenarios
  - Fire hazard
  - Occupational safety hazards
  - Natural disasters
- Socioeconomic impacts

Workers are prone to safety hazards during construction work such as accidents during work at height, poor ergonomic conditions etc. and exposure to hazards and toxic and explosive materials.

Hazards associated with the operational activities of the proposed project can be of the following categories:

1. **Electrical:** Electrocution from live conductors and misuse of power tools, overhead power lines, downward electrical wires, buried cables.
2. **Structural:** Potential for falling or strain when working conditions include slippery surfaces, steep grades, narrow stairs, open holes, trip hazards and unstable flooring; potential puncture from objects and potential burial from trench cave-ins or from unstable slopes on material stock-piles.
3. **Mechanical:** Collision accidents with moving equipment, especially when operating in reverse, failed pulleys, snapped cables, and clothes catching in gears or drills.
4. **Temperature:** Heat stress in hot environments or when working in clothing which limits the dissipation of body heat and moisture.
5. **Noise:** Stress and physical damage to the ear when subjected to noise levels exceeding recommended guidelines (e.g. an 8-hour, time-weighted average sound level of 90 dB(A), as per US guidelines, SEQS recommend 85dB (A) as the limiting value for motor vehicle noise- there is no SEQS limitation imposed on noise generated from industrial process).
6. **Exposure to Hazardous Material:** During handling of hazardous waste worker can be exposed to hazardous and infectious materials.

   In addition, it is possible that if the work areas are not designed properly, they can cause workers discomfort and mental stress, which can result in loss of efficiency, and thus lessen the worker's ability to respond promptly to any hazard. Also, creation of such conditions can cause monotony and fatigue, thereby increasing the potential for hazards and accidents to occur.

## 7.9 Legislations & Guidelines

The EIA for the proposed Project has discussed in detail the national and international legislation and guidelines that are relevant to the project in Chapter 3 of the EIA report.

The proponent of the project will ensure that the project is conducted in conformance with national legislation and relevant international conventions and that guidance is sought form national and international guidelines. It will also be ensured that key project management of the company and all its assigned contractors are aware of these legislation and guidelines prior to start of the project activities.

## 7.10 Roles & Responsibilities

Environmental management should become an integral part of policy of the proposed project. Therefore, committing to reduce the environmental impacts will reflect the management approach and believe that good performance in this area is synonymous with running well-managed efficient proposed project operations. During the construction phase, main responsibility of environmental performance will be followed by the EHS officer on the daily basis.

In case of normal operational phase, main responsibility for environmental performance will be supervised by site manager while the daily management will be performed under the site officer who in turn charges of environmental matters. Under their surveillance, environmental management during operations will be performed as per the mitigation and monitoring plans outlined in this EIA. A brief structure of role and responsibilities is given below:

### 7.10.1 Top Management of Incinerator Plant

Environmental management plan (EMP) will be regulated by the Top Management of proposed Incinerator Plant; therefore, will play an important role. Some of the key role & responsibilities are given below:

- To cooperate and consult with relevant environmental agency in order to perform in better way.
- To evaluate the progress of development and implementation of this management plan.
- To approve any change in decision making with the consultation of respective managers, if appropriate.

### 7.10.2 Project Manager

The role of Project Manager is very important. The success of an EMP will mainly depend upon effective management of the EMP by Project Manager. Following are some of the roles & responsibilities given to the Project Manager:

- Ensure that the contractor is aware of all specifications, legal constraints, standards and procedures pertaining to the project specifically with regards to environment.
- Ensure that all stipulations within the EMP are communicated and adhered to by contractor(s).
- Monitor the implementation of the EMP throughout the project by means of site inspections and meetings. This will be documented as part of the minutes of the site meeting documents.
- Be fully conversant with the Environmental Impact Assessment of the project, the conditions of the approval of EIA and all relevant environmental legislations.
- To ensure that the points of views of staff are considered and placed in the EMP accordingly.
- To identify issues and where possible propose solutions for inclusion in the management plan review process.

- To improve coordination and exchange of information between top management, employees, contractors, etc.
- To contribute towards the actions to deliver the management plan and ensure its continued development.
- To monitor the progress of development and implementation of this management plan.
- Have overall responsibility for the implementation of EMP.

### 7.10.3 Contractor(s) for Construction and Operation

On behalf of contractor, the main responsibilities for all matters pertaining to environment will be that of the chief of the assigned contractor. The role and responsibilities of the contractor will consist of the following basic points:

- To carry out construction/operation activities in environmentally sound manner.
- Shall propose measures to minimize environmental impacts during construction process, and submit them to the Environmental Officer.
- In case of having impacts on the environment, the contractor will inform them to the Project Manager in time to get instructions and then take next step.
- Comply with the environmental management specifications;
- Submitting and obligatory Method Statements for approval by the Project Manager before any work is undertaken;
- Submitting a report at each site meeting which will document all incidents that have occurred during the period before the site meeting.
- Maintaining a public complaint register.
- Arrange that all his employees and those of his subcontractors receive training before the commencement of construction.

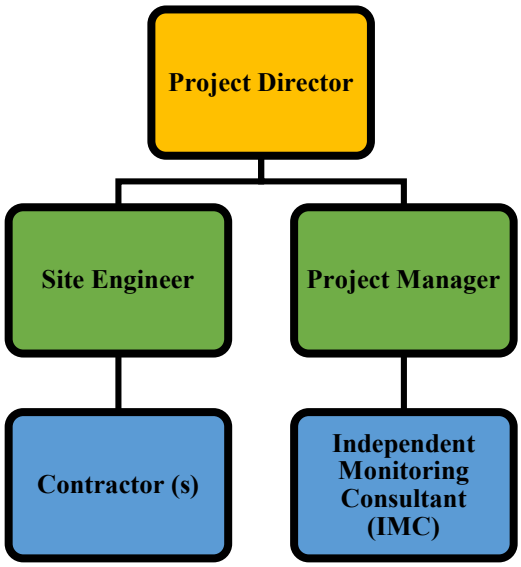



**Figure 6.1: Suggested Organogram for Environmental Management for proposed Incinerator Plant**

### 7.10.4 Independent Monitoring Consultant

The proponent shall appoint an Independent Monitoring Consultant (IMC) who will monitor to ensure that the construction is in accordance with the EIA approval conditions. The results of the periodic monitoring will be compiled in monitoring reports which will be submitted to the project management for review and necessary action. The consultant will maintain monitoring records and any deviations from or changes to the contract plans.

### 7.10.5 Environmental Management Program

Current plans for environmental management during development/design, construction, and operation phase of the proposed project are mentioned in sections below.

### 7.10.6 Design of Facility

It includes the location of proposed project site, extension area, facilities to be installed in given space of project area as well as machines and other related operations. If design parameters need to be change due to any reason after getting environmental approval, proponent will assess the environmental impacts that may arise from such changes. If the impacts are found to be different and in excess of those mentioned in the report, mitigation measures must be developed to minimize these impacts with respect to the changes.

### 7.10.7 Approvals

Obtaining NOC from SEPA does not relieve the proponent for other obligations and hence proponent and the contractor will obtain all relevant clearances and necessary approvals required by the Government of Sindh prior to initiate the proposed operations.

### 7.10.8 Environmental Trainings

Necessary training on environmental and other safety issues will be provided to the technical and supporting staff before start of activities to ensure that all the staff is well acquainted with the nature of job, inherent risks, hazards, requirements of job safety and EMP. The Project Manager will determine the training requirements.

During the training, the following areas of knowledge and experience are considered essential:

- Understanding the properties (e.g. flammability, corrosiveness, toxicity, reactivity, infectious) of hazardous waste, as well as the levels at which they pose a significant danger requiring protective measures.
- Waste management plan
- Health and safety risks associated with the plant operation
- Awareness of early-warning indicators, hazards/risk identification, and ability to recognize potentially hazardous situations.
- Familiarity with engineering controls to avoid occurrence of hazardous situations.
- Knowledge of the use and maintenance of emergency response equipment, as well as routine equipment for health and safety monitoring and protection.

- Knowledge of methods and procedures for decontaminating equipment, and facility, following potential chemical contamination.

Records of all trainings should be maintained. It is recommended that in case of any undesirable event or emergency situation, a follow-up session should be arranged to review the weaknesses ad gaps in the existing system and possible reasons which caused the event. This would enable the management in keeping such events from recurring by placing additional and more efficient controls.

### 7.10.9 Communications

For effective management and monitoring of the environmental performance during the construction and operation phase, communication will be maintained by the Site Supervisor and Project Manager who will coordinate with the project management and regulatory agency on necessary matters.

- **Construction Phase:** Site supervisor will be responsible for coordinating the project progress to the Project Manager during construction phase. He will supervise the construction work to ensure that provisions of EMP/EIA are not violated at any stage. If any undesirable event such as work-related injury, death, or any other emergency situation arises during construction, the Site Supervisor shall report this to the Project manager. Any issues that require attention of higher management will be communicated to them for action by the EHS manager. The site supervisor should report to the Project Manager on weekly basis during the construction phase.
- **Kick-off Meeting** to define the environmental responsibilities, awareness of EMP to the managing staff and to streamline the work plan according to the EMP. This meeting is to be arranged prior to commencement of activities.
- **Quarterly Meetings** to review the progress of activities performed and effectiveness of measures in place for pollution control. Deadlines are re-evaluated in it and if necessary, the project program is revised in these meetings. In the end of quarterly meetings, minutes will be issued to include the outcome of the meeting, issues discussed, and decisions. The minutes of meeting will also be provided to the project manager and the contractor for their own record.
- **Peer Review** for professional opinion and evaluation of the project performance, recommendations for innovation such as new available pollution controls, waste minimization strategies etc.

### 7.10.10 Fire Protection System

The following fire-fighting facilities should be provided depending upon the nature and risk of the installation:

- Fire water system (mixed installation)
- Foam generation system
- Fixed fire-fighting equipment
- Mobile fire-fighting equipment
- Fire detection and alarm system
- Communications

Design of the fire-protection system facilities is provided as per the following criteria, and recommendations of the NFPA 30 have generally been followed:

a) Fire-protection facilities are based on the single largest emergency contingency.
b) All the potential fire risk areas are fully covered by hydrant and monitoring systems.
c) Water spray systems will be considered in hazardous locations and equipment in process unit areas.

### 7.10.11 Construction Phase

**1. Construction Work Management**

All construction related work including campsite establishment, operation, and management of waste streams, equipment and material mobilization etc. shall be in compliance with the (1) agreed procedures (if) provided by the proponent to the contractor and (2) provisions of NOC. The contractors will abide by the relevant contractual provisions relating to the environment.

Performance of contractor and subcontractor will be monitored by IMC periodically and site supervisor constantly. All the construction crew particularly the technical staff will be provided with necessary PPEs and other safety equipment as required by their job. Site supervisor and contractor will ensure that each job is being performed in safe and sound manner and in accordance with the safe work procedures.

Solid waste during construction will be removed on daily basis either through a local waste contractor or by the construction contractor himself who will engage some workers for removal of construction waste from site and disposal to a waste collection facility.

Proper drainage will be provided to construction camp and construction site, especially near excavations. The wastewater will be initially treated by sedimentation technique to remove suspended solids and reused if it meets the desired quality. If the effluent cannot be reused, it will be discharged to local sewers after ensuring that it does not contain any solid debris which can choke the sewer lines. Where possible, wastewater will be used for watering the vegetation nearby.

Type of construction material for the Project shall meet the seismic design requirements for buildings located in seismic zone 2B. The design consultant also needs to consider other safety aspects for events like cyclones, Tsunami etc.

The Site Supervisor also needs to ensure that construction and operation of the project does not influence the business going on in the vicinity. This is possible during construction phase from obstruction of routes; campsite location, noise emissions, and resource consumption e.g. water. Similarly, during operation phase, logistics will be managed by traffic management plan. Any complaints from nearby industrial units will be addressed effectively.

**2. Site Restoration**

The Site Supervisor will ensure that the restoration of the site after the end of construction activities is carried out according to the requirements of the EIA and EMP.

**3. Construction Monitoring**

An Independent monitoring consultant will be hired to monitor the construction work and EMP compliance which would also include monitoring of waste management.

### 7.10.12 Operation Phase

**1. Co-ordination with Stakeholders**

The proponent will ensure that co-ordination required with the project stakeholders on environmental and social matters as required by the EMP is maintained throughout the operation of the project.

**2. Control of Air Pollution from incinerator**

Air pollution due to the incinerator operations would primarily result from waste burning and waste transportation and handling. movement of trucks carrying the waste and emissions from generator.

Air Emissions from incinerator plant will comply with the Sindh Environmental Quality Standards (SEQS). At no time will the emission levels be allowed to go beyond the stipulated standards. To ensure this, following measures will be undertaken:

- Regular monitoring of stack emissions
- Monitoring that the plant is being operated as per manufacturer specifications.
- Monitoring of pollution control technology is effectively working
- Regular maintenance of all machinery and equipments

**3. Monitoring**

The proponent will ensure that the mitigation measures mentioned in the EIA are adhered to and organizational EHS Management Systems are implemented during the proposed project.

Ambient air quality will be monitored by IMC in the Incinerator plant facility.

**4. Emergency Procedures**

The EHS department will prepare contingency plans to deal with any emergency situation that may arise during the operation e.g. fire, major oil, chemical spills, medical evacuation and communicate these to the regulatory agencies if required by these agencies.

The EHS department will also implement necessary measures to prevent fire hazards, contain oil spills, and perform soil remediation as needed.

**a) Fire Contingency Plan**

Possibility of presence of flammable materials at this site, fire is an ever-present hazard. All personnel and subcontractors are not trained professional fire-fighters. Therefore, if there is any doubt that a fire cannot be quickly contained and extinguished, a designated officer will notify by radio and vacate the area. The designated officer will immediately notify the local Fire Department.

The following procedures will be used to prevent the possibility of fires and resulting injuries:

- Sources of ignition will be kept away from where flammable materials are handled or stored.
- “No Smoking" signs will be conspicuously posted in areas where flammable materials are present.

- Fire extinguishers will be placed in all areas where a fire hazard may exist.

The following procedures will be implemented in the event of a fire:

- Anyone who sees a fire will notify their designated fire officer who will then contact the work crew and ring the siren.
- When the emergency siren sounds, workers will disconnect electrical equipment in use (if possible) and proceed to the nearest fire exit.
- Work crews will be comprised of pairs of workers (buddy system) who join each other immediately after hearing the fire alarm and remain together throughout the emergency. Workers will assemble at a predetermined rally point for a head count. When a small fire has been extinguished by a worker, all workers will be notified.

## 5. Emergency Response Plan (ERP)

Emergency may be defined as a sudden event causing and has the potential to cause serious human injury and/or environmental degradation of large magnitude. The best "cure" for an emergency is, of course, "prevention".

The probable emergency situation can be:

- Serious fire and explosion;
- Natural calamity such as heavy rain, flooding, dust storm, earthquake etc.;
- Bomb threat or any sabotage/terrorist activity;
- Any other incident involving all or large part of the premises and its workers.

A Project-specific ERP will be developed by proponent which primarily relates to the different construction activities of the project. It supports the EMP and addresses actions and requires responses of proposed project employees and contractors.

Emergency response management will be provided with small teams of senior managers (the control committee) who in turn will direct all response activities through the Emergency response unit, industry security, communications, public relations, environment and safety affairs and material procurement departments. Each of these departments has specific responsibilities to perform in the event of an emergency.

## 6. Communication and Documentation

For effective monitoring, management and documentation of the environmental performance during the operation, environmental matters will be discussed during regular meetings. Any environmental issue identified at the meeting will be considered and addressed by the EHS department. Issues that require attention of senior management will be communicated to them for action.

## 7. Occupational health and safety risk management

During routine operations, workers may develop occupational diseases of the lungs, skin, and other organs, depending on the amount and length of time of exposures. Workers exposed to hazardous noise levels may develop noise-induced hearing loss. Other dangers include confined spaces, in which untrained workers may get seriously injured or killed.

In view of the existence of the occupational health and safety risks in the proposed facility, the EHS department needs to develop an Occupational Health and Safety Risk Management Plan for exposure control in situations when workers may be overexposed to chemical hazards. This plan should provide a detailed approach for protecting workers against chemical exposures, including health hazard information, engineering controls, safe work procedures, worker training, and record keeping.

It is recommended that the Occupational Health and Safety Risk Management Plan should necessarily include the following elements:

1. Statement of purpose
2. Responsibilities of employers, supervisors, and workers
3. Risk identification and assessment
4. Risk controls
5. Worker education and training
6. Written safe work procedures
7. Hygiene facilities and decontamination procedures
8. Documentation
9. Health monitoring (may also be required, depending on the nature of the chemicals being used)

## 8. Waste Streams

To provide guidelines and simplify the process of categorizing, quantifying, managing, and disposing of wastes. Waste management is a critical component of operating policies. Waste management includes proper handling, accumulation, storage, transportation, and disposal of the waste generated and collected.

A Project-specific Waste management procedure will be developed by proponent which primarily relates to the different activities of the project. It supports the EMP and addresses actions and requires responses of proposed project employees and contractors.

## 9. Training

All employees will receive general firefighting training (i.e. fire extinguisher use). Employees who are members of the fire brigade shall receive at a minimum the following training:

- Use and limitations of the firefighting equipment.
- Firefighting strategies and methods.
- Use of respiratory equipment and its limitations.
- Care and maintenance of firefighting equipment and hoses.
- First aid.

## 10. Equipment maintenance

Equipment maintenance schedule is proposed to be as follows for efficient and safe operations;

| Suggested maintenance schedule | | | |
|---|---|---|---|
| **S. No.** | **Incinerator Plant** | **Maintenance Area** | **Maintenance Frequency** |
| 1 | Iinside Of Furnace | Removing Of Ash | After Operatlon |

| Suggested maintenance schedule | | | |
|---|---|---|---|
| **S. No.** | **Incinerator Plant** | **Maintenance Area** | **Maintenance Frequency** |
| 2 | Inside Of Furnace | Cleaning Of Deposit | After Operatlon |
| 3 | Thermo-Couple | Cleaning Of Protect Cover | After Operatlon |
| 4 | Flame Eye | Cleaning Of Cover Glass | After Operatlon |
| 5 | Main Burner | Cleaning Of Atomizing Cup And Primary Air Nozzle | After Operatlon |
| 6 | Ignition Burner | Cleaning Of Nozzle And Electrodes | After Operatlon |
| 7 | Ignition Burner | Relocation Of Electrodes | Before Operation |
| 8 | Sludge Strainer | Cleaning Of Screen | After Operatlon |
| 9 | Diesel Oil Strainer | Cleaning Of Screen | Weekly |
| 10 | Main Burner | Filling Up Of Lubricant | Weekly |
| 11 | Main Burner And Exhaust Fan | Adjustment Of Tension Of Driving Belt | Monthly |
| 12 | Main Burner And Exhaust Fan | Replacement Of Lubricant | Quarterly |
| 13 | Inside Of Furnace | Mending Of Refractory | Quarterly |
| 14 | Every Parts | Ensure And Tighten Screws And Threads | Quarterly |
| 15 | Air Cylinder | Cleaning Of Spindle | Biannually |
| 16 | Panels And Sensors | Cleaning Of Contactors Of Switch-Gear | Biannually |
| 17 | Main Burner And Sludge Pump | Overhaul | Biannually |
| 18 | Solenoid Valves | Overhaul | Biannually |
| 19 | Ignition Burner And D. O. Pump | Overhaul | Biannually |
| 20 | Exhaust Fan | Overhaul | Biannually |
| 21 | Duct And Pipings | Cleaning Of Inside | Annually |

| Table 7.1: Mitigation Matrix for Proposed Incinerator Project | | | |
|---|---|---|---|
| **S. No.** | **Affected Areas** | **Mitigation Measures** | **Responsibility** |
| **Construction Phase** | | | |
| **1.** | Employment Opportunities and workforce | • Unskilled labor should be preferred from the neighborhood to avoid community issues.<br>• Project management should be careful about hiring the construction staff and must consider workers' behavioral aspects. | Contractor |
| **2.** | Soil Erosion | • The contractor must minimize the area of exposed soil at any given time and to wet, compact and resurface the disturbed areas during the construction phase.<br>• Removal topsoil with vegetation in it (rather than cutting off the vegetation) so that the vegetation helps to hold and enrich the soil.<br>• Exposed surface will be regularly wetted to effectively keep airborne dust levels to minimum<br>• Stockpiles of fine material will be wetted or covered with tarpaulin especially during windy conditions until concreting and landscaping is complete. | Contractor |
| **3.** | Soil Contamination | • Washing of vehicles will be carried out in the designated areas.<br>• Vehicles and equipment maintenance will be taken place at specified site.<br>• Construction vehicles and machinery will be examined on a regular basis for leakage prevention.<br>• Removal of oil and contaminated soil around the fuel and oil storage areas will be made possible by the availability of appropriate implements i.e. shovels, plastic bags and absorbent materials.<br>• Contaminated medium will be managed with the objective of protecting the safety and health of laborer at the site, the surrounding residents, and the environment.<br>• Plans and procedures will be prepared, to respond to the discovery of contaminated media to minimize or reduce the risk to health, safety, and the environment. | Contractor |
| **4.** | Construction Waste | • A comprehensive waste disposal plan to be developed to effectively manage these wastes in signigificant quantities.<br>• The construction waste which will be sent for recycling like damage pipes left over steel, wooden and plastic pieces. While, the rest of the left-over waste will then be taken away to the approved dumping sites for disposal. | Contractor |

| Table 7.1: Mitigation Matrix for Proposed Incinerator Project | | | |
|---|---|---|---|
| **S. No.** | **Affected Areas** | **Mitigation Measures** | **Responsibility** |
| | | • The construction material will be kept in a covered place, especially during the precipitation season.<br>• The excavated soil will be re-used by adopting different methods, which will be used as a filling material for the construction.<br>• Various waste containers for different types of waste will be deployed, in order to dispose/recycle the waste in accordance with its nature.<br>• The waste bins will be properly marked for each type of waste produced during the constructional activities.<br>• Use of building materials that have minimal packaging to avoid the generation of excessive packaging waste.<br>• Use of durable, long-lasting materials that will not need to be replaced as often, thereby reducing the amount of construction waste generated. | |
| **5.** | Impact on Water Quality, Consumption | • Construction of storm water diversion channels to divert storm runoff from flowing over the construction areas.<br>• Regular monitoring of water consumption.<br>• Use of leak proof storage tanks. | Contractor |
| **6.** | Dust/ Particulate Matter | • Sprinkling of water to suppress dust at predetermined frequency. It can considerably reduce dust emissions.<br>• Allocate specific timings during normal daytime working hours for movement of heavy earth moving equipment.<br>• Develop schedule for movement of dump trucks that will be initially used for hauling or excavation soil.<br>• Use of proper roads for transportation means during construction work.<br>• Stockpiles of fine material should be wetted or covered with tarpaulin especially during windy weather conditions.<br>• Site workers and drivers should wear dust mask and safety goggles especially during dry and windy weather conditions to avoid injuries and health risk due to dust. | Contractor |

| Table 7.1: Mitigation Matrix for Proposed Incinerator Project | | | |
|---|---|---|---|
| **S. No.** | **Affected Areas** | **Mitigation Measures** | **Responsibility** |
| | | • Good housekeeping practices will also reduce dust emission. | |
| **7.** | Exhaust Emission | • Where possible, use of new diesel generators may reduce the emissions.<br>• Generators shall be kept away from walking areas and at safe place where the probability of human intervention are very limited.<br>• Generators should be properly tuned, serviced and monitored on regular basis.<br>• Ensure that the vent of the generator exhaust is at adequate height.<br>• Low Sulphur Fuel should be utilized for generators. | Contractor |
| **8.** | Wastewater Generation | • Washing of vehicles and construction machinery will be restricted to a designated area.<br>• Wastewater will not be disposed of directly into the water bodies, but first be treated through Septic Tank and then the will be disposed of in a proper manner.<br>• The oily waste, if any, will be contained before disposing the wastewater into the sewer.<br>• Monitoring of the wastewater generation will be taken into consideration.<br>• Adequate portable or permanent sanitation facilities serving all workers will be provided at all construction sites. | Contractor |
| **9.** | Noise | • The activities associated with greatest potential to generate noise will preferably be planned during the day period.<br>• Noise control devices will be used such as temporary noise barriers and deflectors for impact activities.<br>• Truck drivers will be sensitized to switch off vehicle engines while offloading material, when practicable.<br>• Construction machinery will be kept in good condition to reduce noise generation.<br>• Generators and heavy-duty equipment should be installed and placed in enclosures to minimize ambient noise levels.<br>• Generator and other noisy equipment will be regularly monitored.<br>• Minimize night time activities as practically possible. | Contractor |

| Table 7.1: Mitigation Matrix for Proposed Incinerator Project | | | |
|---|---|---|---|
| **S. No.** | **Affected Areas** | **Mitigation Measures** | **Responsibility** |
| | | • Site labor working in high noise area such as where noise level exceeds 90 dB (A), should wear earplugs/earmuffs. | |
| **10.** | Flora | • Cutting of trees will be avoided.<br>• The vegetation which if gets chopped down during the construction of the project will be replanted. | Contractor |
| **11.** | Traffic Flow | • The proponent will put in place measures to address such concerns by ensuring that construction vehicles preferably deliver materials during off-peak hours when traffic volume is low.<br>• There will also be provision for caution signs on the access road to alert users on construction activities in progress in order to prevent occurrence of accidents.<br>• Impacts from the traffic flow will be minimized through proper planning of the transportation of materials to ensure that vehicle fills are increased, in order, to reduce the number of trips done or the number of vehicles on the road.<br>• Truck drivers will be sensitized to avoid unnecessary racing of vehicle engines at loading/offloading areas and to switch off or keep vehicle engines at construction site. | Contractor |
| **12.** | Occupational Health & Safety Issues | • Workers will be trained with lifting and materials handling techniques before the construction of the project, including the placement of weight limits above which mechanical assists or two person lifts are necessary.<br>• Work site layout will be planned to minimize the need for manual transfer of heavy loads.<br>• Tools will be selected and work stations would be designed to reduce force requirements and holding times, which promote improved postures, including, where applicable, user adjustable work stations.<br>• Administrative controls, such as job rotations and rest or stretch breaks will be implemented into the work processes. | Contractor |
| **Operational Phase** | | | |
| **1.** | Air Emissions and Ambient Air Quality | • Waste segregation and/or presorting to avoid incineration of wastes that contain metals and metalloids that may volatilize during combustion and be difficult to control through air emission technology (e.g., mercury and arsenic); | Proponent |

| Table 7.1: Mitigation Matrix for Proposed Incinerator Project | | | |
|---|---|---|---|
| **S. No.** | **Affected Areas** | **Mitigation Measures** | **Responsibility** |
| | | • Removal of the following items from waste destined for incineration: halogenated plastics (e.g. PVC), pressurized gas containers, large amounts of active chemical waste, silver salts and photographic / radiographic waste, waste with high heavy metal content (e.g. broken thermometers, batteries), and sealed ampoules or ampoules containing heavy metals;<br>• Follow applicable national requirements and internationally recognized standards for incinerator design and operating conditions.<br>• Introduce wastes into the incinerator only after the optimum temperature is reached in the final combustion chamber.<br>• Minimize the uncontrolled ingress of air into the combustion chamber via waste loading or other routes;<br>• Optimize furnace geometry, combustion air injection, and, if used, NOx control devices using flow modeling;<br>• The pollution control equipments should be regularly checked and maintained to ensure their efficiency.<br>• Use flue gas treatment system for control of acid gases, particulate matter, and other air pollutants;<br>• Minimize formation of dioxins and furans by ensuring that particulate control systems do not operate in the 200 to 400 degrees Celsius temperature range; identifying and controlling incoming waste composition; using primary (combustion-related) controls; using designs and operation conditions that limit the formation of dioxins, furans, and their precursors; and using flue gas controls;<br>• The flue gases from the primary chamber would be combusted completely in the secondary chamber which is further heated up to more than 1100 ˚C by firing additional auxiliary fuel or high calorific value liquid incinerable waste. The secondary chamber and the ducting would be designed in such way as to have minimum of 2 seconds residence time in order to ensure complete combustion. The refractory in secondary chamber will be capable of withstanding around 1400 ˚C.<br>• Stack height must be kept high enough to disperse the gas effectively and should be as per suggestions of Air Dispersion modeling.<br>• Regular maintenance and tuning of the incinerator and generators will be carried out. | |

| Table 7.1: Mitigation Matrix for Proposed Incinerator Project | | | |
|---|---|---|---|
| **S. No.** | **Affected Areas** | **Mitigation Measures** | **Responsibility** |
| | | • For control of VOCs, Dioxins and Furans flue gas should be passed through secondary combustion chamber where these pollutants are burned and destroyed at temperatures between 700º C to 1,300ºC.<br>• Staff operating the refractory lined dual chamber type incinerator would be required to wear proper PPE.<br>• Staff operating the incinerator should be trained to operate the facility in accordance with the SOPs and EIA study requirements.<br>• In the incinerator; materials to be burnt would be limited to those proposed in incineration manual;<br>• Incinerator operations guide (including bypass operations) should be developed and maintained.<br>• All the records of waste processing should be kept and maintained on daily basis. | |
| **2.** | Noise | • Equipment including standby generators will be managed and maintained regularly.<br>• Truck drivers to be advised for turning off the engines when vehicle is in idle state.<br>• Truck drivers to be restricted to procedures for proper maintenance of vehicles.<br>• Steps will be taken to reduce the noise at the source level.<br>• Provision of earmuffs to the workers and enforcement to its use by the workers will be ensured. | Proponent |
| **3.** | Soil Contamination | • Spills will be cleaned and removed from the site and will be restored back to its original conditions;<br>• Oils, lubricants, chemicals, and others hazardous materials should be placed safely at designated spots and away from any potential source of fire;<br>• Ash from incineration operations will be disposed in approved dump sites; | Proponent |
| **4.** | Waste Water | • Wastewater discharged to industrial drain must comply with SEQS limits.<br>• Regular monitoring of wastewater to ensure compliance of SEQS. | Proponent |
| **5.** | Transporting, Storage and Handling of Incinerable Hazardous Wastes | • Labeling on packaging is readily visible and material used for packaging shall withstand physical and climatic conditions.<br>• Upon collection from waste generation site or on receiving of the waste at facility the labeling and packing of waste shall be inspected and inventory of waste received and incinerated must be maintained. | Proponent |

| Table 7.1: Mitigation Matrix for Proposed Incinerator Project | | | |
|---|---|---|---|
| **S. No.** | **Affected Areas** | **Mitigation Measures** | **Responsibility** |
| | | • All hazardous waste shall be handled, transported and stored as per Hazardous Substance Rules, 2014 and Sindh Hospital Waste Management Rules, 2014.<br>• The transport vehicles shall be designed suitably to handle and transport the hazardous wastes of various characteristics.<br>• Transporting the wastes in closed containers at all times delivering the wastes at designated points.<br>• Informing regulatory authorities immediately in case of spillage, leakage or other accidents during transportation.<br>• Solid waste storage facilities will be properly lined with impervious material. | |
| **6.** | Odor Management | • Waste combustion facility will be designed to draw air from the waste receiving and storage areas to be used to provide oxygen to the combustion process. This should create a negative air pressure in these waste handling areas and prevent the escape of odor causing pollutants to outside surrounding areas. If odors are being emitted, the air pressure should be able to be controlled by closing unused openings to the outside.<br>• Ventilated areas to be provided for onsite temporary storage of waste.<br>• Any leakages should be checked and fixed.<br>• Suitable masks should be provided to the workers. Good housekeeping shall be ensured. | Proponent |
| **7.** | Impacts due to Waste Disposal | • Site specific waste management plan should be developed.<br>• Incinerator Ash and sludge from the scrubber will be collected and stored at covered designated area and will be sent for recycling and/or adequate disposal at regular intervals. | Proponent |
| **8.** | Fire Hazard | • There should be clear and visible labeling on ignitable wastes (if any).<br>• Firefighting equipment such as fire extinguishers and hydrant systems will be maintained at strategic locations within the premises.<br>• Regular inspection and servicing of the extinguishers will be undertaken by a reputable service provider and record of such inspections should be maintained.<br>• Firefighting training and drills should be conducted on regular basis. | Proponent |

| Table 7.1: Mitigation Matrix for Proposed Incinerator Project | | | |
|---|---|---|---|
| **S. No.** | **Affected Areas** | **Mitigation Measures** | **Responsibility** |
| | | • The facility will possess a detailed emergency and evacuation plan that will be regularly drilled to make sure that the responsible staff remains trained at all times.<br>• Proper grounding to avoid static electricity build up and lightning hazards (including formal procedures for the use and maintenance of grounding connections) | |
| **9.** | Natural Disaster (Earthquake) | • In order to avoid the disastrous situation due to earthquake, it is anticipated that management of proposed project will consider the zoning requirement for building and machinery erection. It is desired that all project structures should be constructed keeping in view the structural and material requirements of Zone 2B projects. | Proponent |
| **10.** | Occupational Health and Safety | • Health and safety Management Plan should be implemented and workers training related to health and safety and waste management should be provided on regular basis.<br>• Hazardous materials management plan should be incorporated into and be consistent with facility operations. Written standard operating procedures should be made available.<br>• Health and safety risks associated with onsite processes would be addressed in procedures developed to guide the safe handling of materials and waste.<br>• Provide workers with appropriate protective clothing, gloves, respiratory face masks and slip-resistant shoes for waste transport workers and hard-soled safety shoes for all workers to avoid puncture wounds to the feet. For workers near loud equipment, include noise protection. For workers near heavy mobile equipment, buckets, cranes, and at the discharge location for collection trucks, include provision of hard hats;<br>• Control and characterize incoming waste.<br>• Provide adequate personnel facilities, including washing areas and areas to change clothes before and after work; | Proponent |

## 7.11 Environmental Monitoring Plan

Monitoring of activities during the construction and operation phase will be necessary to assess the impacts of these activities on the environment. For this purpose, the proponent will engage an Independent Monitoring Consultant (IMC) for implementing a monitoring program to:

- Monitor the:
  - Air Emissions
  - Wastewater
  - Solid waste management
  - Occupational health and safety
- Follow the monitoring frequency of selected parameters as per the monitoring plan given in the Tables below
- Record all non-conformities observed and report them along with actions to Project Management for further action.
- Report any impact anticipated along with recommendations for further action.

The Contractor shall take note of the recommendations relating to issues identified in the construction monitoring report. Similarly, the proponent will consider the issues identified by IMC for the operation phase monitoring. Table 7.2 & 7.3 presents a proposed monitoring plan to monitor different environmental Aspects during the Construction and Operations Phases of the Project. This monitoring plan can also be improved by the proponent if found necessary to improve the usefulness of the Plan.

| Table 7.2: Environmental Monitoring Plan (Construction Phase) | | | | |
|---|---|---|---|---|
| **Environmental Concern** | **Parameters to be Monitored** | **Monitoring Location** | **Frequency** | **Responsibility** |
| Ambient air quality | Ambient air quality parameters as per SEQS | Construction site | Quarterly | - Contractor<br>- IMC |
| Exhaust emissions from generators and other construction equipment | Gaseous emission includes COx, NOx, SOx and PM from generators and other equipment | selected equipment at construction site | Quarterly | - Contractor<br>- IMC |
| Vehicular emissions | Vehicular emissions include Smoke, CO and Noise from vehicle exhaust vent. | selected vehicles at construction site | Quarterly | - Contractor<br>- IMC |
| Noise level | Noise level Leq dB(A) monitoring | Construction site as well as the generators, equipment and vehicles. | Quarterly | - Contractor<br>- IMC |
| Soil Erosion | Visual inspections and photographic evidences | Construction site and its immediate surroundings | periodically | - Contractor<br>- IMC |
| Solid Waste Management | Record and logging of daily generated waste. Hazardous and non-hazardous waste quantity | Construction site | periodically | - Contractor<br>- IMC |
| Occupational Health and Safety | EHS compliance | Construction site | periodically | - Contractor<br>- IMC |

| Table 7.3: Environmental Monitoring Plan (Operational Phase) | | | | |
|---|---|---|---|---|
| **Environmental Concern** | **Parameters to be Monitored** | **Monitoring Location** | **Frequency** | **Responsibility** |
| **Operational Phase** | | | | |
| Ambient Air Quality | Ambient air quality parameters as per SEQS | Approx.5 m away from the incinerator stack | Monthly | - Proponent |
| Exhaust emissions | For backup Generators: CO, NOx, SOx, PM,<br>For incinerator stack: CO, NOx, SOx, PM | Exhaust at operational site<br>Generators<br>Equipment etc. | Monthly | - Proponent |
| Wastewater | Priority paremeters for wastewater as per SEQS | Waste discharge point | Monthly | - Proponent |
| Noise level | Noise level Leq dB(A) monitoring | Incinerator room and waste areas | Monthly | - Proponent |
| Waste Management | - Records of waste received and waste incinerated<br>- Ash storage and Disposal<br>- Sludge disposal | waste areas inside the facility | Monthly | - Proponent |

| Table 7.4: EMP Implementation Cost | | |
|---|---|---|
| **Activity** | **Cost (Rupees PKR)** | **Remarks** |
| Training Program | 200, 000 | refer section 7.10.8 |
| Environmental Monitoring | | |
| Ambient Air (Construction) | (40,000*1*4) = 160,000 | Cost for monitoring at 01 location @Rs.40, 000/per location. |
| Ambient Air (Operation) | (40,000 * 1*12) = 480,000 | Cost for 1-year monitoring at 1 location @Rs.40,000/per location |
| Wastewater (Operation) | (50,000 * 12) = 600,000 | Cost for 1-year monitoring at 1 location @Rs.50,000/location |
| Noise Levels (Construction) | (1,000 * 4 * 4) = 16,000 | Cost for 1-year monitoring at 04 locations @Rs.1,000/location |
| Noise Levels (Operation) | (1,000 * 4 * 4) = 16,000 | Cost for 1-year monitoring at 04 location @Rs.1,000/location |
| Solid Waste (Construction/Operation) | (10,000*12) = 120,000 | Estimated cost for 1 year@Rs.10,000/month |
| Gaseous Emissions (Construction) | (1,500 * 2 * 6 * 4) = 72,000 | Cost for 1-year monitoring at 1 location for 06 parameters @Rs.1,500/parameter |
| Gaseous Emissions (Operation) | (1,500 * 2 * 6 * 12) = 216,000 | Cost for 1-year monitoring at 2 locations for 06 parameters @Rs.1,500/parameter |
| Mitigation Measures (Construction) | 300,000 | Initial estimates |
| Mitigation Measures (Operation) | 500,000 | Initial estimates |
| Reporting | 200,000 | Initial estimates |
| Sub-total | 2,880,000 | - |
| Contingencies (5% of EMP cost) | 144,000 | - |
| **Grand Total** | **3,024,000** | - |

# Chapter 8 CONCLUSION

The EIA study for proposed Incinerator Plant has identified potential impacts that are likely to arise during construction and operational phases of the project. Potential environmental impacts are associated with air quality, solid waste, Wastewater, water quality, soil quality, terrestrial ecology, health and safety, as well as socio-economic impacts. The project is expected to bring a positive change in the socioeconomic setup of the area through short to medium term employment creation and providing a suitable waste disposal option for the city.

Potential Project impacts have been identified related to the project construction and operation phases. Impact predictions are based on the consultants' previous experiences on similar projects; professional judgment; data collected in the field; discussions with local communities, relevant government officials and relevant technical specialists. Many of the mitigation measures are related to good design practices, others with good construction and housekeeping practices.

A series of mitigation and monitoring measures have been included to address the concerns for these measures. Assuming effective implementation of the mitigation measures and monitoring requirements as outlined in the Environmental Management Plan, the adverse environmental and social impacts of the proposed Project are envisaged to be within the acceptable limits.

The implementation of the mitigation measures detailed in Environmental Impact Assessment report and listed in the Environmental Management Plan (EMP) of the EIA Report, including monitoring, will provide a basis for ensuring that the potential positive and negative impacts associated with the establishment of the development are enhanced and mitigated to a level which is deemed adequate for the development to proceed.

In summary, based on the findings of this assessment there is no reason why the facility proposed for the site should not be authorized, contingent on the mitigations and monitoring for potential environmental and socio-economic impacts as outlined in the EIA and EMP being implemented.

# ANNEXURES

# Annexure – I:
# Sindh Environmental Protection Act, 2014

**EXTRAORDINARY** **Registered No. M324**

# The Sindh Government Gazette

**Published by Authority**

**KARACHI THURSDAY MARCH 20, 2014**

## PART-IV

**PROVINCIAL ASSEMBLY OF SINDH**
**NOTIFICATION**
**KARACHI, THE 20TH MARCH, 2014.**

**NO.PAS/Legis-B-06/2014-** The Sindh Environmental Protection Bill, 2014 having been passed by the Provincial Assembly of Sindh on 24th February, 2014 and assented to by the Governor of Sindh on 19th March, 2014 is hereby published as an Act of the Legislature of Sindh.

### THE SINDH ENVIRONMENTAL PROTECTION ACT, 2014.

**SINDH ACT NO. VIII OF 2014.**

**AN**
**ACT**

to provide for the protection, conservation, rehabilitation and improvement of the environment, for the prevention and control of pollution, and promotion of sustainable development.

**WHEREAS** it is expedient to provide for the protection, conservation, rehabilitation and improvement of the environment, prevention and control of pollution, promotion of sustainable development, and for matters connected therewith and incidental thereto; **Preamble.**

**PART-I**

It is hereby enacted as follows:-

1. (1) This Act may be called the Sindh Environmental Protection Act, 2014. **Short title and commencement.**

(2) It extends to the whole of the Province of Sindh.
(3) It shall come into force at once.

Definitions.

2. In this Act, unless there is anything repugnant in the subject or context-

(i) "adverse environmental effect" means impairment of, or damage to, the environment and includes—

(a) impairment of, or damage to, human health and safety or to biodiversity or property;

(b) pollution; and

(c) any adverse environmental effect as may be specified in the rules or regulations made under this Act;

(ii) "Agency" means the Sindh Environmental Protection Agency established under section 5 of this Act;

(iii) "agricultural waste" means waste from farm and agricultural activities including poultry, cattle farming, animal husbandry residues from the use of fertilizers, pesticides and other farm chemicals and agricultural runoff;

(iv) "air pollutant" means any substance that causes pollution of air and includes soot, smoke, dust particles, odor, light, electro-magnetic radiation, heat, fumes, combustion exhaust, exhaust gases, noxious gases, hazardous substances and radioactive substances;

(v) "biodiversity" or "biological diversity" means the variability among living organisms from all sources, including inter-alia terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems;

(vi) "biosafety" means the mechanism developing through policy and procedure to ensure human health and the environmentally safe application of biotechnology;

(vii) "Council" means the Sindh Environmental Protection Council established under section 3 of this Act;

(viii) "discharge" means spilling, leaking, pumping, depositing, seeping, releasing, flowing-out, pouring, emitting, emptying or dumping into the land, water or atmosphere;

(ix) "ecosystem" means a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit;

(x) "effluent" means any material in solid, liquid or gaseous form or combination thereof being discharged from industrial activity or any other source and includes a slurry, suspension or vapour;

(xi) "emission standards" means the permissible standards established by the Agency for emission of air pollutants and noise and for discharge of effluent and waste;

(xii) "environment" means-
(a) air, water, land and natural resources;
(b) all layers of the atmosphere;
(c) all organic and inorganic matters and living organisms;
(d) ecosystems and ecological relationships;
(e) buildings, structures, roads, facilities and works;
(f) all social and economic conditions affecting community life; and
(g) the inter-relationship between any of the factors in sub-clause (a) to (f) made under this Act;

(xiii) "environmental aspect" means an organization's activities or services that can interact with the environment;

(xiv) "environment audit" means a systemic scrutiny of environmental performance of an organization, factory, company or manufacturing and production unit regarding to its operations;

(xv) "environmental impact assessment" means an environmental study comprising collection of data, prediction of qualitative and quantitative impacts, comparison of alternatives, evaluation of preventive, mitigation and compensatory measures, formulation of environmental management and training plans and monitoring arrangements, and framing of recommendations and such other components as may be prescribed;

(xvi) "Environmental Management Plan" means a site specific plan developed to ensure that all necessary measures are identified and implemented in order to protect the environment and comply with the environmental legislation;

(xvii) "Environmental Protection Order" means an order passed under Section 21 made under this Act.

(xviii) "Environmental Protection Tribunal" means the Environmental Protection Tribunal constituted under section 25 of this Act ;

(xxix) "Environmental Review" means a quantitative and qualitative assessment of documents submitted by proponent, comments from public and Government agencies or organizations;

(xx) "factory" means any premises in which industrial activity is being undertaken;

(xxi) "genetically modified organism" means any organism that possesses a novel combination of genetic material obtained through the use of modern biotechnology and which does not occur naturally through mating and or recombination and includes both living and non-living modified organisms;

(xxii) "Government" means the Government of Sindh;

(xxiii) "Government Agency" includes:-

(a) A department, attached department or any other office of Government; and

(b) A development authority, local authority, company body corporate established or control by Government;

(xxiv) "Court" means the Court of the Judicial Magistrate First Class;

(xxv) "hazardous substance" means-

(a) a substance or mixture of substances, other than a pesticide as defined in the Agricultural Pesticides Ordinance, 1971 (II of 1971), which, by reason of its chemical activity or toxic, explosive, flammable, corrosive, radioactive or other characteristics, causes, or is likely to cause, directly or in combination with other matters an adverse environmental effect; and

(b) any substance which may be prescribed as a hazardous substance;

(xxvi) "hazardous waste" means waste which is or which contains a hazardous substance or which may be prescribed as hazardous waste, hospital waste, nuclear waste, obsolete pesticides and persistent organic pollutants;

(xxvii)"hospital waste" means waste medical supplies and materials of all kinds, and waste blood, tissue, organs and other parts of the human and animal bodies, from hospitals, clinics, laboratories and veterinary facilities;

(xxviii) "industrial activity" means any operation or process for manufacturing, making, formulating, synthesising, altering, repairing, ornamenting, finishing, packing or otherwise treating any article or substance with a view to its use, sale, transport, delivery or disposal, or for mining, for oil and gas exploration and development, or for pumping water or sewage, or for generating, transforming or transmitting power or for any other industrial or commercial purposes;

(xxix) "industrial waste" means waste resulting from an industrial activity;

(xxx) "initial environmental examination" means a preliminary environmental review of the reasonably foreseeable qualitative and quantitative impacts on the environment of a proposed project to determine whether it is likely to cause an adverse environmental effect for requiring preparation of an environmental impact assessment;

(xxxi) "local authority" means any agency set up or designated by Government, by notification in the official Gazette, to be a local authority for the purposes of this Act;

(xxxii) "local council" means a local council constituted or established under a law relating to local government;

(xxxiii) "motor vehicle" means any mechanically propelled vehicle adapted for use upon land whether its power of propulsion is transmitted thereto from an external or internal source, and includes a chassis to which a body has not been attached, and a trailer, but does not include a vehicle running upon fixed rails;

(xxxiv) "municipal waste" includes sewage, refuse, garbage, waste from abattoirs, sludge and human excreta and the like;

(xxxv) "noise" means the intensity, duration and character of sounds from all sources, and includes vibration;

(xxvi) "non degradable plastic products" means a plastic product which are made from the non-biodegradable substances;

(xxxvii) "nuclear waste" means waste from any nuclear reactor or nuclear plant or other nuclear energy system, whether or not such waste is radioactive;

(xxxviii) "Oxo-biodegradable Plastic Products" means a plastic product made of a polymer by adding a pro-degrading additive containing a transition metal salt, except cobalt, which cause the plastic to degrade and bio-grade from oxidative and cell mediated phenomena either simultaneously or successfully;

(xxxix) "person" means any natural person or legal entity and includes an individual, firm, association, partnership, society, group, company, corporation, co-operative society, Government Agency, non-governmental organization, community-based organization, village organization, local council or local authority and, in the case of a vessel, the master or other person having for the time being the charge or control of the vessel;

(xl) "pollution" means the contamination of air, land or water by the discharge or emission of effluent or wastes or air pollutants or noise or other matter which either directly or indirectly or in combination with other discharges or substances alters unfavorably the chemical, physical, biological, radiational, thermal or radiological or aesthetic properties of the air, land or water or which may, or is likely to make the air, land or water unclean, noxious or impure or injurious, disagreeable or detrimental to the health, safety, welfare or property of persons or harmful to biodiversity;

(xli) "prescribed" means prescribed by rules made under this Act;

(xlii) "project" means any activity, plan, scheme, proposal or undertaking involving any change in the environment and includes-

(a) construction or use of buildings or other works;

(b) construction or use of roads or other transport systems;

(c) construction or operation of factories or other installations;

(d) mineral prospecting, mining, quarrying, stone-crushing, drilling and the like;

(e) any change of land use or water use; and

(f) alteration, expansion, repair, decommissioning or abandonment of existing buildings or other works, roads or other transport systems, factories or other installations;

(xliii) "proponent" means the person who proposes or intends to undertake a project;

(xliv) "regulations" means regulations made under this Act;

(xlv) "rules" means rules made under this Act;

(xlvi) "sewage" means liquid or semi-solid wastes and sludge from sanitary conveniences, kitchens, laundries, washing and similar activities and from any sewerage system or sewage disposal works;

(xlvii) "Schedule Plastic Products" means all types of flexible plastic packaging and disposable plastic products made of Polythene, Polypropylene, Polystyrene and Poly-ethylene Terephthalate (PET), used for food and non-food items, like shopping bags, garbage bags, snacks packs, water and milk packaging, shrink wraps, bubble pellet wraps, films, liners, woven or non-woven bags, mulch films;

(xlviii) "Sindh Environmental Quality Standards" means standards established by the Agency under clause (e) of sub-section(1) of section 6 and approved by the Council under clause (c) of sub-section(1) of section 4 made under this Act;

(xlix) "standards" means qualitative and quantitative standards for discharge of effluent and wastes and for emission of air pollutants and noise either for general applicability or for a particular area, or from a particular production process, or for a particular product, and includes the Sindh Environmental Quality Standards, emission standards and other standards established under this Act and the rules and regulations;

(l) "strategic environmental assessment" mean an analysis of a proposed policy, legislation, plan or programme to determine whether the principles of sustainable development have been integrated therein and to identify its likely environmental effects and such components as require an initial environmental examination or environmental impact assessment;

(li) "sustainable development" means development that meets the needs of the present generation without compromising the ability of future generations to meet their needs;

(lii) "trans-boundary environmental impacts" means environmental impact arising from beyond the boundaries or limits of Sindh province and causing any adverse environmental impact or pollution in the air, land, water and coaster water of Sindh province;

(liii) "waste" means any substance or object which has been, is being or is intended to be, discarded or disposed-of, and includes liquid waste, solid waste, waste gases, suspended waste, industrial waste, agricultural waste, nuclear waste, municipal waste, hospital waste, used polyethylene bags and residues from the incineration of all types of waste.

(liv) "waters (coastal waters, internal waters, territorial waters and historical waters)" means such limits of the waters adjacent to the land territory as may be specified in the Territorial Waters and Maritime Zones Act, 1976 (LXXXII of 1976).

## PART-II
## THE SINDH ENVIRONMENTAL PROTECTION COUNCIL.

**Establishment of the Sindh Environmental Protection Council.**

3. (1) The Government of Sindh shall, by notification in the official Gazette, establish a Council to be known as the Sindh Environmental Protection Council consisting of-

| | | |
|---|---|---|
| (i) | Chief Minister or such other person as the Chief Minister may nominate in this behalf. | **Chairperson** |
| (ii) | Minister-in-charge of the Environment Protection Department. | **Vice Chairperson** |
| (iii) | Additional Chief Secretary, Planning and Development Department, Government of Sindh. | **Ex-officio Member** |
| (iv) | Secretaries of the Environment, Finance, Public Health Engineering, Irrigation, Health, Agriculture, Local Government, Industries, Live Stock and Fisheries, Forest and Wildlife, Energy, Education, Departments of Government of Sindh and the divisional commissioners of Sindh. | **Ex-officio Members** |

| | | |
|---|---|---|
| (v) | Such other persons not exceeding twenty- five as Government may appoint from representatives of the Chambers of Commerce and Industry and industrial associations, representatives of the Chambers of Agriculture, the medical and legal professions, trade unions, non-governmental organizations concerned with the environment and sustainable development, and scientists, technical experts and educationists. | **Non-official Members** |
| (vi) | Director General, Sindh Environment Protection Agency | Member / Secretary |
| **(vii)** | **Two Members of the Provincial Assembly of Sindh amongst the eleven Members of the Standing Committee on Environment nominated by the Speaker** | **Members** |

2) The Members of the Council, other than ex-officio members, shall be appointed in accordance with the prescribed procedure.

(3) A non-official member, unless he sooner resigns or is removed, shall hold office for a term of three years and shall be eligible for re-appointment but shall not hold office for more than two terms.

(4)The Council shall frame its own Rules of Procedure.

(5) The Council shall hold meetings, as and when necessary, but not less than two meetings, shall be held in a year.

(6) The Council may constitute committees of its members and entrust them with such functions as it may deem fit, and the recommendations of the committees shall be submitted to the Council for approval.

(7) The Council, or any of its committees, may invite any technical expert or representative of any Government Agency or non-governmental organization or other person possessing specialized knowledge of any subject for assistance in performance of its functions.

**Functions and Powers of the Council.**

4. (1) The Council shall-

(a) co-ordinate and supervise the enforcement of the provisions of this Act and other laws relating to the environment in the Province;

(b) approve comprehensive provincial environmental and sustainable development policies and ensure their implementation within the framework of a conservation strategy and sustainable development plan as may be approved by Government from time to time;

(c) approve the Sindh Environmental Quality Standards;

(d) provide guidelines for the protection and conservation of species, habitats, and biodiversity in general and for the conservation of renewable and non-renewable resources.

(e) coordinate integration of the principles and concerns of sustainable development into socio-economic and development policies, plans and programmes at the provincial, district and local levels;

(f) consider the annual Sindh Environment report and give appropriate directions thereon and cause it to be laid before the Provincial Assembly;

(g) deal with inter-provincial and federal-provincial issues, and liaise and coordinate with other Provinces through appropriate inter-provincial forums regarding formulation and implementation of standards and policies relating to environmental matters with an inter-provincial impact;

(h) provide guidelines for biosafety and for the use of genetically modified organisms; and

(i) assist the Federal Government or Federal Agency in implementation and or administration of various provision of United Nation Convention on Laws on Seas, 1980 (UNCLOS) in coastal waters of the province.

(2) The Council may, either itself or on the request of any person or organization, direct the Agency or any Government Agency to prepare, submit, promote or implement projects for the protection, conservation, rehabilitation and improvement of the environment, the prevention and control of pollution, and the sustainable development of resources or to undertake research in any specified aspect of environment.

## PART-III
## THE SINDH ENVIRONMENTAL PROTECTION AGENCY

**Establishment of the Sindh Environmental Protection Agency.**

5. (1) Government shall, by notification in the Official Gazette, establish the Sindh Environmental Protection Agency, to exercise the powers and perform the functions assigned to it under the provisions of this Act and the rules and regulations made thereunder.

(2) The Agency shall be headed by a Director General who shall be appointed by Government on such terms and conditions as it may determine.

(3) The Agency shall have such administrative, technical and legal staff as Government may specify, to be appointed in accordance with such procedure as may be prescribed.

(4) The powers and functions of the Agency shall be exercised and performed by the Director General.

(5) The Director General may, by general or special order, delegate any of these powers and functions to staff appointed under sub-section (3).

(6) For assisting the Agency in the discharge of its functions Government shall establish Advisory Committees for various sectors and appoint as members thereof eminent representatives of the relevant sector, educational institutions, research institutes and non-governmental organizations.

**Functions of the Agency.**

6. (1) The Agency shall –

(a) administer and implement the provisions of this Act and the rules and regulations;

(b) prepare, in co-ordination with the appropriate Government Agency or local council and, in consultation with the concerned Advisory Committees where established, environmental policies for the approval of the Council;

(c) take all necessary measures for the implementation of the environmental policies approved by the Council;

(d) prepare and publish an annual Sindh Environment Report on the state of the environment in the province;

(e) prepare or revise and establish the Sindh Environmental Quality Standards with approval of the Council:

Provided that before seeking approval of the Council, the Agency shall publish the proposed Sindh Environmental Quality Standards for public opinion in accordance with the prescribed procedure;

(f) ensure enforcement of the Sindh Environmental Quality Standards;

(g)where the quality of ambient air, water, land or noise so requires, the Agency may, by notification in the Official Gazette establish different standards for discharge or emission from different sources and for different areas and conditions as may be necessary:

Provided that where these standards are less stringent than the Sindh Environmental Quality Standards; prior approval of the Council shall be obtained;

(h) establish systems and procedures for surveys, surveillance, monitoring, measurement, examination, investigation, research, inspection and audit to prevent and control pollution, and to estimate the costs of cleaning up pollution and rehabilitating the environment in various sectors;

(i) take measures to promote research and the development of science and technology which may contribute to the prevention of pollution, protection of the environment, and sustainable development;

(j) issue licences, approval for the consignment, handling, transport, treatment, disposal of, storage, handling or otherwise dealing with hazardous substances;

(k) certify laboratories as approved laboratories for conducting tests and analysis and one or more research institutes as environmental research institutes for conducting research and investigation for the purposes of this Act;

(l) identify the needs for and initiate legislation in various sectors of the environment;

(m) provide assistance to relevant Federal and Provincial Government Agencies in the management of environment accidents and natural and environmental disasters, including conduct of inquiry thereto;

(n) render advice and assistance in environmental matters including such information and data available with it as may be required for carrying out the purposes of this Act:

Provided that the disclosure of such information shall be subject to the restrictions specified in Part XI (Access to Information);

(o) assist Government Agencies, local councils, local authorities and other persons to implement schemes for the proper disposal of wastes so as to ensure compliance with the Sindh Environmental Quality Standards;

(p) provide information and guidance to the public on environmental matters;

(q) recommend environmental courses, topics, literature and books for incorporation in the curricula and syllabi of educational institutions;

(r) promote public education and awareness of environmental issues through mass media and other means including seminars and workshops;

(s) establish and maintain mechanisms, including its own website, to disseminate information, subject to the provisions of this Act, regarding policies, plans and decisions of the Government, the Council and the Agency, relating to the environment;

(t) specify safeguards for the prevention of accidents and disasters which may cause pollution, collaborate with the concerned persons in the preparation of contingency plans for control of such accidents and disasters, and co-ordinate implementation of such plans;

(u) review and approve mitigation plans and give guidance and directions, where necessary, relating to clean up operations ordered under this Act;

(v) encourage the formation and working of non-governmental organizations, community organizations and village organizations to prevent and control pollution and promote sustainable development;

(w) take or cause to be taken all necessary measures for the protection, conservation, rehabilitation and improvement of the environment, prevention and control of pollution and promotion of sustainable development; and

(x) perform any function that the Council may assign to it.

(2) The Agency may -

(a) undertake inquiries or investigation into environmental issues, either of its own accord or upon complaint from any person or organization;

(b) request any person to furnish any information or data relevant to its functions;

(c) initiate, with the approval of Government, requests for foreign assistance in support of the purposes of this Act and enter into arrangements with foreign agencies or organizations for the exchange of material or information and participate in international seminars or meetings;

(d) recommend to Government and the Council the adoption of financial and fiscal programmes, schemes or measures for achieving environmental objectives and goals and the purposes of this Act, including -

(i) taxes, duties, cesses and other levies; and

(ii) incentives, prizes, awards, rewards, subsidies, tax exemptions, rebates and depreciation allowances;

(e) establish and maintain laboratories to help in the performance of its functions under this Act and to conduct research in various aspects of the environment and provide or arrange necessary assistance for the establishment of similar laboratories in the private sector;

(f) arrange, in accordance with such procedure as may be prescribed, financial assistance for projects designed to facilitate in discharge of its functions; and

(g) acquire assistance of concerned authorities of district administration and other relevant agencies, departments and police assistance for enforcement of this Act.

**Powers of the Agency.**

7. Subject to the provisions of this Act, the Agency may-

(a) lease, purchase, acquire, own, hold, improve, use or otherwise deal in and with any property both moveable and immovable;

(b) sell, convey, mortgage, pledge, exchange or otherwise dispose of its property and assets;

(c) fix and realize fees, rates and charges for rendering any service or providing any facility, information or data under this Act or its rules and regulations;

(d) enter into contracts, execute instruments, incur liabilities and do all acts or things necessary for proper management and conduct of its business;

(e) appoint, with the approval of Government and in accordance with such procedures as may be prescribed, such advisers, experts and consultants as it considers necessary for the efficient performance of its functions on such terms and conditions as it may deem fit;

(f) summon and enforce the attendance of any person and require him to supply any information or document needed for the conduct of any enquiry or investigation into any environmental issue;

(g) Director General may authorize any officer or official to enter and inspect or under a search warrant issued by Environmental Protection Tribunal or a Court, search at any time, any land, building, premises, vehicle or vessel or other place where or in which there are reasonable grounds to believe that an offence under this Act has been, or is being, or likely to be committed;

(h) take samples of any materials, products, articles or substances or of the effluent, wastes or air pollutants being discharged or emitted or of air, water or land in the vicinity of the discharge or emission;

(i) arrange for the testing and analysis of samples at a certified laboratory;

(j) confiscate any article used in the commission of the offence where the offender is not known or cannot be found within a reasonable time:

Provided that the powers under clauses (f), (g), (h) (i), and (j) shall be exercised in accordance with the provisions of the Code of Criminal Procedure, 1898 (Act V of 1898) or the rules and regulations and under the direction of the Environmental Protection Tribunal or a Court; and

(k) establish the Sindh Environmental Co-ordination Committee comprising the Director-General as its Chairman and such other persons as Government shall appoint as its members to exercise such powers and perform such functions as shall be delegated or assigned to it by Government for carrying out the purposes of this Act and for ensuring coordination among Government Agencies in implementation of environmental policies.

## PART-IV
## SINDH SUSTAINABLE DEVELOPMENT FUND

**Establishment of the Sindh Sustainable Development Fund.**

**8.** (1) There shall be established a Sindh Sustainable Development Fund.

(2) The Sindh Sustainable Development Fund shall be derived from the following sources, namely—

(a) allocations and grants made or loans advanced by the Government of Sindh or by the Federal Government;

(b) aid and assistance, grants, advances, donations and other non-obligatory funds received from foreign governments, national or international agencies, and non-governmental organizations; and

(c) voluntary contributions from private, corporate, multinational organizations and other persons.

(d) Any fees generated under the provision of this act including the fines imposed against contraventions including penalties.

(3)The Sindh Sustainable Development Fund shall be utilized, in accordance with such procedures as may be prescribed for -

(a) providing financial assistance to projects designed for the protection, conservation, rehabilitation and improvement of the environment, the prevention and control of pollution, the sustainable development of resources and for research in any specified aspect of the environment; and

(b) any other purposes which, in the opinion of the Board, will help achieve environment objectives and the purposes of this Act.

**Management of the Sindh Sustainable Development Fund.**

9. (1)The Sindh Sustainable Development Fund shall be managed by a Board known as the Provincial Sustainable Development Fund Board consisting of—

| | | |
|---|---|---|
| (i) | Additional Chief Secretary, Planning and Development Department, Government of Sindh, | **Chairperson** |
| (ii) | Such officers of Government, not exceeding five (05), as Government may appoint including Secretaries of the Environment, Finance, Industries and Local Government Departments, Government of Sindh. | **Ex-officio Members** |
| (iii) | Such non-official persons, not exceeding five(05), as Government may appoint, including representatives of the Chambers of Commerce and Industry, non-governmental organizations and major donors. | **Non-official Members** |
| (iv) | Director General, Sindh Environmental Protection Agency. | **Secretary/ Member** |

(2) The members of the Board, other than ex-officio members, shall be appointed in accordance with the prescribed procedure.

(3) A non-official member of the Board, unless he sooner resigns or is removed, shall hold office for a term of three years and shall be eligible for re-nomination, but shall not hold office for more than two terms.

(4) The Board shall frame its own rules of procedure with the approval of Government.

(5) In accordance with such procedures and such criteria as may be prescribed, the Board shall have the power to —

(a) sanction financial assistance for eligible projects;

(b) invest moneys held in the Sindh Sustainable Development Fund in such profit-bearing Government bonds, saving schemes and securities as it may deem suitable; and

(c) take such measures and exercise such powers as may be necessary for utilization of the Sindh Sustainable Development Fund for the purposes specified in sub-section (3) of section 8.

(6) The Board shall constitute committees of its members to undertake regular monitoring of projects financed from the Sindh Sustainable Development Fund and to submit progress reports to the Board which shall publish an Annual Report incorporating its annual audited accounts and performance evaluation based on the progress reports.

**Accounts.**

**10.** (1) The Agency shall maintain proper accounts of the Sindh Sustainable Development Fund and other relevant records and prepare annual statement of accounts in such form as may be prescribed.

(2) The accounts of the Sindh Sustainable Development Fund shall be audited annually by the Auditor General of Pakistan.

## PART-V
## PROHIBITIONS AND ENFORCEMENT

**Prohibition of certain discharges or emissions and compliance with standards.**

**11.** (1) Subject to the provisions of this Act and the rules and regulations, no person shall discharge or emit or allow the discharge or emission of any effluent, waste, pollutant, noise or any other matter that may cause or likely to cause pollution or adverse environmental effects, as defined in section 2 of this Act, in an amount, concentration or level which is in excess to that specified in Sindh Environmental Quality Standards; or, where applicable, the standards established under Section 6(1)(g)(i); or direction issued under Section 17, 19, 20 and 21 of this Act; or any other direction issued, in general or particular, by the Agency.

(2) All persons, in industrial or commercial or other operations, shall ensure compliance with the Environmental Quality Standards for ambient air, drinking water, noise or any other Standards established under section 6(1)(g)(i); shall maintain monitoring records for such compliances; shall make available these records to the authorized person for inspection; and shall report or communicate the record to the Agency as required under any directions issued, notified or required under any rules and regulations.

(3) Monitoring and analysis under sub-section (1) and (2), shall be acceptable only when carried out by the Environmental Laboratory certified by the Agency as prescribed in the rules.

**Prohibition of import of hazardous waste.**

12. No person shall import hazardous waste into Sindh province or its coastal, internal, territorial or historical waters, except acquiring prior approval of the Agency.

**Handling of hazardous substances.**

13. Subject to the provisions of this Act, no person shall import, generate, collect, consign, transport, treat, dispose of, store, handle or otherwise use or deal with any hazardous substance except-

(a) under a licence issued by the Agency; or

(b) in accordance with the provisions of any other law, rule, regulation or notification for the time being in force, or of any international treaty, convention, protocol, code, standard, agreement or other instrument to which Government is a party.

**Prohibition of action adversely affecting Environment.**

14. (1) Subject to the provisions of this Act and the rules and regulations, no person shall cause any act, deed or any activity, including-

(a) recycling or reuse of hospital waste and infectious waste;

(b) disposal of solid and hazardous wastes at unauthorized places as prescribed;

(c) dumping of wastes or hazardous substances into coastal waters and inland water bodies;

(d) release of emissions or discharges from industrial or commercial operations as prescribed;

(e) recycling or reuse or recovery of hazardous wastes or industrial by-products in an unauthorized or non-prescribed manner or procedure; and

(f) any activity which may cause adverse environmental affect due to trans boundary projects of Province of Sindh.

which lead to pollution or impairment of or damage to biodiversity, ecosystem, aesthetics or any damage to environment and natural resources as defined in section 2 (xxxvi) of this Act.

(2) No person shall generate, handle, transport, dispose of or handle the hospital waste and infections waste except in accordance with the Hospital Waste Management Rules and in such manner as may be prescribed.

(3) No person shall import, manufacture, stockpile, trade, supply, distribute or sell any scheduled plastic product which is non-degradable. The scheduled plastic products must be oxo-biodegradable and the pro-degradant used must be approved by the Agency or any other department or agency and in such manner as prescribed.

**Regulation of motor vehicles.**

15. (1) Subject to the provisions of this Act, no person shall operate or manufacture a motor vehicle or class of vehicles from which air pollutants or noise are being emitted in an amount, concentration or level which is in excess of the Sindh Environmental Quality Standards or, where applicable, the standards established under sub-clause (i) of clause (g) of sub-section (1) of section 6.

(2) For ensuring compliance with the standards mentioned in sub-section (1), the Agency may direct that any motor vehicle or class of vehicles shall install such pollution control devices or other equipment or use such fuels or undergo such maintenance or testing as prescribed.

(3) For ensuring compliance with the standards mentioned in sub-section (1), the Agency may direct that any manufacturer of motor vehicle or class of vehicles shall use such manufacturing standard or design or pollution control devices or other equipment or undergo such testing as may be prescribed.

(4) Where a direction has been issued by the Agency under sub-section (2) and (3) in respect of any motor vehicles or class of motor vehicles, no person shall operate or manufacture any such vehicle till such direction has been complied with.

**Certified Environmental Laboratory.**

16. (1) The monitoring, testing and analysis carried out in compliance or for the enforcement of any provisions of this Act

(2) The laboratory or organization having any facility for environmental monitoring, testing and analysis and intend to perform under sub-section (1) shall register with the Agency in accordance with the Environmental Laboratory Certification Rules as prescribed.

## PART-VI
## ENVIRONMENTAL EXAMINATIONS AND ASSESSMENTS

**Initial environmental examination and environmental impact assessment.**

17. (1) No proponent of a project shall commence construction or operation unless he has filed with the Agency an initial environmental examination or environmental impact assessment, and has obtained from the Agency approval in respect thereof.

(2) The Agency shall –

(a) review the initial environmental examination and accord its approval, subject to such terms and conditions as it may prescribe, or require submission of an environmental impact assessment by the proponent; or

(b) review the environmental impact assessment and accord its approval subject to such terms and conditions as it may deem fit to impose or require that the environmental impact assessment be re-submitted after such modifications as may be stipulated or decline approval of the environmental impact assessment as being contrary to environmental objectives.

(3) Every review of an environment impact assessment shall be carried out with public participation and, subject to the provisions of this Act, after full disclosure of the particulars of the project.

(4) The Agency shall communicate its approval or otherwise within a period of two months from the date that the initial environmental examination is filed, and within a period of four months from the date that the environmental impact assessment is filed complete in all respects in accordance with the regulations, failing which the initial environmental examination or, as the case may be, the environmental impact assessment shall be deemed to have been approved, to the extent to which it does not contravene the provisions of this Act and the rules and regulations:

(5) The provisions of sub-sections (1), (2), (3) and (4) shall apply to such categories of projects and in such manner as prescribed:

(6) The Agency shall maintain separate registers for initial environmental examination and environmental impact assessment projects, which shall contain brief particulars of each project and a summary of decisions taken thereon, and which shall be open for inspection to the public during office hours.

**Strategic environmental assessment.**

**18.** (1) All provincial government agencies, departments authorities, local councils and local authorities responsible for formulating policies, legislation, plans and programmes to be implemented in Sindh province which may cause any environmental impact in the jurisdiction of the province shall, before submitting the same to the competent authority for approval, forward to the Sindh Environmental Protection Agency a strategic environment assessment containing —

(a) description of the objectives and features of the proposed policy, legislation, plan or programme that are in consonance with the principles of sustainable development;

(b) assessment of the adverse environmental effects, if any, likely to be caused during implementation of the policy, legislation, plan or programme alongwith proposed preventive, mitigation and compensatory measures;

(c) analysis of possible alternatives; and

(d) identification of those components of the policy, legislation, plan or programme, if any, in respect of which specific environmental impact assessment need to be carried out in due course.

(2) The Agency shall, in consultation with the concerned Government Agencies and Advisory Committees where established, review the strategic environment assessment, within sixty (60) days of its filing, and prepare a report containing its comments and recommendations in respect thereof which shall be forwarded to the initiating Government Agency, authority, local council or local authority and duly considered by it and the competent authority before approval or otherwise of the proposed policy, legislation, plan or programme.

(3) The provisions of sub-sections (1), and (2) shall apply to such categories of policies, plans and programmes and in such manner as may be prescribed.

**Environmental monitoring.**

**19.** (1) The Agency shall carry out or arrange environmental monitoring of all projects in respect of which it has approved an initial environmental examination or environmental impact assessment to determine whether the actual environmental impact exceeds the level predicted in the assessment and whether the conditions of the approval are being complied with.

(2) For purposes of sub-section (1), the Agency may require the person in charge of a project to furnish such information as it may specify pertaining to the environmental impact of the project, including quantitative and qualitative analysis of -

(a) discharge of effluents, wastes, emissions of air pollutants, noise and any other matter or action that may be found offensive under section 14 from the project on daily, weekly, monthly or annual basis;

(b) ambient quality of the air, water, noise and soil before, during and after construction and during operation of the project.

(3) On review of the data collected by it and information provided, the Agency may issue such directions to the person in charge as it may consider necessary to ensure compliance with the conditions of the approval.

**Environmental Audit and Review.**

**20.** (1) The Agency shall from time to time require the person in charge of a project to furnish, within such period as may be specified, an environmental audit or environmental review report or environmental management plan containing a comprehensive appraisal of the environmental aspects of the project.

(2) The report of a project prepared under sub-section (1) shall include -

(a) analysis of the predicted qualitative and quantitative impact of the project as compared to the actual impact;

(b) evaluation of the efficacy of the preventive, mitigation and compensatory measures taken with respect to the project; and

(c) recommendations for further minimizing or mitigating the adverse environmental impact of the project.

(3) Based on its review of the environmental audit report, the Agency may, after giving the person in charge of the project an opportunity of being heard, direct that specified mitigation and compensatory measures be adopted within a specified time period and may also, where necessary, modify the approval granted by it under section 17.

## PART-VII
## ENVIRONMENTAL PROTECTION ORDER

**Environmental Protection Order.**

**21.** (1) Where the Agency is satisfied that the discharge or emission of any effluent, waste, air pollutant or noise, or the disposal of waste, or the handling of hazardous substances, or any other act or omission is likely to occur, or is occurring, or has occurred, in violation of any provision of this Act, the rules or regulations or of the conditions of a licence, or is likely to cause, or is causing or has caused an adverse environmental effect, the Agency may, after giving the person responsible for such

discharge, emission, disposal, handling, act or omission an opportunity of being heard, by order direct such person to take such measures as the Agency may consider necessary within such period as may be specified in the order.

(2) In particular and without prejudice to the generality of the foregoing power, such measures may include —

(a) immediate stoppage, preventing, lessening or controlling the discharge, emission, disposal, handling, act or omission, or to minimize or remedy the adverse environmental effect;

(b) installation, replacement or alteration of any equipment or thing to eliminate, control or abate on a permanent or temporary basis, such discharge, emission, disposal, handling, act or omission;

(c) action to remove or otherwise dispose of the effluent, waste, air pollutant, noise, or hazardous substances;

(d) action to restore the environment to the condition existing prior to such discharge, disposal, handling, act or omission, or as close to such condition as may be reasonable in the circumstances, to the satisfaction of the Agency; and

(e) impose a penalty as prescribed.

(3) Notwithstanding the provisions of sub-section (1), in an emergency situation where, for reasons to be recorded, the Agency is satisfied that the discharge or emission of any effluent, waste, air pollutant or noise, or the disposal of waste, or the handling of hazardous substances, or any other act or omission is likely to occur, or is occurring, or has occurred, in violation of the provisions of this Act and that circumstances of the case warrant immediate action in the public interest, it may pass an ad-interim order of the nature described in sub-sections (1) and (2) by providing reasonable opportunity of hearing.

## PART-VIII
## OFFENCES AND PENALTIES

**Penalties.**

22. (1) Whoever contravenes or fails to comply with the provisions of sections 11, 17, 18 and 21 or any order issued there under shall be punishable with a fine which may extend to five million rupees, to the damage caused to environment and in the case of a continuing contravention or failure, with an additional fine which may extend to one hundred thousand rupees for every day during which such contravention or failure continues:

Provided that if the contravention of the provisions of section 11 also constitutes a contravention of the provisions of section 15, such contravention shall be punishable under sub-section (2).

(2) Whoever contravenes or fails to comply with the provisions of sections 13, 14, 15 and 16 or any rule or regulation or conditions of any license, any order or direction, issued by the Agency, shall be punished with a fine, and in case of continuing contravention or failure with an additional fine which may extend to ten thousand rupees for every day during which such contravention continues.

(3) Where an accused has been convicted of an offence under sub-sections (1) and (2), the Environmental Protection Tribunal and Court shall, as the case may be, in passing sentence, take into account the extent and duration of the contravention or failure constituting the offence and the attendant circumstances.

(4) Where an accused has been convicted of an offence under sub-sections (1) or (2), the Environmental Protection Tribunal or Court, as the case may be, shall endorse a copy of the order of conviction to the concerned trade or industrial association, if any, or the concerned Provincial Chamber of Commerce and Industry or the Federation of Pakistan Chambers of Commerce and Industry.

(5) Where a person convicted under sub-sections (1) and (2) had been previously convicted for any contravention of this Act and its rules or regulations, the Environmental Protection Tribunal, as the case may be, may, in addition to the punishment awarded thereunder-

(a) sentence him to imprisonment for a term that may extend up to three years;

(b) order the closure of the factory;

(c) order confiscation of the facility, machinery and equipment, vehicle or substance, record, document or other object used or involved in contravention of the provisions of this Act;

(d) order such person to restore the environment at his own cost, to conditions existing prior to the contravention or as close to such conditions as may be reasonable in the circumstances to the satisfaction of the Agency; and

(e) order that compensation be paid to any person or persons for any loss, or damage to their health or property suffered by such contravention.

(6) The Director General or an officer generally or specially authorised by him in this behalf may, on the application of the accused, compound an offence under this Act with the permission of the Environmental Protection Tribunal or Court in accordance with such procedure as prescribed.

(7) Where the Director General is of the opinion that a person had contravened any provision of this Act, he may, subject to the rules, by notice in writing to that person require him to pay to the Agency a penalty in the amount set out in the notice for each day the contravention continues.

**Offences by body corporate.**

23. Where any contravention of this Act has been committed by a body corporate, and it is proved that such offence has been committed with the consent or connivance of, or is attributed to any negligence on the part of, any director, partner, manager, secretary or other officer of the body corporate, such director, partner, manager, secretary or other officer of the body corporate, shall be deemed guilty of such contravention along with the body corporate and shall be punished accordingly:

Provided that in the case of a company as defined under the Companies Ordinance, 1984 (XLVII of 1984), only the Chief Executive as defined in the said Ordinance shall be liable under this section.

*Explanation.*— For the purposes of this Section, "body corporate" includes a firm, association of persons and a society registered under the Societies Registration Act, 1860 (XXI of 1860), or under the Co-operative Societies Act, 1925 (VII of 1925).

**Offences by Government Agencies, local authorities or local councils.**

24. Where any contravention of this Act has been committed by any Government Agency, local authority or local council, and it is proved that such contravention has been committed with the consent or connivance of, or is attributable to any negligence on the part of, the Head or any other officer of Government Agency, local authority or local council, such Head or other officer shall also be deemed guilty of such contravention along with the Government Agency, local authority or local council and shall be liable to be proceeded against and punished accordingly.

## PART-IX
## ENVIRONMENTAL PROTECTION TRIBUNALS AND COURTS

**Environmental Protection Tribunals.**

25. (1) Government may, by Notification in the Official Gazette, establish as many Environmental Protection Tribunals as it considers necessary and, where it establishes more than one Environmental Protection Tribunal, it shall specify territorial limits within which, or the class of cases in respect of which, each one of them shall exercise jurisdiction under this Act.

(2) An Environmental Protection Tribunal shall consist of a Chairperson who is, or has been, or is qualified for appointment as a Judge of the High Court to be appointed after consultation with the Chief Justice of the High Court and two members to be appointed by Government, of which at least one shall be a technical member nominated from amongst the officers of the Agency with suitable professional qualifications and experience in the environmental field.

(3) For every sitting of the Environmental Protection Tribunal, the presence of the Chairperson and not less than one Member shall be necessary.

(4) A decision of an Environmental Protection Tribunal shall be expressed in terms of the opinion of the majority of its members, including the Chairperson, or if the case has been decided by the Chairperson and only one of the members and there is a difference of opinion between them, the decision of the Environmental Protection Tribunal shall be expressed in terms of the opinion of the Chairperson.

(5) An Environmental Protection Tribunal shall not, merely by reason of a change in its composition, or the absence of any member from any sitting, be bound to recall and rehear any witness who has given evidence, and may act on the evidence already recorded by, or produced, before it.

(6) An Environmental Protection Tribunal may hold its sittings at such places within its territorial jurisdiction as the Chairperson may decide.

(7) No act or proceeding of an Environmental Protection Tribunal shall be invalid by reason only of the existence of a vacancy in, or defect in the constitution, of, the Environmental Protection Tribunal.

(8) The terms and conditions of service of the Chairperson and members of the Environmental Protection Tribunal shall be such as may be prescribed.

**Jurisdiction and powers of Environmental Protection Tribunals.**

26. (1) An Environmental Protection Tribunal shall exercise such powers and perform such functions as are, or may be, conferred upon or assigned to it by or under this Act or the rules and regulations.

(2) All contraventions punishable under sub-section (1) of section 22 shall exclusively be triable by an Environmental Protection Tribunal.

(3) An Environmental Protection Tribunal shall not take cognizance of any offence triable under sub-section (2) except on a complaint in writing by—

(a) the Agency or any Government Agency or Local Council; and

(b) any aggrieved person, who has given notice of not less than thirty days to the Agency, of the alleged contravention and of his intention to make a complaint to the Environment Protection Tribunal.

(4) In exercise of its criminal jurisdiction, the Environmental Protection Tribunal shall have the same powers as are vested under the Code of Criminal Procedure, 1898 (Act V of 1898).

(5) In exercise of the appellate jurisdiction under section 27 the Environmental Protection Tribunal shall have the same powers and shall follow the same procedure as an appellate court in the Code of Civil Procedure, 1908 (Act V of 1908).

(6) In all matters with respect to which no procedure has been provided for in this Act, the Environmental Protection Tribunal shall follow the procedure laid down in the Code of Civil Procedure, 1908 (Act V of 1908).

(7) An Environmental Protection Tribunal may, on application filed by any officer duly authorised in this behalf by the Director General, issue bailable warrant for the arrest of any person against whom reasonable suspicion exists, of his having been involved in contravention punishable under sub-section (1) of section 22:

Provided that such warrant shall be applied for, issued and executed in accordance with the provisions of the Code of Criminal Procedure, 1898 (Act V of 1898):

Provided further that if the person arrested executes a bond with sufficient sureties in accordance with the endorsement on the warrant he shall be released from custody, failing which he shall be taken or sent without delay to the officer in-charge of the nearest jurisdiction police station.

(8) All proceedings before the Environmental Protection Tribunal shall be deemed to be judicial proceedings within the meaning of sections 193 and 228 of the Pakistan Penal Code (Act XLV of 1860), and the Environmental Protection Tribunal shall be deemed to be a court for the purpose of sections 480 and 482 of the Code of Criminal Procedure, 1898 (Act V of 1898).

(9) No court other than an Environmental Protection Tribunal shall have or exercise any jurisdiction with respect to any matter to which the jurisdiction of an Environmental Protection Tribunal extends under this Act and the rules and regulations.

(10) Where the Environmental Protection Tribunal is satisfied that a complaint made to it under sub-section (3) is false and vexatious to the knowledge of the complainant, it may, by an order, direct the complainant to pay to the person complained against such compensatory costs which may extend to one hundred thousand rupees.

**Appeals to the Environmental Protection Tribunal.**

27. (1) Any person aggrieved by any order or direction of the Agency under any provision of this Act or the rules or regulations may prefer an appeal with the Environmental Protection Tribunal within thirty days of the date of communication of the impugned order or direction to such person.

(2) An appeal to the Environmental Protection Tribunal shall be in such form, contain such particulars and be accompanied by such fees as prescribed.

**Appeals from orders of the Environmental Protection Tribunal.**

28. (1) Any person aggrieved by any final order or by any sentence of the Environmental Protection Tribunal passed under this Act may, within thirty days of communication of such order or sentence, prefer an appeal to the High Court.

(2) An appeal under sub-section (1) shall lie before the High Court of Sindh.

**Jurisdiction of Judicial Magistrate.**

29. (1) Notwithstanding anything contained in the Code of Criminal Procedure, 1898 (Act V of 1898), or any other law for the time being in force, but subject to the provisions of this Act, all contraventions punishable under sub-section (2) of section 22 shall exclusively be triable by the Court of Judicial Magistrate of First Class having of First Class having jurisdiction.

(2) A Judicial Magistrate shall be competent to impose any punishment specified in sub-sections (2) and (4) of section 22.

(3) A Judicial Magistrate shall not take cognizance of an offence triable under sub-section (1) except on a complaint in writing by—

(a) the Agency; and

(b) any aggrieved person.

**Appeals from orders of the Judicial Magistrate.**

30. Any person aggrieved by any final order or sentence passed by a Judicial Magistrate under section 28 may, within thirty days from the date of the communication of such order or sentence, appeal to the Court of the District and Sessions Judge defined as Green Court under this Act, whose decision thereon shall be final.

## PART-X
## PUBLIC PARTICIPATION

**Public participation.**

31.(1)The Agency shall cause relevant details of any proposed project regarding which an Environmental Impact Assessment has been received to be published, alongwith an invitation to the public to furnish their comments thereon within a specified period.

(2) In accordance with such procedure as may be prescribed, the Agency shall hold public hearings to receive additional comments and hear oral submissions.

(3) All comments received under sub-sections (1) and (2) shall be duly considered by the Agency while reviewing the environmental impact assessment or strategic impact assessment, and decision or action taken thereon shall be communicated to the persons who have furnished the said comments.

## PART-XI
## GENERAL

**Power to make and amend schedule.**

32. The Agency may, by notification in the official Gazette, make and amend the schedule.

**Indemnity**

33. No suit, prosecution or other legal proceedings shall lie against Government, the Council, the Agency, the Director General of the Agency, members, officers, employees, experts, advisors, committees or consultants of the Agency or Environmental Protection Tribunal or Court or any other person for anything which is done or intended to be done in good faith under this Act or rules or regulations.

**Dues recoverable as arrears of land revenue.**

34. Any dues recoverable by the Agency under this Act and rules or regulations shall be recoverable as arrears of land revenue.

**Act to override other laws.**

35. The provisions of this Act shall have effect notwithstanding anything inconsistent therewith contained in any other law for the time being in force.

**Power to make rules.**

36. The Sindh Environment Protection Agency may, by notification in the Official Gazette, make rules for carrying out the purposes not in consistence of this Act with the approval of Government.

**Power to make regulations.**

37. (1) For carrying out the purposes of this Act, the Agency may, by Notification in the Official Gazette and with the approval of Government, make regulations not inconsistent with the provisions of this Act or the rules.

(2) In particular and without prejudice to the generality of the foregoing power, such regulations may provide for —

(a) submission of periodical reports, data or information by any Government Agency, local authority or local council in respect of environmental matters;

(b) preparation of emergency contingency plans for coping with environmental hazards and pollution caused by accidents, natural disasters and calamities;

(c) appointment of officers, advisors, experts, consultants and employees **as per prescribed rules**;

(d) levy of fees, rates and charges in respect of services rendered, actions taken and schemes implemented;

(e) monitoring and measurement of discharges and emissions;

(f) categorization of projects to which, and the manner in which sections 17, 18 and 20 applies;

(g) laying down of guidelines for preparation of initial environmental examination, environmental impact assessment and strategic environmental assessment, and development of procedures of their filing, reviews and approval.

(h) laying down standard operating procedures for environmental sampling, examination of water, waste water, gaseous emissions, solid waste and noise;

(i) providing procedures for handling hazardous substances; and

(j) installation of devices in, use of fuels by, and maintenance and testing of motor vehicles for control of air and noise pollution.

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**BY ORDER OF THE SPEAKER**
**PROVINCIAL ASSEMBLY OF SINDH**

**G.M.UMAR FAROOQ**
**SECRETARY**
**PROVINCIAL ASSEMBLY OF SINDH**

**Karachi: Printed at the Sindh Government Press**
**20-3-2014**

# Annexure – II:
# Sindh EPA Environmental Assessment Regulations, 2021

**GOVERNMENT OF SINDH**
**SINDH ENVIRONMENTAL PROTECTION AGENCY**

Karachi dated the 03rd September, 2021

# NOTIFICATION

**NO.EPA/TECH/739/2021:-** In exercise of the powers conferred by section 37 of the Sindh Environmental Protection Act, 2014, the Sindh Environmental Protection Agency, with the approval of Government, is pleased to make the following regulations, namely:-

**1. Short title and commencement**

(1) These regulations may be called the Sindh Environmental Protection Agency (Environmental Assessment) Regulations, 2021.

(2) They shall come into force at once.

**2. Definitions. -**

(1) In these regulations, unless there is anything repugnant in the subject or context

(a) "Act" means the Sindh Environmental Protection Act, 2014 (VIII of 2014);

(b) "Agency" means the Sindh Environmental Protection Agency as defined under section 2(ii);

(c) "Director General" means the Director General of the Agency;

(d) Environmental Checklist means rapid environmental assessment or environmental screening through a prescribed checklist in respect of projects having least/minimal impacts on the environment.

(e) "Firm" means the Environmental Consulting Firm registered by the Agency.

(f) "Environmentally sensitive area" means a location, large or small, that has significant environmental values that contribute to maintaining biological diversity and integrity, have intrinsic or attributed scientific, historical or cultural heritage value, or are important in providing amenity, harmony or sense of community, ecosystem as declared by Agency.

(g) "Protected area" means any area which safeguards the earths precious bio-diversity, protected areas of natural beauty and conservation of cultural significance as declared by relevant authority;

(h) "Schedule" means the Schedules provided in these regulations;

(i) "Urban area" means an area within the limits of a town, municipality or city as determined by the Agency on the basis of population and environmental issues

(2) All other words and expressions used but not defined in these regulations shall have the same meaning as are assigned to them in the Act.

**3. Projects requiring Environmental Checklist (EC)**

A proponent of a project falling in any category listed in Schedule-I shall file environmental checklist with the Agency and the provisions of section 17 shall apply to such projects.

**4. Projects requiring an Initial Environmental Examination (IEE)**

A proponent of a project falling in any category listed in Schedule-II shall file an IEE with the Agency, and the provisions of section 17 shall apply to such projects.

**5. Projects requiring an Environmental Impact Assessment (EIA)**

A proponent of a project falling in any category listed in Schedule-III shall file an EIA with the Agency, and the provisions of section 17 shall apply to such projects.

**6. Projects not requiring an Environmental Assessment**

(1) A project not falling in any category listed in Schedules-I, II and III shall not be required to file an EC, IEE or EIA

(2) Notwithstanding anything contained in sub-regulation (1), the Agency may direct the proponent of a project, whether or not listed in Schedule I or II or III, to file an EC or IEE or EIA, for reasons to be recorded in such direction:

Provided that no such direction shall be issued without the recommendations in writing of the Advisory Committee constituted under regulations 21.

**7. Preparation of environmental assessment report**

(1) The Agency may issue guidelines for preparation of an EC or IEE or EIA reports including guidelines of general applicability, and sectoral guidelines indicating specific assessment requirements for planning, construction and operation of projects relating to particular sector.

(2) The Agency may issue guidelines for preparation scope of an Environmental Management Plan(EMP) or Environmental Audit(EA).

(3) Where guidelines have been issued under sub-regulation (1) & (2), an EC, IEE or EIA or EMP or EA shall be prepared, to the extent practicable, in accordance therewith and the proponent shall justify any departure therefrom.

**8. Review Fees**

The proponent shall pay, at the time of submission of an EC, IEE or EIA or EMP or BTS tower a non-refundable review fee to the Agency as prescribe in Schedule-IV.

**9. Filing of report**

(1) Two hard copies and two electronic copies for an EC or IEE or EIA report shall be filed with the Agency by the proponent. The Agency may require the proponent to submit additional copies, as and when required during the review process.

(2) Every EC, IEE and EIA shall be accompanied by -

(a) an application, in the form prescribed in Schedule-V;

(b) Copy of receipt showing payment of review fee as prescribed in Schedule-IV

**10. Preliminary Scrutiny**

(1) Any report filed by the proponent or applicant shall be returned, if found incomplete in terms of Regulation 9.

(2) Notwithstanding anything contained in sub-regulation (1) of regulation 12, the Agency may require the proponent to submit an additional information at any stage during the review process.

**11. Public participation**

(1) In the case in an EIA, the Agency shall issue a public notice to be published in widely circulated English or Urdu or Sindhi national newspaper and in a local newspaper of general circulation in the area affected by the project, mentioning the type of project, its exact location, the name and address of the proponent and the date, time and place of public hearing for inviting comments from primary stakeholders.

(2) The date fixed under sub-regulation (1) shall not be earlier than ten days from the date of publication of the notice.

(3) The Agency shall also ensure the circulation of the EIA, where necessary, to the concerned Government Agencies and solicit their comments thereon.

(4) All comments received by the Agency from the public or any Government Agency shall be duly considered before issuance of decision.

(5) The Agency may issue guidelines indicating the basic techniques and measures to be adopted to ensure effective public consultation, involvement and participation in EIA assessment.

**12. Review process**

(1) Notwithstanding anything contained in sub section (4) of Section 17, the Agency shall make every effort to conclude its review process of the EA, EMP or environmental checklist within fifteen days, of the IEE within thirty days, and of the EIA within sixty days after receiving of complete case.

(2) In reviewing an EIA, the Agency shall consult such Committee of Experts be constituted for the purpose by the Director General, and may also solicit views of concerned Advisory Committee, if any, constituted by the Agency.

(3) The Director General may, where considers it necessary, constitute a committee to inspect the site of the project and submit its report on such matters as may be specified.

(4) In reviewing the IEE, the Director General may constitute a committee of the officers from within the Agency, on case to case basis, in view of the jurisdiction and location of the project for the purpose to extend final recommendation about the approval or rejection of the IEE.

(5) The review of the IEE or EIA by the Agency shall be based on quantitative and qualitative assessment of the documents and data furnished by the proponent, comments from the public and Government Agencies received under regulation 12, and views of the committees mentioned in sub-regulations (2) and (3) above.

(6) EMP, EA, EC shall be reviewed as per guidelines issued by SEPA

**13. Decision**

(1) The documentary evidence in the form of videos (soft copies) of public hearing shall be submitted by the proponent within three days after conclusion of public hearing to the Agency.

(2) On completion of the review process, the decision of the Agency shall be communicated to the proponent in the form prescribed in Schedule-VI or in case of an IEE or EMP or environmental checklist or environmental audit in the form prescribed in Schedule-VII in case of an EIA.

**14. Conditions of approval**

(1) Every approval of an EC or IEE or EIA or EMP or EA shall, in addition to such conditions as may be imposed by the Agency, be subject to the condition that the project shall be designed, constructed or operated and mitigatory and other measures adopted, strictly in accordance with the EC or IEE or EIA or EMP or EA, unless any variations thereto have been specified in the approval by the Agency.

(2) Where the Agency accords its approval subject to certain conditions, the proponent shall submit an undertaking to the Agency, before commencing operation of the project, in the form prescribed in Schedule-VIII that the conditions of approval, and the requirements in the IEE or EIA relating to design and construction, adoption of mitigation and other measures have been duly complied with.

**15. Validity period of Approval**

(1) The approval accorded by the Agency under section 17 read with sub-regulation (2) of regulation 15 shall be valid, for commencement of construction, for a period of three years from the date of issue.

(2) If construction is commenced during the initial three years validity period, the

validity of the approval shall stand extended for a further period of three year.

(3) The proponent may apply to the Agency for extension in the validity periods mentioned in sub-regulations (1), (2), which may be granted by the Agency in its discretion for such period not exceeding three years at a time, if the conditions of the approval do not require significant change:

Provided that the Agency may require the proponent to submit a fresh IEE or EIA, if in its opinion changes in location, design, construction and operation of the project so warrant.

**16. Entry and inspection**

(1) For the purpose of verification of any matter relating to the review or to the conditions of approval of an EC or IEE or EIA or EMP or EA list prior to, before or during and after commencement of construction or operation of a project, duly authorized staff of the Agency shall be entitled to enter and inspect the project site, factory building and plant and equipment installed therein.

(2) The proponent shall ensure full cooperation of the project staff at site to facilitate the inspection, and shall provide such information as may be required by the Agency for this purpose and pursuant thereto.

**17. Cancellation of approval**

(1) Notwithstanding anything contained in these regulations, if, at any time, on the basis of information or report received or inspection carried out, the Agency is of the opinion that the conditions of an approval have not been complied with, or that the information supplied by a proponent in the approved EC or IEE or EIA or EMP or EA list is incorrect, it shall issue notice to the proponent for show cause within two weeks of receipt thereof as to why the approval should not be cancelled.

(2) In case no reply is received or if the reply is considered unsatisfactory, the Agency may, after giving the proponent an opportunity of being heard -

(i) require the proponent to take such measures and to comply with such conditions within such period as it may specify, failing which the approval shall stand cancelled; or

(ii) cancel the approval.

(3) On cancellation of the approval, the proponent shall cease construction or operation of the project forthwith.

(4) Any action taken under this regulation shall be without prejudice to any other action that may be taken against the proponent under the Act or rules or regulations or any other law for the time being in force.

**18. Registers of EC or IEE and EIA projects**

Separate Registers to be maintained by the Agency for EC or IEE and EIA projects shall be in the form prescribed in Schedule-IX.

**19. Environmentally sensitive areas**

(1) The Agency may designate an area to be an environmentally sensitive area,

(2) Notwithstanding anything contained in regulations 3 and 5, the proponent of a project situated in an environmentally sensitive area shall be required to file an EIA with the Agency.

**20. Environmental assessment guidelines**

(1) The Agency may from time to time issue guidelines to assist proponents and other persons involved in the preparation of environmental assessment.

(2) Where guidelines have been issued under sub-regulation (1), the projects shall be planned and prepared, to the extent practicable, in accordance therewith and any departure therefrom justified in the IEE/EIA pertaining to the project.

**21. Environmental Assessment Advisory Committee. -**

The agency may constitute one or more Committees for the purpose of rendering advice on implementation and enforcement of Section 17, which may include experts of relevant field, civil society, academia, environmental experts, representative of Administrative Department, legal expert and experts from natural resources.

**22. Repeal and Savings.**

(1) The Sindh Environmental Protection Agency (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulations 2014, shall, on commencement of these regulations, stand repealed.

(2) All orders made, notification issued, actions taken under the repealed Regulations shall remain in force until amended, altered or repealed by the provisions of these regulations.

**DIRECTOR GENERAL**
**SINDH ENVIRONMENTAL PROTECTION AGENCY**

## SCHEDULE-I

*(See* Regulation 3)

**List of projects requiring Environmental Screening (through check list)**

a. Subject to the compliance with concerned zoning laws:
   i. Construction of residential and commercial buildings having total covered area from 60,000 sq.feet to 100,000 sq.feet
   ii. Housing Schemes covering an area from 05 acres to 15 acres.
   iii. Ware Houses for Non-Hazardous substances having total area from 1000 sq.yards to 5,000 sq.yards
   iv. Warehouse for Fertilizers
   v. Marriage Halls/Banquet/Restaurants/Baking facilities having total area more than 500 sq.yards
   vi. Motor vehicle workshops/Service Stations having total area of more than 500 sq.yards.

b. Construction/Reconstruction/Rehabilitation of roads in urban area from 500 meters to 01 kilometres and in rural area from 500 meters to 05 kilometres.

c. Construction of Flyover, underpasses and bridges of length from 100 meters to 500 meters

d. On-farm dams and fish farms

e. Pulses mills

f. Flour Mills

g. Lining of existing minor canals and /or water courses.

h. Canal cleaning

i. Forest harvesting operations

j. Rain harvesting projects

k. Health care units of less than 50 beds

l. BTS Tower

m. Lime Kilns

n. Ice factories and cold storage.

o. Cotton oil mill

p. Construction of LPG, CNG, LNG filling station and petrol pumps

q. Carpet manufacturing units

r. Rain harvesting projects

s. Industrial Effluent Treatment Plant

t. Sanitary Landfill site up to 500 tons/day

## Schedule-II

*(See* Regulation 4)

**List of projects requiring an Initial Environmental Examination**

**A. Agriculture, Livestock and Fisheries**

1. Poultry, livestock and fish farms
2. Warehousing for pesticides and pharmaceuticals
3. Projects involving packaging, formulation, cold storage and warehouse of agricultural, livestock and fish products.
4. Construction & Operation of Slaughter houses

**B. Energy**

1. Hydroelectric power generation up to 25 MW
2. Thermal power generation up to 100 MW
3. Coal fired power plants with capacity up to 50 MW
4. Transmission lines up to 132 KV, and grid stations
5. Waste-to-energy generation projects including bio-mass up to 25 MW
6. Construction of Coal Handling and storage facilities
7. Handling, Transportation & Storage of Biofuel Facility
8. Handling and storage of edible grains and seeds
9. All Renewable energy Projects (excluding Protected/Sensitive area under any law)

**C. Oil and Gas projects:**

1. Oil and gas 2D/3D Seismic survey and drilling activities (on and off shore)
2. Oil and gas extraction projects including exploration and production located outside the environmentally sensitive/protected areas
3. Oil & Gas transmission gathering, storage, separation & transportation system
4. Construction of CNG, LPG Petroleum and LNG bulk storage facility
5. Oil blending and recycling units

**D. Manufacturing and processing**

1. Ceramics and glass units
2. Food processing units
3. Pharmaceutical units.
4. Rice mills, ghee/oil mills, Cotton ginning
5. Man-made fibers and resin projects

6. Tanning and leather finishing projects
7. Manufacturing of apparel, textile garments units, including weaving, spinning, dyeing, bleaching and printing
8. Woodwork units manufacturing products
9. Steel re-rolling mills
10. Waste recycling plants
11. Battery manufacturing plant
12. Brick Kilns
13. Marble processing units
14. Stone Crushing units

**E. Mining and mineral processing**

1. Commercial extraction of sand, gravel, limestone, clay, Sulphur and other minerals not included in Schedule I.
2. Crushing, grinding and separation processes
3. Metal Smelting plant production capacity up to 20 tons/day

**F. Transport**

1. Construction of flyovers, underpasses and bridges having length more than 500 meters to 1000 meters in urban areas and more than 5km in rural areas
2. Bus terminals/ railway station/ metro stops and construction & operation of transport related terminals
3. Rehabilitation or rebuilding or reconstruction of existing roads more than one kilometers in urban areas and more than 5 km from rural areas

**G. Water management, dams, irrigation and flood protection**

1. Dams and reservoirs with storage volume of less than 25 million cubic meters of surface area less than 4 square kilometers
2. Irrigation systems and drainage system with the area of less than 15,000 hactors
3. Flood protection bunds

**H. Water supply and filtration**

Water supply schemes and filtration plants

**I. Waste disposal and wastewater treatment**

1. Solid and Non-hazardous waste with annual capacity up to 10,000 tonnes (excluding municipal landfill sites and commercial facilities) including Garbage Transfer station/composting plant

2. Wastewater treatment for sewerage treatment facility less than 100 mgd
3. Hospital waste disposal facilities including incineration units owned by Hospitals for own use excluding commercial facility.

**J. Urban development**

1. Housing schemes more than 15 acres to 50 acres
2. Residential, Commercial multistory High rise construction projects having covered area more than 100,000 sq.feet to 500,000 sq.feet.
3. Laboratories
4. Hospitals, health care unit of more than 50 beds
5. Construction of Educational and Academic institutions.

**K. Other projects**

Any other project for which filing of an IEE is required by the Agency under sub-regulation (2) of Regulation 6.

## SCHEDULE III

*(See* Regulation 5)

**List of projects requiring an EIA**

**A. Energy**

1. Hydroelectric power generation more than 50 MW
2. Thermal power generation more than 100 MW
3. Coal power projects more than 50 MW
4. Transmission lines above 132 KVA and distribution projects.
5. Nuclear power plants
6. Wind, Solar or renewable energy projects if falls under any environmental sensitive and protected area.

**B. Oil and Gas projects**

1. Oil Petroleum refineries.
2. LPG and LNG Terminals Projects
3. Coal Handling Terminals Projects

**C. Manufacturing and processing**

1. Cement plants
2. Chemical manufacturing industries
3. Fertilizer plants
4. Steel Mills
5. Sugar Mills and Distilleries
6. Establishment of Industrial estates & Export processing zones
7. Petrochemicals complex
8. Synthetic resins, plastics and man-made fibers, paper and paperboard, paper pulping, plastic products, printing and publishing, paints and dyes.

**D. Mining and mineral processing**

1. Mining and processing of coal, gold, copper, sulphur and precious stones
2. Mining and processing of major non-ferrous metals, iron and steel rolling
3. Metal Smelting plant production capacity more than 20 tons/day

**E. Transport**

1. Airports
2. Construction of highway, motor ways, major roads (Intercity roads) more than one km and above

3. Ports and harbor development
4. Mass transit projects
5. Railway works
6. Construction of Flyover, underpass and bridges having total length more than one km.

**F. Water management, dams, irrigation and flood protection**

1. Dams and reservoirs with storage volume of 25 million cubic meters and above having surface area of 4 square kilometers and above
2. Irrigation and drainage projects serving more than 15,000 hectares and above

**G. Water supply and filtration**

Public water supply schemes and **filtration** plants.

**H. Waste Disposal and treatment**

1. Facilities for handling, storage or disposal of hazardous or toxic wastes or radioactive waste (including landfill sites, incineration units, etc.)
2. Solid waste municipal landfill sites.
3. Combine Effluent Treatment Plant
4. Domestic wastewater treatment plant more than 100mgd

**I. Urban development and tourism**

**1.** Housing schemes above 50 acres
2. Residential, Commercial High rise buildings subject to compliance of building bylaws of relevant organizations more than 500,000 sq.feet
3. All Projects located in High Density Zones notified by Government and relevant land controlling organization, irrespective of their size.
4. Commercialization of major corridors/roads in urban centers
5. Large Scale public facilities
6. Large-scale tourism development projects

**J. Environmentally Sensitive Areas**

All projects situated in environmentally sensitive areas being identified by the Agency.

**K. Other projects**

1. Any other project for which filing of an EIA is required by the Agency under sub-regulation (2) of Regulation 5.
2. Any other project likely to cause an adverse environmental effect.

## Schedule-IV

## (See Regulation 8)

| Project Cost (in million) | Review Fee |
|---|---|
| **Up to 20** | **Rs.50,000** |
| **Above 20 up to 100** | **Rs. 100,000** |
| **Above 100 up to 200** | **Rs. 200,000** |
| **Above 200 up to 500** | **Rs. 400,000** |
| **Above 500** | **Rs. 600,000** |
| **Review fee for Environmental Checklist or EMP shall be Rs. 40,000/=** | |
| **Review fee for BTS Tower shall be 20,000/=** | |

*

**Note:**

The fee shall be payable into the "Sindh Sustainable Development Fund" account Details are as under:

**A/C Title:** Sindh Sustainable Development Fund

**Account Number:** 03084572626100

**Bank:** Sindh Bank

**Branch Code:** 0308-Korangi Industrial Area

**SCHEDULE V**
*[See* Regulation 9(2)(a)]
**Application Form**

| | | | | |
|---|---|---|---|---|
| 1. | Name and address of Proponent | | Phone:<br>Email: | |
| 2. | CNIC No. of proponent | | | |
| 3. | Brief description of project | | | |
| 4. | Location of project | | | |
| 5. | Cost of the Project | | | |
| 6. | Objectives of project | | | |
| 7. | IEE/EIA attached? | IEE/EIA: Yes/No | | |
| 8. | Have alternative sites/options been considered/ reported in IEE/EIA? | | Yes/No | |
| 9. | Title document of the project | | | |
| 10. | Existing land use | | Land requirement | |
| 11. | Is basic site data available, or has it been measured? | (only tick yes if the data is reported in the IEE/EIA) | Available | Measured |
| | | Meterology (including rainfall) | Yes/No | Yes/No |
| | | Ambient air quality | Yes/No | Yes/No |
| | | Water balance | Yes/No | Yes/No |
| | | Solid waste disposal | Yes/No | Yes/No |
| 12. | Have estimates of the following been reported, especially Quantitative Analysis? | Liquid waste | Estimated | Reported |
| | | | Yes/No | Yes/No |
| | | | Yes/No | Yes/No |
| | | | Yes/No | Yes/No |
| 13. | Source of power | | Power requirement | |
| 14. | Labour force (number) | Construction:<br>Operation: | | |
| 15. | Environmental Consulting Firm | | | |

Verification. I do solemnly affirm and declare that the information given above and contained in the attached EC/IEE/EIA is true and correct to the best of my knowledge and belief.

Date

Signature, name _____
of proponent (with official stamp/seal)

**SCHEDULE VI**

*[See* Regulation 13(2)]

**Decision on IEE/Environmental Check List**

1. Name and address of proponent _____

   _____

2. Description of project

3. Location of project

4. Date of filing of IEE

5. After careful review of the IEE, the Agency has decided –

   (a) to accord its approval, subject to the following conditions:

   _____

   _____

   or (b) that the proponent should submit an EIA of the project, for the following reasons –

   _____

   Dated _____

Tracking no.___

Director-General
Sindh Environmental Protection Agency
(with official stamp/seal)

## SCHEDULE VII

*[See* Regulation 13(2)]

### Decision on EIA

1. Name and address of proponent _____

2. Description of project _____

3. Location of project _____

4. Date of filing of EIA _____

5. After careful review of the EIA, and all comments thereon, the Federation Agency has decided –

   (a) to accord its approval, subject to the following conditions:

   _____

   _____

or (b) that the proponent should submit an EIA with the following modifications-

   _____

   _____

or (c) to reject the project, being contrary to environmental objectives, for the following reasons:

   _____

Dated _____

Tracking no.___

Director-General
Sindh Environmental Protection Agency
(with official stamp/seal)

**SCHEDULE VIII**

*[See* Regulation 14(2)]

**Undertaking**

I, (full name and address) as proponent for (name, description and location of project) do hereby solemnly affirm and declare that the conditions of approval and the requirements in the IEE or EIA relating to design and construction, adoption of mitigation and other measures and other relevant matters have been duly complied with in the design and construction of the project.

Signature, name and designation of proponent
(with official stamp/seal)

Witnesses(full names and addresses)

_____

_____

**SCHEDULE IX**

*(See* Regulation 18)

**Form of Registers for EC, IEE and EIA projects**

| S. No. | Description | Relevant Provisions |
|---|---|---|
| 1 | 2 | 3 |
| 1. | Tracking number | |
| 2. | Category type (as per Schedules I or II) | |
| 3. | Name of proponent | |
| 4. | Name and designation of contact person | |
| 5. | Name of consultant | |
| 6. | Description of project | |
| 7. | Location of project | |
| 8. | Date of submission of IEE/EIA | |
| 9. | Date of public hearing / technical presentation | |
| 10. | Date of committee of experts for schedule-II projects | |
| 11. | Approval granted (Yes/No) | |
| 12. | Date of approval granted or refused | |

# Annexure – III:
# Sindh Environmental Quality Standards (SEQS)

EXTRAORDINARY Registered No. M324

# The Sindh Government Gazette

Published by Authority

KARACHI THURSDAY JANUARY 28, 2016

## PART-I

**GOVERNMENT OF SINDH**
**SINDH ENVIRONMENT PROTECTION AGENCY**

**NOTIFICATION**

**NO.EPA/TECH/739/2014**:- In exercise of the powers conferred under clause (g) of sub-section (1) of section of 6 of the Sindh Environmental Protection Act, 2014, the Sindh Environmental Protection Agency, with the approval of the Sindh Environmental Protection Council, is pleased to establish the following standards:-

1. (1) These Standards may be called the Sindh Environmental Industrial Waste Water, Effluent, Domestic, Sewerage, Industrial Air Emission and Ambient Airs, Noise for Vehicles, Air Emissions for Vehicles and Drinking Water Quality Standards, 2015.

(2) These Standards shall come into force at once.

2. In these Standards, unless there is anything repugnant in the subject or context –

(a) "Government" means the Government of Sindh;

(b) "Standards" means the Sindh Environmental Quality Standards.

## SINDH ENVIRONMENTAL QUALITY STANDARDS FOR MUNICIPAL AND LIQUID INDUSTRIAL EFFLUENTS (mg/l, UNLESS OTHERWISE DEFINED)

| S. No. | Parameter | Standards | | |
|---|---|---|---|---|
| | | Into Inland Waters | Into Sewage Treatment [5] | Into Sea [6] |
| 1 | 2 | 3 | 4 | 5 |
| 1. | Temperature 40 $^0$C or Temperature Increase * | ≤3$^o$C | ≤3$^o$C | ≤3$^o$C |
| 2. | pH value ($H^+$) . | 6-9 | 6-9 | 6-9 |
| 3. | Biochemical Oxygen Demand (BOD)5 at 20$^0$C [1] | 80 | 250 | 80** |
| 4. | Chemical Oxygen Demand(COD) [1] .. .. | 150 | 400 | 400 |
| 5. | Total Suspended Solids (TSS) .. .. .. | 200 | 400 | 200 |
| 6. | Total Dissolved Solids (TDS) | 3500 | 3500 | 3500 |
| 7. | Oil and Grease | 10 | 10 | 10 |
| 8. | Phenolic compounds (as phenol) | 0.1 | 0.3 | 0.3 |
| 9. | Chloride (as $Cl^-$) | 1000 | 1000 | SC*** |
| 10. | Fluoride (as $F^-$) | 10 | 10 | 10 |
| 11. | Cyanide (as $CN^-$) total . | 1.0 | 1.0 | 1.0 |
| 12. | An-ionic detergents (as MBAS)[2] | 20 | 20 | 20 |
| 13. | Sulphate ($SO_4^{2-}$) | 600 | 1000 | SC*** |
| 14. | Sulphide ($S^{2-}$) | 1.0 | 1.0 | 1.0 |
| 15. | Ammonia ($NH_3$) | 40 | 40 | 40 |
| 16. | Pesticides [3] | 0.15 | 0.15 | 0.15 |
| 17. | Cadmium [4] .. | 0.1 | 0.1 | 0.1 |
| 18. | Chromium (trivalent and hexavalent [4] .. | 1.0 | 1.0 | 1.0 |
| 19. | Cooper [4] .. .. | 1.0 | 1.0 | 1.0 |
| 20. | Lead [4] | 0.5 | 0.5 | 0.5 |
| 21. | Mercury [4] | 0.01 | 0.01 | 0.01 |
| 22. | Selenium [4] | 0.5 | 0.5 | 0.5 |
| 23. | Nickel [4] .. | 1.0 | 1.0 | 1.0 |
| 24. | Silver [4] | 1.0 | 1.0 | 1.0 |
| 25. | Total toxic metals .. .. | 2.0 | 2.0 | 2.0 |
| 26. | Zinc .. .. .. | 5.0 | 5.0 | 5.0 |
| 27. | Arsenic [4] | 1.0 | 1.0 | 1.0 |
| 28. | Barium [4] | 1.5 | 1.5 | 1.5 |
| 29. | Iron .. .. .. | 8.0 | 8.0 | 8.0 |
| 30. | Manganese .. .. | 1.5 | 1.5 | 1.5 |
| 31. | Boron [4] | 6.0 | 6.0 | 6.0 |
| 32. | Chlorine .. .. .. | 1.0 | 1.0 | 1.0 |

**Explanations:**

1. Assuming minimum dilution 1:10 on discharge, lower ratio would attract progressively stringent standards to be determined by the Sindh Environmental Protection Agency. By 1:10 dilution means. for example that for each one cubic meter of treated effluent, the recipient water body should have 10 cubic meter of water for dilution of this effluent.
2. Methylene Blue Active Substances; assuming surfactant as biodegradable.
3. Pesticides include herbicides, fungicides, and insecticides.
4. Subject to total toxic metals discharge should not exceed level given at S. N. 25.
5. Applicable only when and where sewage treatment is operational and BOD5=80mg/l is achieved by the sewage treatment system.
6. Provided discharge is not at shore and not within 10 miles of mangrove or other important estuaries.

* The effluent should not result in temperature increase of more than $3^0C$ at the edge of the zone where initial mixing and dilution take place in the receiving body. In case zone is not defined, use 100 meters from the point of discharge.

** The value for industry is 200 mg/l

*** Discharge concentration at or below sea concentration (SC).

Note: 1. Dilution of liquid effluents to bring them to the STANDARDS limiting values is not permissible through fresh water mixing with the effluent before discharging into the environment.

2. The concentration of pollutants in water being used will be subtracted from the effluent for calculating the STANDARDS limits".

**"SINDH ENVIRONMENTAL QUALITY STANDARDS FOR INDUSTRIAL GASEOUS EMISSION (mg/$Nm^3$, UNLESS OTHERWISE DEFINED)."**

| S. No. | Parameter | Source of Emission | Standards |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| 1. | Smoke | Smoke opacity not to exceed | 40% or 2 Ringleman Scale or equivalent smoke number |
| 2. | Particulate matter | (a) Boilers and Furnaces | |
| | (1) | (i) Oil fired | 300 |
| | | (ii) Coal fired | 500 |
| | | (iii) Cement Kilns | 300 |

| | | | |
|---|---|---|---|
| | | (b) Grinding, crushing, Clinker coolers and Related processes, Metallurgical Processes, converter, blast furnaces and cupolas. | 500 |
| 3. | Hydrogen Chloride | Any | 400 |
| 4. | Chlorine | Any | 150 |
| 5. | Hydrogen Fluoride | Any | 150 |
| 6. | Hydrogen Sulphide | Any | 10 |
| 7. | Sulphur Oxides (2) (3) | Sulfuric acid/ Sulphonic acid plants | |
| | | Other Plants except power Plants operating on oil and coal | 1700 |
| 8. | Carbon Monoxide | Any | 800 |
| 9. | Lead | Any | 50 |
| 10. | Mercury | Any | 10 |
| 11. | Cadmium | Any | 20 |
| 12. | Arsenic | Any | 20 |
| 13. | Copper | Any | 50 |
| 14. | Antimony | Any | 20 |
| 15. | Zinc | Any | 200 |
| 16. | Oxides of Nitrogen | Nitric acid Manufacturing unit. | 3000 |
| | (3) | Other plants except power plants operating on oil or coal: | |
| | | Gas fired | 400 |
| | | Oil fired | 600 |
| | | Coal fired | 1200 |

**Explanations:-**

1. Based on the assumption that the size of the particulate is 10 micron or more.
2. Based on 1 percent Sulphur content in fuel oil. Higher content of Sulphur will case standards to be pro-rated.
3. In respect of emissions of Sulphur dioxide and Nitrogen oxides, the power plants operating on oil and coal as fuel shall in addition to Standards specified above, comply with the following standards:-

A. **Sulphur Dioxide**

Sulphur Dioxide Background levels Micro-gram per cubic meter ($ug/m^3$) Standards.

| Background Air Quality ($SO_2$ Basis) | Annual Average | Max. 24-hours Interval | Criterion I Max. $SO_2$ Emission (Tons per Day Per Plant) | Criterion II Max. ground level increment to ambient (One year Average) |
|---|---|---|---|---|
| Unpolluted | <50 | <200 | 500 | 50 |
| Moderately Polluted* | | | | |
| Low | 50 | 200 | 500 | 50 |
| High | 100 | 400 | 100 | 10 |
| Very Polluted** | >100 | >400 | 100 | 10 |

* For intermediate values between 50 and 100 $ug/m^3$ linear interpolations should be used.
** No projects with Sulphur dioxide emissions will be recommended.

**B. Nitrogen Oxide**

Ambient air concentrations of Nitrogen oxides, expressed as $NO_X$ should not be exceed the following:-

Annual Arithmetic Mean 100$ug/m^3$ (0.05 ppm)

Emission level for stationary source discharge before missing with the atmosphere should be maintained as follows:-

For fuel fired steam generators as Nanogram ($10^0$-gram) per joule of heat input:

| | |
|---|---|
| Liquid fossil fuel .. .. .. | 130 |
| Solid fossil fuel.. .. .. | 300 |
| Lignite fossil fuel .. .. .. | 260 |

Note:- Dilution of gaseous emissions to bring them to the STANDARDS limiting value is not permissible through excess air mixing blowing before emitting into the environment.

## Sindh Environmental Quality Standards for Motor Vehicle Exhaust and Noise

**(i) For in-use Vehicles**

| S. No. | Parameter | Standards (maximum permissible limit) | Measuring Method | Applicability |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| 1. | Smoke | 40% or on the Ringleman Scale during engine acceleration mode | To be compared with Ringleman Chart at a distance of 6 meters or more. | Immediate effect |
| 2 | Carbon Monoxide | 6 % | Under idling conditions: Non-dispersive infrared detection through gas analyzer. | |
| 3. | Noise | 85 db (A) | Sound-meter at 7.5 meter from the source. | |

**For new Vehicles**

## EMISSION STANDARDS FOR DIESEL VEHICLES

### (a) For passenger Cars and Light Commercial Vehicles (g/Km)

| Type of Vehicle | Category/Class | Tiers | CO | HC+ NOx | PM | Measuring Method | Applicability |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Passenger Cars. | M 1: with reference mass (RW). | Pak-II, IDI | 1.0 | 0.7 | 0.08 | | All imported and local manufactured |
| | up to 2500 kg. Cars with RW over 2500 kg. to meet NI Category standards | Pak-II DI | 1.0 | 0.9 | 0.10 | NEDC (ECE 15+ EUDCL) | Diesel vehicles with effect from 01-07-2012 |
| Light Commercial Vehicles | NI-I (RW≤1250 Kg) | Pak-II IDI | 1.0 | 0.70 | 0.08 | | |
| | | Pak-II DI | 1.0 | 0.90 | 0.10 | | |
| | NI-II(1250kg< RW < 1700 Kg) | Pak-II IDI | 1.25 | 1.0 | 0.12 | | |
| | | Pak-II DI | 1.25 | 1.3 | 0.14 | | |
| | NI-III(RW< 1700 Kg) | Pak-II IDI | 1.50 | 1.2 | 0.17 | | |
| | | Pak-II DI | 1.50 | 1.6 | 0.20 | | |

**Parameter Standards (maximum permissible limit) Measuring method**

| | | |
|---|---|---|
| Noise | 85 db (A) | Sound-meter at 7.5 meters from the source |

**(b) For Heavy Duty Diesel Engines and Large Goods Vehicles (g/Kwh)**

| Type of Vehicle | Catogry/ Class | Tiers | CO | HC | NOx | PM | Measuring Method | Applicability |
|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Heavy Duty Diesel Engines | Turks and Buses | Pak-II | 4.0 | 1.1 | 7.0 | 0.15 | ECE-R-49 | All Imported and local manufactured diesel vehicles with the effect 1-7-2012 |
| Large goods Vehicles | N2(2000 and up | Pak-II | 4.0 | 7.0 | 1.10 | 0.15 | EDC | |

**Parameter Standards (maximum permissible limit) Measuring method**

**Noise 85 db (A) Sound-meter at 7.5 meters from the Source**

**Emission Standards for Petrol Vehicles (g/km)**

| Type of Vehicle | Category/ Class | Tier | Co | HC+ NOx | Measuring Method | Applicability |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Passenger Cars. | M 1: with reference mass (RW). upto 2500 kg. Cars with RW over 2500 kg. to meet N1 Category standards | Pak-II | 2.20 | 0.5 | NEDC (ECE 15+ EUDCL) | All imported and new models * locally manufactured petrol vehicles with effect from 1st July, 2009** |

| | | | | | |
|---|---|---|---|---|---|
| Light Commercial Vehicles | NI-I (RW<1250 kg) NI-NI-II (1250kg> kg RW < 1700 Kg) | Pak-II | 2.20 | 0.5 | |
| | | Pak-II | 4.0 | 0.65 | |
| | | Pak-II | 5.0 | 0.08 | |
| | NI-III(RW> 1700 kg) | | | | |
| Motor Rickshaws & Motor Cycles | 2,4 strokes < 150 cc | Pak-II | 5.5 | 1.5 | ECER 40 |
| | 2,4 strokes > 150cc | Pak-II | 5.5 | 1.3 | |

| Parameter | Standards (maximum permissible limit) | Measuring method |
|---|---|---|
| Noise source | 85 db (A) | Sound-meter at 7.5 meters from the |

Explanations:

| | |
|---|---|
| DI: | Direct Injection. |
| IDI: | Indirect Injection. |
| EUDCL: | Extra Urban Driving Cycle. |
| NEDC: | New European Driving Cycle. |
| ECE: | Urban Driving Cycle. |
| M: | Vehicles designed and constructed for the carriage of passenger and Comprising no more than eight seats in addition to the driver's seat. |
| N: | Motor vehicles with at least four wheels designed and constructed for the carriage of goods. |
| * | New model means both model and engine type change. |
| ** | The existing models of petrol driven vehicles locally manufactured will immediately switch over to Pak-II emission standards but no late than 30th June, 2012. |

## SINDH ENVIRONMENTAL QUALITY STANDARDS FOR AMBIENT AIR

| Pollutants | Time-weight average | Concentration in Ambient Air | Method of measurement |
|---|---|---|---|
| Sulphur Dioxide(SO2) | Annual Average* | 80 µg/m³ | Ultraviolet Fluorescence method |
| | 24 hours** | 120 µg/m³ | |
| Oxides of Nitrogen as (NO) | Annual Average* | 40 µg/m³ | Gas Phase Chemiluminescence |
| | 24 hours** | 40 µg/m³ | |
| Oxides of Nitrogen as (NO2) | Annual Average* | 40 µg/m³ | Gas Phase Chemiluminescence |
| | 24 hours** | 80 µg/m³ | |
| O³ | 1 hour | 130 µg/m³ | Non dispersive UV absorption method |
| Suspended Particulate Matters(SPM) | Annual Average* | 360 µg/m³ | High Volume Sampling (Average flow rate not less than 1.1 in 3/minutes) |
| | 24 hours** | 500 µg/m³ | |
| Respirable Particulate Matter PM10 | Annual Average* | 120 µg/m³ | ß Ray absorption method |
| | 24 hours** | 150 µg/m³ | |
| Respirable Particulate Matter PM2.5 | Annual Average* | 40 µg/m³*** | ß Ray absorption method |
| | 24 hours** | 75 µg/m³ | |
| Lead Pb | Annual Average* | 1 µg/m³ | ASS Method after sampling using EPM 2000 or equivalent filter paper |
| | 24 hours** | 1.5 µg/m³ | |
| Carbon Monoxide(CO) | 8 hours** | 5 mg/m³ | Non Dispersive Infra Red(NDIR) method |
| | 1 hours** | 10 mg/m³ | |

*Annual arithmetic mean of minimum 104 measurements in a year taken twice a week, 24 hourly and at uniform interval.

** 24 hourly/8 hourly values should be met 98% in a year, 2% of the time. It may exceed but not on two consecutive days.

***Annual Average limit of 40μ/m³ or background annual average concentration plus allowable allowance of 9μg/m³, whichever is lower.

## Sindh Standards for Drinking Water Quality

| Properties / Parameters | Standard Values for Sindh | WHO Standards | Remarks |
|---|---|---|---|
| **Bacterial** | | | |
| All water intended for drinking (e.Coli or Thermo tolerant Coliform bacteria) | Must not be detectable in any 100 ml sample | Must not be detectable in any 100 ml sample | Most Asian countries also follow WHO standards |
| Treated water entering the distribution system (E.Coli or thermo tolerant coliform and total coliform bacteria) | Must not be detectable in any 100 ml sample | Must not be detectable in any 100 ml sample | Most Asian countries also follow WHO standards |
| Treated water in the distribution system (E.coli or thermo tolerant coliform and total coliform and total coliform bacteria) | Must not be detectable in any 100 ml sample<br><br>In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period | Must not be detectable in any 100 ml sample<br><br>In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period | Most Asian countries also follow WHO standards |
| **Physical** | | | |
| Colour | ≤ 15 TCU | ≤ 15 TCU | |
| Taste | Non objectionable/Acceptable | Non objectionable/Acceptable | |
| Odour | Non | Non | |

| | | |
|---|---|---|
| | objectionable/Acceptable | objectionable/Accep table |
| Turbidity | ⟨ 5 NTU | ⟨ 5 NTU |
| Total hardness as $CaCO_3$ | < 500 mg/l | --- |
| TDS | ⟨ 1000 | ⟨ 1000 |
| pH | 6.5 – 8.5 | 6.5 – 8.5 |
| **Chemical** | | |
| ***Essential Inorganic*** | ***mg/Litre*** | ***mg/Litre*** |
| Aluminium (Al) mg/l | ≤ 0.2 | 0.2 |

| Properties / Performance | Standard Values for Pakistan | Who Standards | Remarks |
|---|---|---|---|
| Antimony (Sb) | ≤ 0.005 (P) | 0.02 | |
| Arsenic (As) | ≤ 0.05 (P) | 0.01 | Standard for Pakistan similar to most Asian developing countries |
| **Barium(Ba)** | 0.7 | 0.7 | |
| Boron (B) | 0.3 | 0.3 | |
| Cadmium (Cd) | 0.01 | 0.003 | Standard for Pakistan similar to most Asian developing countries |
| Chloride (Cl) | < 250 | 250 | |
| Chromium (Cr) | ≤ 0.05 | 0.05 | |
| Copper (Cu) | 2 | 2 | |
| ***Toxic Inorganic*** | ***mg/Liter*** | ***mg/Litre*** | |
| Cyanide (CN) | ≤ 0.05 | 0.07 | Standard for Pakistan similar to Asian developing countries |
| Fluoride (F)* | ≤ 1.5 | 1.5 | |
| Lead (Pb) | ≤ 0.05 | 0.01 | Standard for Pakistan similar to most Asian developing countries |
| Manganese (Mn) | ≤ 0.5 | 0.5 | |
| Mercury (Hg) | ≤ 0.001 | 0.001 | |
| Nickel (Ni) | ≤ 0.02 | 0.02 | |

| Properties / Performance | Standard Values for Pakistan | Who Standards | Remarks |
|---|---|---|---|
| Nitrate ($NO_3$) | < 0.50 | 50 | |
| Nitrite ($NO_2$) | ≤ 3 (P) | 3 | |
| Selenium (SE) | 0.01 (P) | 0.01 | |
| Residual chlorine | 0.2-0.5 at consumer end 0.5-1.5 at source | --- | |
| Zinc (Zn) | 5.0 | 3 | Standard for Pakistan similar to most Asian developing countries |

| Properties / Performance | Standard Values for Pakistan | Who Standards | Remarks |
|---|---|---|---|
| **Organic** | | | |
| Pesticides mg/L | | PSQCA No. 4639-2004. Page No. 4 Table No. 3 Serial No. 20-58 may be consulted.*** | Annex II |
| Phenolic compounds (as Phenols) mg/L | | < 0.002 | |
| Polynuclear aromatic hydrocarbons (as PAH g/L) | | 0.01 (By GC/MS method) | |
| **Radioactive** | | | |
| Alpha Emitters bq/L or pCi | 0.1 | 0.1 | |
| Beta emitters | 1 | 1 | |

*** PSQCA: Pakistan Standards Quality Control Authority

## Proviso:

The existing drinking water treatment infrastructure is not adequate to comply with WHO guidelines. The Arsenic concentrations in some parts of Sindh have been found high then Revised WHO guidelines. It will take some time to control arsenic through treatment process. Lead concentration in the proposed standards is higher than WHO Guidelines. As the piping system for supply of drinking water in urban centers are generally old and will take significant resources and time to get them replaced. In the recent past, Lead was completely phased out from petroleum

products to cut down Lead entering into environment. These steps will enable to achieve WHO guidelines for Arsenic, Lead, Cadmium and Zinc. However, for bottled water, WHO limits for Arsenic, Lead, Cadmium and Zinc will be applicable and PSQCA Standards for all the remaining parameters.

**Sindh Environmental Quality Standards for Noise**

| S. No. | Category of Area / Zone | Effective from 1st Jan, 2015 | | Effective from 1st January, 2015 | |
|---|---|---|---|---|---|
| | | Limit in dB(A) Leq * | | | |
| | | Day Time | Night Time | Day Time | Night Time |
| 1. | Residential Area (A) | 65 | 50 | 55 | 45 |
| 2. | Commercial Area (B) | 70 | 60 | 65 | 55 |
| 3. | Industrial Area (C) | 80 | 75 | 75 | 65 |
| 4. | Silence Zone (D) | 55 | 45 | 50 | 45 |

Note: 1. Day time hours: 6:00 a.m to 10:00 p.m

2. Night time hours: 10:00 p.m to 6:00 a.m

3. Silence zone: Zones which are declared as such by the competent authority. An area comprising not less than 100 meters around hospitals, educational institutions and courts

4. Mixed categories of areas may be declared as one of the four above-mentioned categories by the competent authority.

* dB(A) Leq: Time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

3. **Repeal and Savings.**

(1) The provisions of the Statutory Notification dated 10th August, 2000 and 18th October, 2010, issued by the Ministry of Environment, Government of Pakistan, to the extent of the Province of Sindh are hereby repealed.

(2) All actions taken, proceedings initiated shall be deemed to have been taken and initiated validly under the the provisions of these Rules.

DIRECTOR GENERAL
SINDH ENVIRONMENTAL PROTECTION AGENCY

**Karachi: Printed at the Sindh Government Press**
**28-1-2016**

# Annexure –IV:
# Environmental Monitoring Reports

Quality TESTING SERVICES

EPA Certified Lab
EPA/LAB/Certificate/QTS-11/2013

BUREAU VERITAS Certification

| QMS/III/018 WA | |
|---|---|
| Revision : 03 | Date 14.01.2021 |

# Ambient Air Quality Test Report

| | | | |
|---|---|---|---|
| **Project Name:** | **EIA Incineration Plant Near Northern By Pass Karachi.** | **Test Report No** | **QTS/INS/22/4823** |
| | | **Sampling Duration** | **24'hrs.** |
| | | **Sampling Date:** | **05/09/2022** |
| **Sampling Description** | **Ambient Air, Sampling** | **Site ID** | **24 59 57.3- N,66 57 38.1-E** |

| S. No | Time | $SO_2$ (µg/m³) | NO (µg/m³) | $NO_2$ (µg/m³) | CO (mg/m³) | *$O_3$ (µg/m³) | *$PM_{2.5}$ (µg/m³) | *$PM_{10}$ (µg/m³) | *SPM (µg/m³) | Lead (µg/m³) | Wind Speed (m/s) | Wind Direction (Deg) | Air Temperature (°C) | Humidity (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 10:00 | 27.6 | 22.2 | 33.6 | 1.6 | | | | | | 2.8 | 222 | 28 | 66 |
| 2 | 11:00 | 28.8 | 22.8 | 34.4 | 1.7 | | | | | | 2.9 | 227 | 29 | 65 |
| 3 | 12:00 | 29.0 | 22.9 | 35.7 | 1.9 | | | | | | 3.3 | 231 | 30 | 64 |
| 4 | 01:00 | 31.3 | 23.3 | 35.9 | 2.0 | | | | | | 3.6 | 234 | 31 | 63 |
| 5 | 02:00 | 32.4 | 23.8 | 36.0 | 2.1 | | | | | | 3.8 | 238 | 32 | 64 |
| 6 | 03:00 | 33.5 | 24.0 | 36.3 | 2.2 | | | | | | 4.1 | 244 | 33 | 62 |
| 7 | 04:00 | 34.7 | 24.1 | 36.6 | 2.4 | | | | | | 4.0 | 247 | 34 | 60 |
| 8 | 05:00 | 35.5 | 24.4 | 36.9 | 2.5 | | | | | | 4.2 | 251 | 33 | 63 |
| 9 | 06:00 | 36.6 | 24.7 | 37.2 | 2.6 | | | | | | 3.8 | 247 | 32 | 64 |
| 10 | 07:00 | 37.2 | 24.9 | 37.7 | 2.7 | | | | | | 3.6 | 244 | 32 | 66 |
| 11 | 08:00 | 37.5 | 25.0 | 38.0 | 2.8 | | | | | | 3.5 | 240 | 31 | 67 |
| 12 | 09:00 | 38.4 | 25.3 | 38.6 | 2.9 | 18.4 | 63.3 | 127.8 | 341.2 | ND | 3.0 | 239 | 30 | 68 |
| 13 | 10:00 | 41.2 | 25.6 | 39.0 | 2.7 | | | | | | 2.8 | 233 | 29 | 69 |
| 14 | 11:00 | 40.1 | 25.8 | 40.3 | 2.5 | | | | | | 2.6 | 227 | 28 | 67 |
| 15 | 00:00 | 39.8 | 26.1 | 40.7 | 2.3 | | | | | | 2.3 | 230 | 27 | 66 |
| 16 | 01:00 | 38.6 | 26.6 | 41.4 | 2.2 | | | | | | 2.0 | 225 | 28 | 64 |
| 17 | 02:00 | 38.0 | 26.8 | 43.3 | 1.9 | | | | | | 1.9 | 221 | 29 | 66 |
| 18 | 03:00 | 37.8 | 26.9 | 42.9 | 1.8 | | | | | | 1.7 | 222 | 28 | 65 |
| 19 | 04:00 | 37.2 | 27.1 | 42.4 | 1.6 | | | | | | 1.5 | 217 | 27 | 63 |
| 20 | 05:00 | 36.6 | 27.3 | 41.8 | 1.4 | | | | | | 1.2 | 219 | 26 | 64 |
| 21 | 06:00 | 36.1 | 27.5 | 40.6 | 1.5 | | | | | | 1.6 | 213 | 27 | 65 |
| 22 | 07:00 | 35.8 | 27.8 | 38.5 | 1.3 | | | | | | 1.8 | 219 | 28 | 66 |
| 23 | 08:00 | 35.5 | 27.9 | 38.2 | 1.1 | | | | | | 2.2 | 224 | 29 | 63 |
| 24 | 09:00 | 34.2 | 28.0 | 37.9 | 1.3 | | | | | | 2.5 | 228 | 30 | 62 |
| **Minimum** | | 27.6 | 22.2 | 33.6 | 1.1 | | | | | | 1.2 | 213 | 26 | 60 |
| **Maximum** | | 41.2 | 28 | 43.3 | 2.9 | 18.4 | 63.3 | 127.8 | 341.2 | ND | 4.2 | 251 | 34 | 69 |
| **Average** | | 35.4 | 25.4 | 38.4 | 2.0 | | | | | | 2.7 | 231.0 | 29.6 | 64.6 |
| **SEQS*** | | 120 | 40 | 80 | 5 | 130 | 75 | 150 | 500 | 1.5 | - | - | - | - |

*SEQS= Sindh Environmental Quality Standards (The Gazette of Pakistan) Registered No. EPA/TECH/739/2014*

**= The Average Calculation of 24'hr.,* ND = Not Detected

***Term & Condition:***

- This report is not valid for any negotiations
- Report is valid for current batch(sample)
- This report is intended only for your guidance & not for legal purpose or for advertisement.

**Remarks:** The average concentration calculated for the 24 hours are well within guideline values set by SEQS.

| | |
|---|---|
| **Sample Analyzed By: Ather Adil** | **Signature of Laboratory Incharge:**_____<br>**Name : Ali Raza** |

Quality Testing Services Karachi Q.T.S

Office No.505, Anum Estate Building, Opposite Duty Free Shop, Main Shahrah-e-Faisal, Karachi.
Tel. No. 92-21-34311466, 92-21-34382860, 92-21-34321532, Fax. No. 92-21-34311467

Email: info@qts.com.pk

# Ambient Air Quality Test Report

| | | | |
|---|---|---|---|
| **Client Name:** | **EIA Incineration Plant Near Northern By Pass Karachi.** | **Test Report No:** | **QTS/INS/22/4823** |
| | | **Sample Duration:** | **24hr's** |
| **Sample Description:** | **Ambient Air Quality Test** | **Site ID** | **24 59 57.3- N,66 57 38.1-E** |
| **Sampling Date:** | **05/09/2022** | | |

| Parameter | Unit | Monitoring Duration | Average Obtained Concentration | SEQS | LDL-Limits | Methodology/Instrument |
|---|---|---|---|---|---|---|
| **Carbon Monoxide (CO)** | mg/m³ | 08 Hours | **2.0** | 5.0 | 0.0 | Non-Dispersive Intra Red (NDIR) |
| **Nitrogen oxide (NO)** | µg/m³ | 24 Hours | **25.4** | 40.0 | 0.0 | Chemiluminescence |
| **Nitrogen Dioxide ($NO_2$)** | µg/m³ | 24 Hours | **38.4** | 80.0 | 0.0 | |
| **Sulphur Dioxide ($SO_2$)** | µg/m³ | 24 Hours | **35.4** | 120.0 | 0.0 | Ultraviolet Fluorescence Method |
| **Ozone ($O_3$)** | µg/m³ | 01 Hour | **18.4** | 130.0 | 0.0 | Non-Dispersive UV Absorption Method |
| **Particulate Matter ($PM_{10}$)** | µg/m³ | 24 Hours | **127.8** | 150.0 | 10.0 | β Ray Absorption Method |
| **Particulate Matter ($PM_{2.5}$)** | µg/m³ | 24 Hours | **63.3** | 75.0 | 2.5 | |
| **Suspended Particulate Matter (SPM)** | µg/m³ | 24 Hours | **341.2** | 500.0 | 1.0 | |
| **Lead (Pb)** | µg/m³ | 24 Hours | **ND** | 1.5 | - | ASS Method |
| **Wind Speed (m/s)** | **(m/s)** | 24 Hours | **2.7** | - | 1.0 | (Haz-Scanner) EPAS |
| **Wind Direction (Deg)** | Degree | 24 Hours | **231.0** | - | 1.0 | (Haz-Scanner) EPAS |
| **Air Temperature (°C)** | **(°C)** | 24 Hours | **29.6** | - | - | Thermometer |
| **Humidity (%)** | **(%)** | 24 Hours | **64.6** | - | 1.0 | (Haz-Scanner) EPAS |

*SEQS= Sindh Environmental Quality Standards.
WHO= World Health Organization (WHO Air quality Guidelines 2005)
(24 Hours Standard for all the parameters Except O3 and CO),
µg/m3= Micrograms per Cubic Meter
mg/m3= Milligrams per Cubic Meter
ND= Not Detected
LDL=Least Detection Limit

**Remarks:**
The average concentration calculated for the 24 hours are well within guideline values set by SEQS.

| | |
|---|---|
| **Sample Analyzed By: Ather Adil** | **Signature of Laboratory Incharge:**_____ **Name : Ali Raza** |

Quality Testing Services Karachi Q.T.S

Lab Report Ref. No. : QTS/INS/22/4824 Reporting Date: 07/09/2022

Project: **EIA , Incineration Plant Near Northern by Pass Karachi.**

## SAMPLE DESCRIPTION

Sample ID: Noise Level Test
Sample Description: Ambient *Noise*
No. of samples: 05
Sample Collected/Submitted by: QTS representative
Sampling Date 05/09/2022

## NOISE TEST REPORT

| S.NO. | LOCATION/SOURCE | SEQS Limits : *75dB(A) *Leq | | | |
|---|---|---|---|---|---|
| | | Noise Level Readings | | | |
| | | Coordinates | Minimum | Maximum | Average |
| 1 | Right Corner of the project Area (Front Side)-N1 | **24 59 37.5-N 66° 57' 38.1"E** | 66.8 | 67.4 | 67.1 |
| 2 | Left Corner of the project Area (Front Side)-N2 | **24 59 58.9-N 66° 57' 45.5"E** | 64.5 | 66.3 | 65.4 |
| 3 | Right Corner of the project Area (Back Side)-N3 | **25 00 00.4-N 66° 57' 36.8"E** | 59.7 | 61.1 | 60.4 |
| 4 | Left Corner of the project Area (Back Side)-N4 | **25 00 01.6-N 66° 57' 44.4"E** | 60.8 | 62.4 | 61.6 |
| 5 | Near the Proposed Road Side. M-10 | **24 59 57.8-N 66° 57' 41.9"E** | 63.3 | 64.6 | 63.9 |

**SEQS= Sindh Environmental Quality Standard**
***dB (A) Leq:= Time weighted average of the level of sound in decibel on scale which is relatable to human hearing.**
***Noise Standard Limits for Category (C)-Industrial Area/Zone.**

***Terms & Conditions:***

- This report is not valid for any negotiations
- Report is valid for current batch(sample)
- This report is intended only for your guidance & not for legal purpose or for advertisement.

**Comments:**

The Noise level from the source is within acceptable level as describe in SEQS.

**Sample Analyzed by: Ather Adil**

**Signature of Laboratory In charge:**
**Name : Ali Raza**

Quality Testing Services Karachi Q.T.S