M/S. ECO WASTE MANAGEMENT SERVICES

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

CONSTRUCTION OF FACILITY FOR INCINERATION, RECYCLING, HANDLING AND STORAGE OF INDUSTRIAL HAZARDOUS AND NON-HAZARDOUS WASTE, INCLUDING SCRAP ITEMS

PLOT A-26, KHYBER ROAD, ETIHAD TOWN NORTHERN BYPASS KARACHI

Final Report
August 2023

EHS Services

Environmental & Analytical Solutions

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Plot A-26, Khyber Road, Etihad Town Northern bypass Karachi

Prepared for:
M/s. ECO Waste Management Services

Prepared by:
EHS Management Services (Private) Limited

Date:
August 2023

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Executive Summary

The purpose of this Environmental Impact Assessment report submission to the Sindh Environmental Protection Agency (SEPA) is to grant the proponent an opportunity to install an incineration plant at an industrial site located at Plot A-26, Khyber Road, Etihad Town Northern bypass Karachi West, which is ideally located for siting the hazardous waste incineration facility.

M/S ECO Waste Management Services is planning to establish an incineration facility. The proposed site is located at survey no. 318, UC-8, Plot A-26, Khyber Road, Etihad Town Northern bypass Karachi. The area is well connected to road that will enable its operators to safely transport wastes by road from the industrial areas for incineration. The proposed incinerator is expected to handle **800 kgs/hr** during its peak operation. The facility will provide services of Incineration, Recycling, Handling and Storage of Industrial Hazardous and Non-Hazardous Waste. Following are the types of the waste proposed to be handled at the facility of M/S ECO-Waste Management Services:

- Industrial hazardous waste
- Hospital Waste
- Industrial Non-Hazardous Waste (Scrap Items)
- Hazardous Wastewater Treatment Sludge
- Chemical drums
- Chemical plastic cans and drums
- Asbestos Waste
- Industrial Food Waste

The company is also carrying out waste handling, storage and disposal facilities at Plot # 263, Pir Sarhandi Goth, National Highway Razzaqabad, Karachi Sindh.

Project components during construction of incineration facility of M/s. ECO Waste Management Services.

- Collection, transportation, and handling of hazardous (industrial and hospital) and non-hazardous waste items
- Installation of waste incinerator of 800 kg/hr. capacity.
- Recycling unit for non-hazardous waste items (scrap items)
- Establishment of a safe disposal site for asbestos.

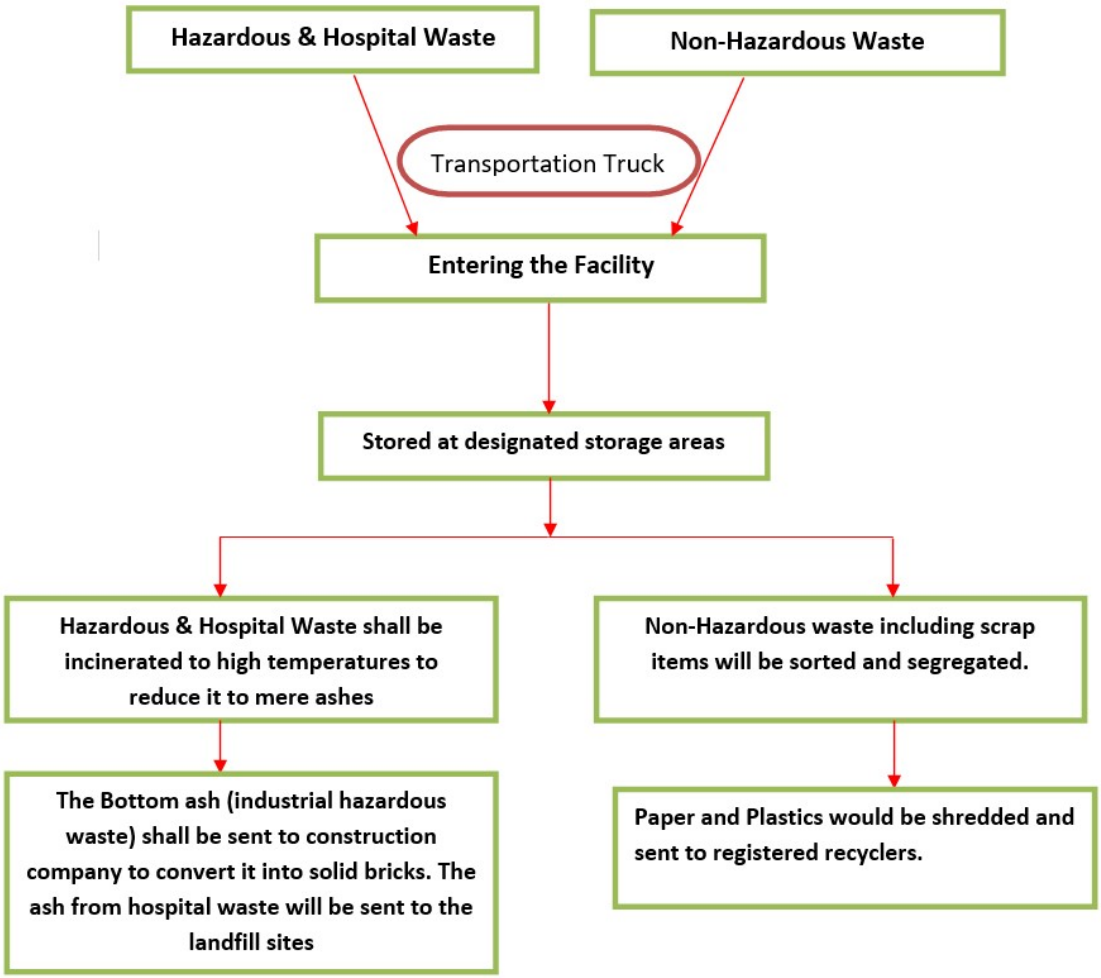

Figure EX-1: Process Flow Diagram

The proposed site for ECO Waste Management Services project has been selected in view of availability of necessary infrastructure and utilities for setting-up the treatment and safe disposal of Hazardous Waste generated from various industries.

The macroenvironment of District West has the largest industrial area. These industries generate considerable amount of incinerable Hazardous Wastes & generate significant amount of waste which can be recycled / reconditioned.

In view of the above, the selected location for the proposed project has been deemed appropriate.

The Site location has the following advantages:

- Site is located in the environs of an Industrial Area.
- Easy availability of infrastructure such as water and power.
- Well connected by Road infrastructure.
- Industries can avail the benefit of proposed common waste treatment facility for disposal of their incinerable hazardous waste & recyclable material.

The impacts of construction phase are temporary in nature and subside once the construction activities get over. Major pollutants generated from construction, erection & commissioning activities are particulate matter (PM10 and PM2.5), NOx, SO2 & CO. Generation of dust from construction activities will be the main cause of increase in PM10 and PM2.5. However, no major construction activity will be required at site for the proposed project. The impacts of construction phase on various environmental attributes are tabulated below:

Table EX-1: Construction Phase: Impact & Mitigation Measures

S. #	***Environmental Attribute***	***Impact***	***Mitigation Measures***
1.	*Land*	→ *The existing land cover of the proposed project site will have a minimal affect from site preparatory works for which clearance of shrubs, preparation of internal roads, excavation and paving of site for installing plant equipment and machineries is required.*	→ *The present land use of macroenvironment is for Industrial purpose.* → *Proposed greenbelt development & plantation will improve the aesthetics of the microenvironment.*
2.	*Soil*	→ *No significant adverse impact on the soil is anticipated from construction & installation work.*	→ *Excavated soil will be reused within site; storm water will be properly channelized to avoid water logging.*
3.	*Air quality*	→ *Dust generation* → *Exhaust emission from vehicles.* → *Exhaust from construction Machinery*	→ *Regular sprinkling of water will be done at the construction site.* → *No unpaved roads will be kept* → *Construction equipments and vehicles will be kept maintained to minimize automobile exhaust*

4.	*Noise levels*	→ *The noise produced during the construction, erection and commissioning activities may add to the existing ambient noise levels.*	→ *The machineries / vehicles will be kept in good order to reduce excessive noise.*
	Water quality	→ *Ground water as well as surface water contamination due to improper management / handling of construction wastes.* → *Non-point discharges of solids* → *Improper discharge of Sewage generated from the construction work force stationed at the site*	→ *Provision of KWSB water supply has been made and will be utilized* → *The construction in the project will be more related to mechanical fabrication, assembly and the erection; hence the water requirements would be small.* → *Septic tanks will be set up for disposal of sewage.*
	Ecology	→ *The impact on the surrounding ecology due to the project will mainly occur from the deposition of dust generated due to construction activities onto the nearby vegetation*	→ *No national park, wildlife sanctuary, biosphere reserve exists within the close proximity of the project site.* → *Agriculture fields dominate the terrestrial ecology in the area.* → *Adequate measures will be taken to suppress dust generated due to construction activities.* → *The incremental emission of air pollutants during construction phase is not likely to induce any significant changes in the terrestrial ecology.* → *No cutting of trees will be done.*
	Socioeconomic Environment	→ *The project will have positive impact on the socioeconomics of the area.* → *Local labour particularly unskilled labour will be employed based on eligibility, during*	→ *The locals would get opportunities for employment in the project. This includes drivers and labors involved in the handling of waste*

		construction as well as post-construction phase.	→ *The socio-economic conditions of the area are expected to improve.*
	Occupational & Community Health	→ *Over-exertion, and ergonomic injuries and illnesses, such as repetitive motion, over-exertion, and manual handling, are among the most common causes of injuries in construction activities.* → *Respiratory issues due to dust* → *High blood pressure etc. due to continuous working near noise generating machinery*	→ *PPEs such as dust masks & earmuffs will be provided to workmen to reduce occupational health hazards.* → *Implementation of administrative controls into work processes, such as job rotations and rest or stretch breaks will be done.* → *Sprinkling of water for dust suppression to minimize dust from vehicle movements & construction activities.*

The following activities may cause impact on air quality during the operational phase:

Table EX-2: Operation Activity, Impact & Mitigation Measures

S. #	***Activity***	***Impact***	***Mitigation Measures***
1.	*Transportation of waste to the facility from industry*	*Generation of dust and emission of HC & CO.*	→ *Water sprinkling for dust suppression.* → *Properly covered vehicles for transportation* → *Regular & preventive maintenance of vehicles.*
2.	*Temporary waste material storage, stabilization & handling, dismantling & segregation*	*Particulate matter emissions & odour generation*	→ *Storage will be done as per Hazardous Substances Rules 2014* → *Standard operating will be* → *developed & implemented* → *Development of green belt for dust & odour suppression*
3.	*Incinerator operations*	*Generation of CO, NOx, SO2, HF, HCl, TSP, dioxin & furan*	→ *Adequate Air Pollution Control System will be installed like Bag Filter, Scrubbers, Mist eliminator, rapid quencher, dioxin & furan control system, ID Fan, HEPA filter & appropriate stack height.*

4.	*ETP operations*	*Generation of Odour*	→ *Development of green belt & landscaping with selection of plant* → *species for odor suppression*
5.	*Operation of DG set*	*Generation of SO_2, NOx, HC, CO & PM emissions*	→ *D.G set is used as back-up power source.* → *Adequate Stack Height provided for proper dispersion of air pollutants*

The proposed project design has integrated mitigation measures with a view to ensuring compliance with all the applicable laws and procedures. From the foregoing, it is concluded that the proposed hazardous waste incinerator project is at appropriate location in as far as land use and interactions with human social and economic setting is concerned. There are no extensive habitations in the neighborhood, no significant sensitive environmental features are found within the vicinity and the area is not fully zoned giving an opportunity to isolate the location for this purpose in future. However, there are certain social concerns that touch on general environmental pollution, groundwater contamination, health of the workers, attraction of human settlements in future and soil contamination. For this reason, appropriate preventive measures have been included in the project design, planning, construction and operation stages.

During the project construction & operation phases, the proponent and contractor will avoid inadequate/inappropriate use of natural resources, conserve nature sensitively and guarantee a respectful and fair treatment of all people working on the project, general public at the vicinity and inhabitants of the project. In relation to the proposed project, mitigation measures that will be incorporated during construction phase, the development's input to the society and cognition that the project proponent is economically and environmentally sound, this development will be considered beneficial and important. The proposed development is a timely venture to tackle Hazardous Waste Management problems through a dedicated facility.

This study recommends that the proposed project be allowed to go ahead provided the outlined mitigation measures are adhered to. Major concerns should nevertheless be focused towards minimizing the occurrence of impacts that would degrade the general environment. This will be achieved through close follow-up and implementation of the recommended Environmental Management and Monitoring plans (EMPs).

1. Introduction

Name of the Project:	Construction of facility for Incineration, Recycling, Handling and Storage of Industrial Hazardous and Non-Hazardous Waste, Including Scrap Items
Name of the Proponent:	M/s. ECO Waste Management Services
Location of the Project:	Plot A-26, Khyber Road, Etihad Town Northern bypass Karachi
Total area of the plot:	3,025 Sq. Yards

Industrialization & Industrial growth in Karachi with the implementation of Hazardous Substances Rules (2014) as well as Hospital waste management rules (2014), has necessitated the need to develop a hazardous waste incineration facility that can deal with the increased demand of industrial hazardous waste & toxic waste disposal and at the same time meet the ever-demanding regulatory framework. The proponent is a private Pakistani entity who intends to develop the site to install an incinerator to facilitate waste management within Karachi.

The availability of a commercial hazardous waste treatment facility is not only a critical environmental issue, but also an essential economic factor for an Industrial Hub like Karachi that aspires to grow its industrial base. Most international companies expect a hazardous waste management program to be in place that is both economical and meets international standards. Besides, without the means to treat and dispose of hazardous wastes, it is not possible to enforce the current environmental legislation. Upon realization of the growing hazardous wastes challenges, the proponent is seeking to install a facility to be able to provide a hazardous waste handling capacity to cater for the need of such waste disposal by ever increasing industrial establishments in the City.

The purpose of this Environmental Impact Assessment report submission to the Sindh Environmental Protection Agency (SEPA) is to grant the proponent an opportunity to install an incineration plant at an industrial site located at Plot A-26, Khyber Road, Etihad Town Northern bypass Karachi West, which is ideally located for siting the hazardous waste incineration facility.

Project location and site view is shown in figure 1.1.

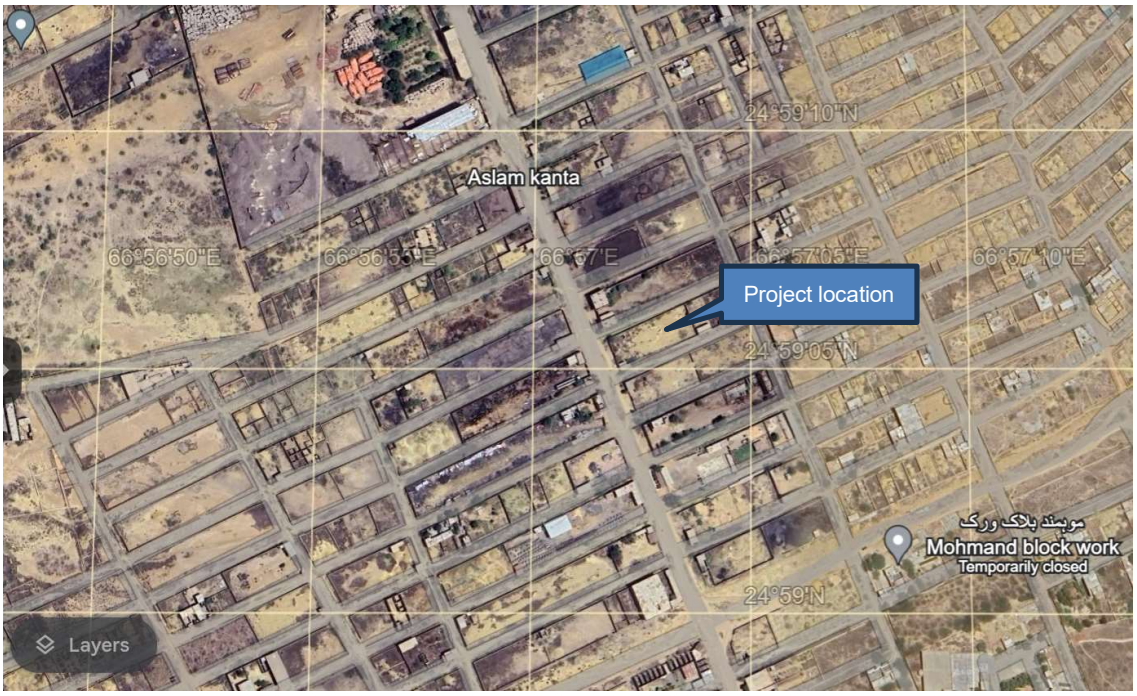

Figure 1.1: Location of Project Site

1.1 Project Overview

M/S ECO Waste Management Services is planning to establish an incineration facility. The proposed site is located at survey no. 318, UC-8, Plot A-26, Khyber Road, Etihad Town Northern bypass Karachi. The area is well connected to road that will enable its operators to safely transport wastes by road from the industrial areas for incineration. The proposed incinerator is expected to handle **800 kgs/hr** during its peak operation. The facility will provide services of Incineration, Recycling, Handling and Storage of Industrial Hazardous and Non-Hazardous Waste. Following are the types of the waste proposed to be handled at the facility of M/S ECO-Waste Management Services:

- Industrial hazardous waste
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- Chemical drums
- Chemical plastic cans and drums
- Asbestos Waste
- Industrial Food Waste

The company is also carrying out waste handling, storage and disposal facilities at Plot # 263, Pir Sarhandi Goth, National Highway Razzaqabad, Karachi Sindh.

Incineration is a high temperature, thermal destruction oxidation process in which hazardous wastes are converted in the presence of oxygen in air into gases and incombustible solid residue. The gases are vented into the atmosphere after passing through an adequate air pollution control system to meet emission guidelines while the solid residue (incineration ash) is sent to authorized landfill for disposal. Any waste can be classified as hazardous, if the waste substance is solid, semi-solid or non-aqueous liquid which because of its quantity, concentration or characteristics in terms of physical, chemical, infectious quality i) can cause or significantly contribute to an increase in mortality or an increase in serious irreversible or incapacitate reversible illness, or ii) pose a substantial present or potential hazard to human health or environment when it is improperly treated, stored, transported, disposed of or otherwise managed. Thus, a waste is hazardous if it exhibits whether alone or when in contact with other wastes or substances, any of the characteristics identified below:

- corrosivity
- reactivity
- ignitability
- toxicity
- explosive
- acute toxicity
- infectious property

1.2 Need for Environmental Impact Assessment (EIA)

The EIA study is a mandatory requirement under the provisions of Sindh Environmental Protection Act 2014 and the rules made thereunder. Sindh Environmental Protection Act, 2014 under section 17 (1) mandatorily requires proponent of project to file an IEE or EIA, as the case may be, and obtain approval from the SEPA before commencing construction or operation of the project. Section 17 (1) of the 2014 Act is reproduced herein under for ready reference:

"17. (1) No proponent of a project shall commence construction or operation unless he has filed with the agency an Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA) and has obtained from the Agency."

Sindh Environmental Protection Agency (Environmental Assessment) Regulations, 2021 made in exercise of powers conferred under section 37 of the Act 2014 categorizes projects in three categories provided in Schedule I, II and III

of the 2014 Regulations. Projects have been classified on the basis of expected degree of adverse environmental impact. Project types listed in Schedule III of the regulations are designated as potentially seriously damaging to the environment and require EIA. The requirement of an EIA study for proposed incineration facility is justified in view of the nature of project category under Schedule III of Regulations 2021, *Category 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.).* It is therefore necessary to prepare a detailed account of the environmental impact of the proposed activities so that appropriate interventions could be taken.

The assessment was conducted with the following objectives:

- To identify possible environmental impacts, both positive and negative
- To assess the significance of the impacts
- To assess the relative importance of the impacts of relative plan designs, and sites
- To propose preventive mitigation and compensative measures for the significant negative impacts of the project on the environment.
- Generate baseline data for monitoring and evaluating how well the mitigation measures are being implemented during the project cycle.
- To present information on impact of alternatives
- To present the results of the EIA that can guide informed decision making and safe operation of the incineration plant.

1.3 Methodology adopted for Environmental Assessment

EHS Management Services (Pvt.) Ltd team was formally inducted in June 2023 to perform the Environmental Impact Assessment (EIA) of proposed incineration plant project. This study has adopted the following methodology for assessment of impact of different activities:

- Environment screening, in which the project was identified as among those requiring environmental impact assessment under schedule II
- Environmental scoping that provided the key environmental issues
- Desk Stop studies and interviews.
- Physical inspection of the site and surrounding areas
- Reporting

1.3.1 Environmental Screening

This step was applied to determine whether an environmental impact assessment was required and what level of assessment was necessary. This was done in reference to requirements of the SEPA (Environmental Assessment) Regulations

2021. Issues considered included the physical location, sensitive issues and nature of anticipated impacts.

1.3.2 Environmental Scoping

The Scoping process helped narrow down onto the most critical issues requiring attention during the assessment. Environmental issues were categorized into physical, natural/ecological and social, economic and cultural aspects.

1.3.3 Desktop Study

This included documentary review on the nature of the proposed activities, project documents, designs policy and legislative framework as well as the environmental setting of the area among others. It also included discussions with managers and design engineers.

1.3.4 Site Assessment

Field visits were meant for physical inspections of the site characteristics and the environmental status of the surrounding areas to determine the anticipated impacts. It also included further interviews with neighbors.

1.3.5 Reporting

Finally, the report has been compiled according to the guidelines for preparation and review of environmental assessment reports. The report includes description of the project, description of microenvironment and macroenvironment, public consultation and screening of potential environmental impact of activities during the pre-construction, construction and operation phases.

The report has been presented in the following sections:
Section 1 - Introduction to Project and EIA Processes
Section 2 - Description of Project
Section 3 - Overview of National and Provincial Legislation & Guidelines relevant to the project and to this EIA
Section 4 - Description of Environment of Project Area
Section 5 - Public Consultation & Participation
Section 6- Screening of Potential Environmental Impacts & Mitigation Measures
Section 7 - Environmental Management and Monitoring Plan (EMP)
Section 8 - Conclusion and Recommendations

2. Description of Project

2.1 Project Objectives

The proposed project objectives are:

- Collection, Transportation, Storage, Handling, Incineration and Disposal of Hazardous (Industrial and Hospital) and Non-Hazardous Waste Material including scrap items.
- Incineration of hazardous and hospital waste through environmentally friendly hazardous waste incinerator of about 800 kg / hour capacity.
- Management and disposal of hazardous and hospital waste in environment friendly waste incinerator
- Reducing, re-using, and recycling the non-hazardous industrial waste and scrap items
- To reduce the burden on the local landfill sites by employing 3R concept of waste reduction
- To convert the industrial food waste items into compost (biodegradation).
- To Remain competitive
- Provide opportunities for project-related community improvements.

2.2 Site Alternatives (Alternatives considered realistically and reason for their rejection)

Many sites were considered before the selection of the proposed location. The proposed site/location has following advantages:

- The site is located in the macroenvironment of industrial activity centre.
- Easy availability of infrastructure such as water and power.
- Availability of raw material (hazardous waste) from nearby areas
- Well connected by road network.
- Well-developed plotting of industrial premises.
- The site does not pose any environmental issue to the community.
- The proposed site does not fall in any category of protected or environmentally sensitive area.

2.3 Location and Site Layout Map

The proposed site is located at Plot A-26, Khyber Road, Etihad Town Northern bypass Karachi". Site Layout of project is attached as Annex. Moreover, the company is also carrying out waste handling, storage and disposal facility at Plot # 263, Pir Sarhandi Goth, National Highway Razzaqabad, Karachi Sindh.

2.3.1 Land Use on the Site

The proposed project site is a barren land. The area is the least populated and other commercial activities are also on a very limited scale. The nearby residential area is 10-12 km away from the proposed site.

2.3.2 Road Access

The proposed project site is easily accessible through Khyber Road, Etihad Town Northern bypass Karachi."

2.3.3 Vegetation Features of the Site

The proposed project site is a barren land and comprises of few wild vegetation mainly grasses and shrubs. No particular species of trees were found at the site.

2.3.4 Cost & Breakdown

The cost of the proposed project is PKR. 80 million and cost break-up is detailed below;

- Installation of hazardous waste Incinerator of Capacity of 800 kg / hour: 45 million Rupees.
- Offices and other auxiliary facilities: 15 million Rupees
- Fire Fighting and other safety equipment: 5 million Rupees
- Gantry Structure (Loading / Unloading):5 million
- Emergency back-up generators: 5 million Rupees
- Land and area rehabilitation, aesthetics and greenery: Rs. 5 million

2.4 Schedule of Implementation

Development work at site will be started after attaining approval from Sindh-EPA. However, the completion time period of the proposed project will be approximately 15 Months.

2.5 Project Description

Project components during construction of incineration facility of M/s. ECO Waste Management Services.

- Collection, transportation, and handling of hazardous (industrial and hospital) and non-hazardous waste items
- Installation of waste incinerator of 800 kg/hr. capacity.

- Recycling unit for non-hazardous waste items (scrap items)
- Establishment of a safe disposal site for asbestos.

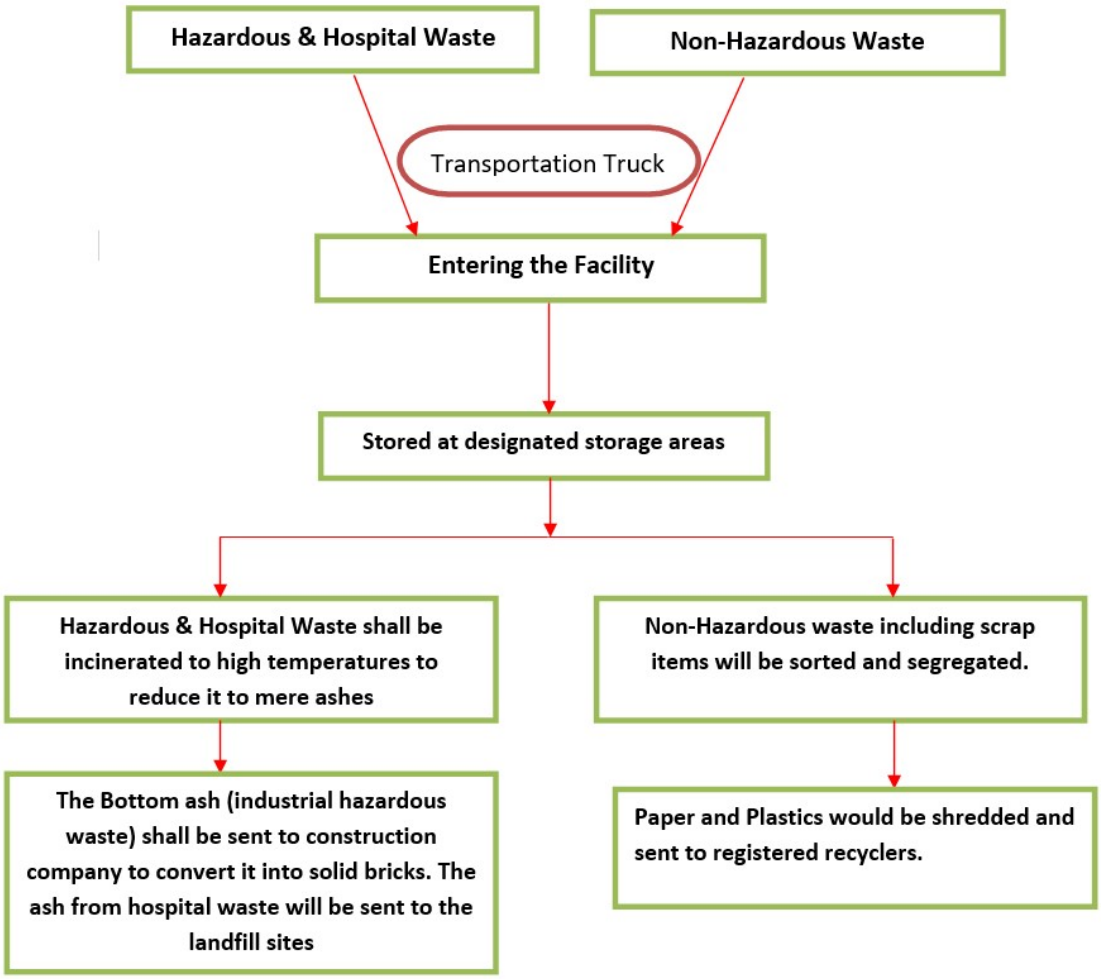


Figure 2.1: Process Flow Diagram

2.5.1 Detailed Process description of Construction/Installation Phase

The activities to be carried out during the construction phase have been listed as follows:

- In the construction phase of the project, M/S ECO Waste Management Service will install incinerator of about 800 kg/hr. capacity for hazardous and hospital waste at proposed site of M/S ECO Waste Management Services.

- The waste incinerator shall incinerate only the industrial and hazardous and hospital waste as per its' capacity of incinerating 800 kg/hr. of industrial and hospital waste on a daily basis.
- The project will also involve the construction of allied facilities of the site, including building the offices, waste storage areas, and washroom areas for the workers and staff.

2.5.2 Technical Features of the Incinerator

M/s. ECO Waste Management Services has proposed to install the incinerator for industrial hazardous and hospital waste, which would have the following technical features installed in it, to maximize the reduction of impacts of incinerating the hazardous and hospital waste on environment:

- **Description of the waste material:**

The waste material proposed to be incinerated at the Site of M/s. ECO Waste Management Services, would of following types:

- Industrial hazardous waste: WWTP sludge, unused and spent chemicals, expired chemicals and other waste material which is contaminated by any harmful agent and is unfit to store or otherwise dispose of in an un-professional manner.
- Pharmaceutical waste: expired bottles, boxes, and expired medicines.
- Hospital Waste: Infectious, Non-Infectious & Pathological Waste
- Scrap items: Paper, Plastic, Iron, carboards etc. and other material which comes under the category of Non-Hazardous Waste.
- Asbestos Waste Items: Engineered landfill

- **Technical features of incinerator**

The technical features of the incinerator are as following:

1. Running Principle
2. Incinerator Components
    - Waste loading facility
    - Combustion chamber
    - Post-combustion chamber
    - Burners
3. Electric control and regulation panel
4. Chimney
5. Wet Scrubber
6. Technical features

- **Running Principle**
    - Waste Destruction Capacity: 800 kg/h
    - Combustion gas would be re-burned in the post-combustion chamber at a temperature of min. 1,300°C.
    - The control panel would be fitted with a functional synoptic view showing the operating situation of the whole installation.

- The incinerator would be designed as a packaged unit, having electrical connection pre-wired and fuel pipes in place, making installation easier at site.

- **Incinerator Components**
- *Waste Feeding Chamber*
  - The incinerator shall have a built-in waste feeding chamber, consisting of a hopper made up of mild steel sheet and internally lined with fire bricks.
- *Combustion Chamber*
  - The first phase of the incineration would be combustion without air comparable to gasification.
  - The combustion chamber shall be made of thick steel sheet.
  - The inside of combustion chamber would be rectangular shape.
  - The insulation of the combustion chamber shall be composed of refractory bricks having high content aluminum and isolation bricks in order to assure a minimum temperature on the outside sheet metal.
- *Composition of the refractory lining:*
  - Refractory bricks:
  - Thickness: 110 mm
  - Maximum temperature: 1,400 °C
  - Nature: 42% of Al_2O_3
- *Insulator:*
  - Thickness: 80 mm
  - Maximum temperature: 1,000 °C-1200°C
  - Nature: Calcium silicate
- *Air Supply Fan:*
  - Electro-ventilator to distribute the primary and secondary air in the incinerator.
  - This combustion hearth would be equipped with primary air nozzles to assure perfect combustion.
  - The air injection would be done with a high-pressure blower in the primary chamber.
  - The adjustment of air rates would be carried out through valves and servomotor according to the automatic cycle controls.
- *Post Combustion Chamber*
  - The post combustion chamber would have a facility for post-combustion of the flue gas produced by the combustion chamber at high temperature.
  - The post-combustion chamber will be situated just beside the combustion chamber so as to re-burn easily the flue gas.
  - The post-combustion of gases will take place at a temperature of 1,200-1300°C.
  - The flue gases would be held for 02 seconds in the post combustion chamber.

- The design of two post-combustion burners would be similar to the combustion burner.
- The post-combustion chamber would be fitted with inspection doors so that a periodical cleaning of dust can be achieved.
- The post-combustion would be lined with high thermal insulating materials with a thickness of 150 mm of refractory bricks and 85 mm of insulator.

- *Burners*
  - There would be four burners. Two burners in the primary chamber and two burners in secondary chamber.
  - The burners will operate on natural gas, crude oil, furnace oil and diesel.
- **Electric control and regulation panel**
  - Power supply would be 380V, 50 Hz three phase.
  - The installed materials would be with well-known marks functioning at the frequencies of 50/60 Hz.
  - Dust-tight control box shall contain:
    - One circuit breaker switch for each engine (ventilator and burners).
    - Four timers with adjustable delay time for controlling each engine (ventilator and burners)
    - One digital display regulator for combustion temperature.
    - One digital display regulator for the post-combustion temperature
    - Control box in compliance with current standards.
- **Chimney**
  - The chimney would be made up of stainless-steel flanged sections with anti-corrosive coating.
  - The height of chimney would be 20 m from the ground putting the incinerator.
  - The chimney would be fitted with sampling port for the collection and measuring of gas samples.
- **Flue Gas Cleaning System**
- *Wet Scrubber*
  - Gas washing system with water sprayer. The gases will pass through the integrated gas washing system, i.e., wet scrubber. The gases will be sprayed with water to remove the particulate matter if present in the gases.
  - The flue gas treatment will be composed of an emergency bypass stack, a flue gas cooling system, two reactors and a particulate filtering system.
- *Cyclones*
  - The gases after leaving the wet scrubber will be subjected to the cyclone section of the incinerator. In a cyclone, the gases will swirl in an anti-clockwise direction, so that the remaining particle in the smoke settles down.
- **Other Technical Features of Incinerator**

- Operation Time: 8 hours daily
- Temperature
  - Combustion Chamber: 800-1200°C
  - Post-Combustion Chamber: 1200-1350°C.
- Burner Power
  - Combustion Chamber: 1000 KW
  - Post-combustion Chamber: 1000 KW
- Gases dwell time in post-secondary chamber: 2 seconds

2.5.3 Detailed Process description of Operational Phase of the Project

This section of the EIA report details the activities of the project proposed to be carried out in the operational phase. As already mentioned, the project may become operational after 15 months of construction/ installation of the machinery, the operational phase is proposed to initiate after successful trial runs of the incinerator. In the operational phase of the project, following would be the proposed stages of the daily operations of the incinerator:

- **Collection and transportation of Hazardous and Hospital Waste**

In this step, the hazardous and non-hazardous waste material from various industries and manufacturing units shall be collected by the specialized vehicles of M/s. ECO Waste Management Services. The vehicle would be equipped with GPS tracking system, CCTVs camera and necessary safety equipment. The workers would be equipped with all the types of necessary personal protective equipment. The PPE, proposed to be involved are: Hard gloves, safety goggles, hard helmets, safety shoes and chemical suits etc., to avoid minimum contact with any type of the hazardous waste they are dealing with. The workers will load the vehicle and ensure the waste is sealed in separate sealed containers and will not come in contact with the environment and workers in during collection and transportation. In case the client had a mixed type of waste material, then M/S ECO Waste Management Services will arrange two vehicles subsequently and avoid the mixing of hazardous and non-hazardous waste material. The vehicles shall be monitored through its vehicle tracking system and through geo-fencing.

- **Unloading of Waste**

At the proposed incineration facility of M/s. ECO Waste Management Services, the workers would unload the vehicle containing the hazardous waste by following proper health safety and environment procedure with zero tolerance. The waste material, as per its' nature, shall be stored temporarily in the storage areas proposed to be constructed under current project. The storage room shall have the following specifications:

- Conditions: dry mostly
- Ventilation: through huge exhaust fans proposed to be installed in ceilings and wall of the warehouse, so that the hazardous fumes may not accumulate in the area

- The warehouses shall have their proper firefighting systems, smoke detectors and fire alarms installed in them.
- The warehouses shall have separate emergency exits, which shall not be blocked in any case.
- Hospital waste shall be stored separately and shall be subjected to incineration immediately.
- The workers would be given proper training on a quarterly basis on the subject of using the firefighting equipment and using the emergency exits and responding to the emergency sirens and bells in case of emergency.

The waste shall be stored, as per the storage instructions given in the MSDS (material safety Data Sheets) of the type of the chemical in the waste, which is proposed to be stored in the warehouse for some time. The waste material shall be stored for a limited period of time, after which it will be incinerated as per the prescribed incineration policy of M/s. ECO Waste Management Services.

- **Incineration**

In this step, the hazardous and hospital waste material will go through a proper incineration channel, in order to de-contaminate it and dispose it of finally in an environmentally safe manner. Following steps would be followed for the proper incineration of the hazardous industrial waste:

- The incinerator shall be pre-heated to temperatures around 400-500°C.
- After pre-heating, the primary chamber of the incinerator will be fed with hazardous and hospital waste. The rotary type primary chamber will initiate the incineration operation and through this very particular action of the primary chamber, the waste material will be homogenized and to ensure the complete incineration of the industrial hazardous waste material.
- The temperature will escalate from 800 to 11000C, which is enough to reduce the huge amount of industrial waste to mere ashes.
- After and during the incineration operation in the primary chamber, the gases produced during the combustion of the hazardous and hospital waste material will be pushed into the secondary chamber of the incinerator where they are incinerated to the highest possible temperatures the secondary chamber of the machine can ever bear, i.e., from 1200 to 13500C.
- At these high temperatures in the secondary chamber, all types of dioxins and furans will be incinerated in the secondary chamber, from where the gases are pushed towards the wet scrubbers to eliminate remaining particulate matters, if still present in the smoke after the high temperature treatment.
- Leaving the wet scrubbers, the gases will be swirled in anti-clockwise direction in the cyclones to remove any other particulate matter present in them.

- **De-Ashing System**

The bottom ashes produced as a result of the incineration will be removed from the primary chamber during the cooling hours of the machine. The ashes recovered from the incineration operations will be stored in specialized ash containers. The samples of the ash will be subjected to laboratory analysis to determine the nature of ash, i.e., hazardous or non-hazardous. If the ash is found to be inert and non-hazardous, it will be mixed with the construction material to convert it into bricks. If the ash is found to be hazardous and reactive, then it will again be subjected to incineration again.

In case of the incineration of Hospital Waste, the ashes produced as the result of the operations will also be subjected to the laboratory analysis for the determination of the hazardous nature. If the ash is found to be non-hazardous, it will be sent to the landfill site for deep burial. The hazardous ash would again be subjected to another cycle of incineration, till the time it loses its hazardous nature and can be sent to the landfill site for deep burial.

2.5.4 Management of Non-Hazardous Waste Material and Scrap Items

The non-hazardous waste material from industries and manufacturing units will be sorted, and following process will be adopted to manage and dispose of the non-hazardous waste material in an environmentally safe and sound management of the scrap items:

- The non-hazardous waste material shall be stored separately and shall not be mixed with the hazardous waste material.
- If the non-hazardous waste material is assumed to be contaminated, then it shall be decontaminated before incineration operation and then shall be subjected to recycling.
- The non-hazardous waste material as per their nature and type shall then be sent to the registered recyclers.
- The company will provide services like Recycling, Storage and Handling of Non-Hazardous Industrial Waste.
- The company is also providing similar services of non-hazardous waste handling, storage and recycling at Plot # 263, Pir Sarhandi Goth, National Highway Razzaqabad, Karachi Sindh.

2.5.5 Quarterly Environmental Monitoring

M/s. ECO Waste Management Services (Proponent) shall carry out environmental monitoring of the facility on a monthly basis through an Independent Monitoring Consultant (IMC) and submit its findings and results to Sindh EPA regularly.

Hazardous waste generated at site will be handled & stored as per Hazardous Substances Rules 2014 and will be disposed as per prescribed procedures.

2.6 Estimated Manpower Requirement in Construction Phase

The proposed project will require 30 persons (20 persons directly involved) for installation of the Incinerator while 10 persons (5 persons directly involved) for operations and support services.

2.7 Water Requirement

Groundwater is available at an average depth of 40-50 feet below surface while at a depth of 450-500 feet, greater quantities of good quality ground water is available from where most of the city water is derived. The water requirements of the proposed installation will be fulfilled by installing tube wells. The source of water for the proposed project will be Ground Water through tube wells. Water consumption during operational phase will be 375 gal per day for personnel use.

2.8 Energy Requirement

The energy requirements of the proposed project will be met from the main K-Electric line which is near the proposed incinerator-site. Generally, the supply of electricity is smooth and without any interruption. Total approx. units consumed by the Incinerator plant are 276/Day and it consumes 7196.8 units for 26 Days (s). Under load shedding conditions a generator of 50 KVA will be installed by the proponent to supply the electricity to the Incinerator.

2.9 Restoration and Rehabilitation Plan

The main areas to be considered for site restoration include the plant site, camp sites area, temporary tracks; land used for vehicle and material stores etc. These areas would be restored to their original condition with the maximum possible effort. The restoration work comprises the removal of temporary work equipment and removal of any fence installed, leveling of areas (wherever required), etc. The following procedures would be adopted for the restoration of the site:

- All temporary equipment built for the site development would be removed.
- Site for labor camp would be restored to its previous conditions as much as possible.
- Any debris from the establishment of the project activities would be removed properly from the site.
- All fencing and gates will be removed, and additional pits will be backfilled.

- The whole of the site will be covered with the original soil to the original levels and grades and vegetation will be done, where required.

Finally, after the completion of the restoration process, the proponent and the supervisory consultants will inspect the site and the proponent would give the restoration clearance to the contractor.

3. Statutory Requirements

Presented in this section are the Policy, Legal and Administrative Framework applicable to Project in the context of sustainable development. All legal provisions relevant to environmental protection applicable to the planning, construction and operation were identified under the scope of the EIA. The proponent has to be well aware of these requirements and comply with the provisions as applicable and necessary.

3.1 Administrative Framework

Before the 18th amendment in the Constitution of Pakistan, the environmental issues were governed under the federal regime through Pakistan Environmental Protection Act, 1997. As a result of the 18th Amendment this subject is now in the exclusive domain of the provincial government. The Ministry of Environment at the federal level was abolished. Its functions related to national environmental management were transferred to the provinces. To manage the international obligations in the context of environment, a new ministry - the Ministry of Climate Change – was created at the federal level. As of now, all four provinces have enacted their own environmental protection laws.

For Sindh province, the Sindh Environmental Protection Act, 2014 (SINDH ACT NO.VIII OF 2014) was passed by the Provincial Assembly of Sindh on 24th February, 2014 and assented to by the Governor of Sindh on 19th March, 2014 and published in official gazette on Thursday March 20, 2014. (Hereinafter the Sindh Environmental Protection Act, 2014 is referred to as the *"2014 Act"*).

Under the 2014 Act, the Environmental Protection Council (*the "EPC"*) 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 EPC within the framework of the 2014 Act acts as a policy making body. 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 & assist Federal Government in implementation of various provisions of UN Convention on laws on Seas (UNCLOS).

Sindh Environmental Protection Agency (*the "SEPA"*) establishes under the provisions of the 2014 Act is headed by Director General with the aim to exercise the powers and perform the functions assigned to it under the provisions of the 2014 Act and the rules and regulations made there under. The SEPA acts as the executive body of the provisions of the 2014 Act. It has technical and legal staff and may form advisory committees. SEPA requires preparing environmental policies, taking measures for implementation of environmental policies, preparing Sindh Environment Report and preparing or revising Sindh Environmental Quality Standards. It also establishes 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 has powers to enter or inspect under a 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 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.

The 2014 Act also provides for establishing Sindh Sustainable Fund derived from various sources such as voluntary contributions or fees generated etc. This fund is utilized for protection, conservation or improvement of environment.

Under the 2014 Act and rules and regulations made there under a complete framework for pre and post approval is given, which a proponent of project requires to comply with.

3.2 Statutory Framework

As stated supra after 18th Amendment in Constitution of Pakistan, 1973 subject of environmental protection is devolved to the provinces and all provinces have enacted their own provincial environmental protection acts, rules and regulations. Now all matters related to environmental protection are governed under respective provincial environmental protection laws. However, it would apposite to give here a brief history of the development of statutory environmental framework in the Country. Prior to the 18th Amendment to the Constitution of Pakistan in 2010, the legislative powers were distributed

between the federal and provincial governments through two 'lists' attached to the Constitution as Schedules. The Federal list covered the subjects over which the federal government had exclusive legislative power, while the 'Concurrent List' contained subjects regarding which both the federal and provincial governments could enact laws. The subject of 'environmental pollution and ecology' was included in the Concurrent List and hence allowed both the national and provincial governments to enact laws on the subject. However, as a result of the 18th Amendment this subject is now in the exclusive domain of the provincial government. The Ministry of Environment at the federal level was abolished. Its functions related to national environmental management were transferred to the provinces. To manage the international obligations in the context of environment, a new ministry - the Ministry of Climate Change – was created at the federal level. The PEPA 1997 is no longer applicable to the provinces. The provinces have enacted their own environmental protection laws. These provincial laws are largely based on PEPA 1997 and, hence, provide the same level of environmental protection as the parent law. Between 1993 and 2010, the Pak-EPA promulgated several rules, regulations, standards, and guidelines to implement the provisions of the PEPA 1997. The province of Sindh has made its own rules and regulations. However, sectorial guidelines made under PEPA 1997 are still useful document to benefit from.

Sindh EPA has taken lead in finalizing and notifying the Sindh Provincial rules, regulations and standards.

- On December 16, 2014, SEPA enacted the Sindh Environmental Protection Agency (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulations, 2014 (the "IEE-EIA Regulations").

- On December 19, 2014, SEPA enacted the (i) Environmental Sampling Rules 2014, (ii) Hazardous Substances Rules, 2014, (iii) Sindh Environmental Protection (Composition of Offences and Payment of Administrative Penalty) Rules 2014, (iv) Sindh Environmental Protection Tribunal Rules, 2014, (v) Sindh Hospital Waste Management Rules, 2014, (vi) Sindh Environmental Quality Standards (Certification of Environmental Laboratories) Rules 2014, (vii) Sindh Prohibition of Non-degradable Plastic Products (Manufacturing, Sale and Usage) Rules 2014, (viii) Sindh Sustainable Development Fund (Procedure and Utilization) Rules 2014, and (ix) Sindh Environmental Quality Standards (Self-Monitoring and Reporting by Industry) Rules 2014.

- 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.

For purpose of this report, the 2014 Act, Sindh Environmental Protection Agency (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulations, 2014 (*"2014 Regulations"*) and other relevant rules and regulations made under the 2014 Act are applicable.

3.3 Constitutional Provision

The Constitution of Pakistan is supreme law of the Country. It is one of the few constitutions in the world, which covers environmental protection and considers it one of the fundamental rights of citizens of Pakistan. Article 9 & 14 of the Constitution bestows fundamental right to life and dignity to every citizen. The Supreme Court of Pakistan in landmark judgment in the case of Shehla Zia and others versus WAPDA (1994) referred to both these Articles and laid down the foundation of modern environmental law in Pakistan. The august Court held that the word "life" in the constitution has not been used in a limited manner. A wide meaning should be given to enable a man not only to sustain life but to enjoy it. Under the Constitution, Article 14 provides that the dignity of man and subject to law the privacy of home shall be inviolable. The fundamental right to preserve and protect the dignity of man under Article 14 is unparalleled and could be found only in few Constitutions of the world. The Constitution guarantees dignity of man and also right to "life" under Article 9 and if both are read together, question will arise whether a person can be said to have dignity of man if his right to life is below bare necessity like without proper food, clothing, shelter, education, health care, clean atmosphere and unpolluted environment.

3.4 Sindh Environmental Protection Act, 2014

The 2014 Act as stated above is the basic legislative tool empowering the provincial government to frame regulations for the protection of the environment. The 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 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…'

- 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.'

- 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;

  - (c) 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 impact 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 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.

- 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 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'.

- 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; and

  - (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'.

3.5 Sindh EPA (Review of IEE and EIA) Regulations 2014

Sindh Environmental Protection Agency (Review of IEE / EIA) Regulations, 2014 ("2014 Regulations") made in exercise of powers conferred under section 37 of the Act 2014 provide the necessary guidelines on the preparation, submission, & review of Initial Environmental Examinations (IEEs) and Environmental Impact Assessments (EIAs). The regulations categorize projects in three categories provided in Schedule I, II and III of the 2014 Regulations.

The project falls in Schedule II (List of Projects requiring EIA) of the 2014 Regulations.

The submission and approval procedure for the EIA is summarized below:

- The EIA report shall be submitted, together with a review fee and form included as Schedule-V of the Sindh IEE/EIA Regulations 2014.
- The SEPA shall conduct a preliminary scrutiny and reply within 15 working days of the submittal of the report a) confirming completeness, or b) asking for additional information, if needed, or c) returning the report requiring additional studies, if necessary.
- The SEPA is required to make every effort to complete the EIA review process within four months of the issue of confirmation of completeness.
- SEPA shall call for a Public Hearing for the project to invite all the concerned persons to raise concerns on the project.
- Following the Public Hearing, SEPA shall constitute a Committee of Experts to assist the agency in review of the EIA.
- The approval granted at the end of the review process is valid for three years for start of construction.
- Once project construction has been completed, the proponent is required to submit a request to the SEPA for confirmation of compliance. An environmental management plan for the operation phase is to accompany the request.
- The SEPA is required to communicate its decision within four months of receipt of the request. The project can commence operation only after it has received approval from the SEPA.

3.6 Sindh Environmental Protection Agency (Environmental Assessment) Regulations, 2021

Sindh Environmental Protection Agency (Environmental Assessment) Regulations, 2021 made in exercise of powers conferred under section 37 of the Act 2014 provide the necessary guidelines on the preparation, submission, & review of Initial Environmental Examinations (IEEs) and Environmental Impact Assessments (EIAs). The regulations categorize projects in three categories provided in Schedule I, II and III of the 2021 Regulations. The proposed project falls in Schedule III of Regulations 2021, Category 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.).

3.7 Guidelines for Public Consultation

Public consultation is mandated under Sindh's environmental law. Regulation 11 of the 2014 Regulations provides the general requirements whereas the sectoral guidelines indicating specific assessment requirements are provided in the Guidelines for Public Consultation 1997 (the 'Guidelines'). These are summarized below:

- **Objectives of Public Involvement:** 'To inform stakeholders about the proposed project, to provide an opportunity for those otherwise unrepresented to present their views and values, providing better transparency and accountability in decision making, creating a sense of ownership with the stakeholders'.
- **Stakeholders:** 'People who may be directly or indirectly affected by a proposal will clearly be the focus of public involvement. Those who are directly affected may be project beneficiaries, those likely to be adversely affected, or other stakeholders. The identification of those indirectly affected is more difficult, and to some extent it will be a subjective judgment. For this reason, it is good practice to have a very wide definition of who should be involved and to include any person or group who thinks that they have an interest. Sometimes it may be necessary to consult with a representative from a particular interest group. In such cases the choice of representative should be left to the group itself. Consultation should include not only those likely to be affected, positively or negatively, by the outcome of a proposal, but should also include those who can affect the outcome of a proposal';
- **Mechanism of consultations: '**Provide sufficient relevant information in a form that is easily understood by non-experts (without being simplistic or insulting), allow sufficient time for stakeholders to read, discuss, consider the information and its implications and to present their views, responses should be provided to issues and problems raised or comments made by

stakeholders, selection of venues and timings of events should encourage maximum attendance';

- **Timing and Frequency:** Planning for the public consultation program needs to begin at a very early stage; ideally it should commence at the screening stage of the proposal and continue throughout the EIA process;
- **Consultation Tools:** Some specific consultation tools that can be used for conducting consultations include; focus group meetings, needs assessment, semi-structured interviews; village meetings and workshops;
- **Other Important Considerations:** 'The development of a public involvement program would typically involve consideration of the following issues; objectives of the proposal and the study; identification of stakeholders; identification of appropriate techniques to consult with the stakeholders; identification of approaches to ensure feedback to involved stakeholders; and mechanisms to ensure stakeholders' consideration are taken into account'.

As above, the Guidelines for Public Consultation introduce effective ways to inform the contents of the project to the general public during the planning stage and that eventually consensus building toward the implementation of project is reached.

Incorporating public involvement into the stages of environmental assessment is explained in the guidelines that public consultation meeting has to be carried out after the works on "developing options, assessing and mitigating impacts" for comments and assessment.

3.8 Hazardous Substances Rules 2014

These rules may be called the Hazardous Substances Rules, 2014.

Substances prescribed as hazardous substances. As provided in subclause (b) of clause (xxv) of section 2, substances listed in Schedule-I are hereby prescribed as hazardous substances.

Packing and labeling. -

(1) A container of a hazardous substance shall be of such size, material and design as to ensure that –

(a) it can be stored, transported and used without leakage and safely;

(b) the hazardous substance therein does not deteriorate in a manner as to render it more likely to cause, directly or in combination with other substances, an adverse environmental effect.

(2) The following information shall be printed conspicuously, legibly and indelibly on every container of a hazardous substance:

(a) name of the hazardous substance;

(b) name, address and license number of the licensee;

(c) net contents (volume or weight);

(d) date of manufacture and date of expiry, if any;

(e) a warning statement comprising –

(i) the word "DANGER!" in red on a contrasting background;

(ii) a picture of a skull and cross-bones;

(iii) pertinent instructions for use, storage and handling and safety precautions relating thereto.

(f) instructions regarding return or disposal of the empty container:

Provided that if the hazardous substance has an inner container as well as an outer container, the information shall be printed on both containers:

Provided further that if it is impracticable to print the aforesaid information on the container itself due to its size, material or design, the same shall be printed on a label or tag which shall be conspicuously affixed or attached to the container in such manner as to render it difficult to remove. The empty chemical containers or drums may not be used for other purposes:

(g)basic instructions mentioning immediate steps to be taken in case of any accident or emergency, preferably in local language.

Conditions for premises.

(1) The premises in which a hazardous substance is generated, collected, consigned, treated, disposed of, stored or handled shall

(a) comply with the conditions specified in Schedule-IV;

(b) be fitted with a notice on the outer door or gate bearing the following information:

(i) the words "DANGER ! HAZARDOUS SUBSTANCE!" in red, on a contrasting background; and

(ii) a prominent picture of a skull and cross-bones.

(2) In case of import of hazardous substances, proponent shall provide approval from Climate Change Division (International Convention Wing) Government of Pakistan.

3.9 Sindh Environmental Quality Standards (SEQS)

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 Sindh environmental quality standard 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**	*80µg/m³*	*Ultraviolet Fluorescence Method*
	*24 hours***	*120µg/m³*	
Oxides of Nitrogen as (NO)	*Annual Average**	*40µg/m³*	*Gas Phase Chemiluminescence*
	*24 hours***	*40µg/m³*	
Oxides of Nitrogen as (NO_2)	*Annual Average**	*40µg/m³*	*Gas Phase Chemiluminescence*
	*24 hours***	*80µg/m³*	
O_3	*1 hour*	*130µg/m³*	*Non dispersive UV absorption méthode*
Suspended Particulate Matter (SPM)	*Annual Average**	*360µg/m³*	*High volume Sampling, (Average flow rate not less than 1.1m³/minute)*
	*24 hours***	*500µg/m³*	
Respirable Particulate Matter (PM10)	*Annual Average**	*120µg/m³*	*B Ray absorption method*
	*24 hours***	*150µg/m³*	
Respirable Particulate Matter (PM2.5)	*Annual Average**	*40µg/m³*	*B Ray absorption method*
	*24 hours***	*75µg/m³*	
	1 hour	*15µg/m³*	
Lead (Pb)	*Annual Average**	*1µg/m³*	*ASS Method after sampling using EPM 2000 or equivalent Filter paper*
	*24 hours***	*1.5µg/m³*	

Carbon Monoxide (CO)	8hours**	5mg/m³	Non Dispersive Infra Red (NDIR) method
	1hours	10mg/m³	
*Annual arithmetic means 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.			

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 Sindh Environmental Quality Standard for noise.

Table 3.3: Sindh Environmental Quality Standard for Noise			
S. No.	Category of Area / Zone	Limit it in dB(A) Leq*	
		Day Time	Night Time
1	Residential area (A)	55	45
2	Commercial area (B)	65	55
3	Industrial area (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. No.	**Parameter**	**Into Inland Waters**	**Into Sewage Treatment**	**Into Sea**	**unit**
1	Temperature or Temp. increase	<3	<3	<3	°C
2	pH value (H^+)	6-9	6-9	6-9	
3	Biological Oxygen Demand $(BOD)_5$ at 20 °C	80	250	80	mg/l
4	Chemical Oxygen Demand $(COD)_{Cr}$	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 2.5: 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 (E.Coli or 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			8	Cadmium (Cd)	0.01

	Treated water in the distribution system (E.coli or 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.*	*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*			

3.10 Sindh Prohibition of Child Employment Act, 2017

Article 11(3) of the Constitution of Pakistan prohibits employment of children below the age of 14 years in any factory, mines or any other hazardous employment. In accordance with this Article, the Prohibition of Child Employment Act (PCEA) 2017 disallows the child labor in Sindh. The PCEA defines a child as a person who has not completed his/her fourteenth years of age, and an adolescent means a person who has completed fourteenth year of age but has not completed eighteenth years of his age. No child shall be employed or permitted to work in any establishment including construction, but an adolescent can be employed or permitted to work under strict guidelines provided in the PCEA and rules. An adolescent shall not be employed in any hazardous work included in the schedule to the PCEA.

3.11 Land Acquisition Act, 1894

The Land Acquisition Act, 1894 (LAA) governs land acquisition against compensation for public interest projects. It is termed as draconian law because it gives complete powers to the government to acquire the land and there is no provision for landowner to refuse transferring the land. Only remedy to a landowner is to challenge quantum of compensation, that too, through a civil court where decades pass in deciding the matter. The Act gives power to the Government to acquire the land under emergency clause under which requirement of prior public notice is exempted.

3.12 Pakistan Panel Code, 1860 (PPC)

Chapter XIV of the 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 disease dangerous to life. The chapter also deals with environmental pollution.

3.13 Sindh Solid Waste Management Board Act, 2014

A board established under the Act for management of collection and disposal of all solid waste, to arrange for effective delivery of sanitation services, and to deal with other relevant matters. Under the Act, the board shall have the right over the solid waste related issues, assets, funds and liabilities of the Councils and shall possess sole rights on all kinds of solid waste within the limits of all Councils.

3.14 Disaster Management Act, 2010

This Act was enacted to provide for the establishment of a National Disaster Management System for Pakistan. Sindh Disaster Management Authority enforces the Act. The Act defines 'disaster' as a catastrophe or a calamity in an affected area, arising from natural or man-made causes or by accident which results in a substantial loss of life or human suffering or damage to, and destruction of, property. Disaster management includes preparedness and response. The Act provides establishment of disaster management authorities at national, provincial and district levels. The authorities require preparing and implementing disaster management plan for their area.

3.15 The Sindh Occupational Safety and Health Act, 2017

The Sindh Occupational Safety and Health Bill 2017 has been approved by the Provincial Assembly of Sindh (Ref. Sindh Bill No. 27 of 2017) and enacted as the Sindh Occupational Safety and health Act, 2017. The Act makes provision for

Occupational Safety and Health conditions at all workplaces for the protection of persons at workplaces against risk of injury arising out of the activities at work places and the promotion of safe, healthy and decent working environment adapted to the physical, physiological and psychological needs of all persons at work.

3.16 Sindh Drinking Water Policy, 2017

Public Health Engineering & Rural Development Department, Government of Sindh, with the approval of Chief Minister Sindh issued the drinking water policy on 3rd May 2017. The main principles of Sindh Drinking Water Policy, adopted from the National Drinking Water policy 2009, and aligned with the Sustainable Development Goals, are as follows:

- Access to safely managed drinking water is a fundamental right of every citizen and that it is the responsibility of the Government to ensure its provision to all citizens,
- Water allocation for drinking purpose shall be given priority over other uses,
- In order to ensure equitable access, special attention shall be given to removing the existing disparities in coverage of safe drinking water and for addressing the needs of the poor and the vulnerable on priority basis.
- Recognizing that inadequate and unsafe water supply and sanitation are a major cause of diarrhea and nutritional deficiency in children, which as a consequence contribute towards child mortality. Safely managed drinking water supply and sanitation shall be integrated in health, nutrition and school health programs.
- Access shall be increased to high quality nutrition-sensitive services, including access to water, sanitation facilities, and hygiene.
- Key hygiene actions (safe drinking water, hand washing with soap, safe disposal of excreta, food hygiene) shall be integrated as essential components in all nutrition programs.
- Realizing the fact that access and availability of safe drinking water affects all aspects of life of a citizen, a multi sectoral approach, involving different departments of the government, shall be adopted to address the issues related to safe drinking water.
- Being cognizant of the fact that women are the main providers of domestic water supply and maintainers of hygienic household environment, their participations in planning, implementation, monitoring and operation & maintenance of water supply systems shall be ensured, and WASH shall be integrated in maternal and neonatal health programs.
- Responsibilities and resources shall be delegated to local authorities to enable them to discharge their assigned functions with regard to provision of safe water supply.

- A supportive policy framework shall be developed that encourages alternate options through private provision, public private partnerships, the role of NGOs and community organizations.
- The execution of component-sharing model for government programs and projects shall be promoted to ensure financial sustainability and community and private sector involvement in development and O&M.
- Low cost technologies in water and sanitation, that are easy and cost-effective to maintain shall be developed and used.

3.17 Sindh Sanitation Policy, 2016

The goal of the Provincial Sanitation policy is to ensure that the entire population of Sindh has access to a safely managed sanitation service and sanitary environment that is also nutrition- sensitive and hygienic. The motto of the policy was 'Saaf Suthro Sindh' (Neat & Clean Sindh). The Policy sets targets to achieve its motto. For instance, eradication of Open Defecation from Sindh Province by 2025, while 70% villages of 13 high priority districts achieve the status of open defecation free by 2020; create and develop wastewater treatment mechanisms to cover 75% of urban areas and 40% in rural areas by 2025, and implement integrated solid waste management with 100% coverage in urban areas and 60% in rural areas of Sindh by 2025. A WASH behavior change and communication strategy has also been developed for sustainable and safe hygiene environment by 2025 to enhance the living standards of the people of Sindh.

3.18 Sub Soil Water (Extraction and Consumption) Regulations, 2018

Besides many one big achievement of the Supreme Court appointed water commission was ensuring making of regulations on sub soil water. The Regulations are made in exercise of the powers conferred under section 16 of the KW&SB Act 1996. The Regulation introduces license regime for sub soil water extraction and consumption by industrial consumers. It empowers the Board established under KW&SB Act 1996 to ask for carrying out hydrological study and tests to qualify for applying for the license. The Regulations prohibit transportation of extracted water through water tankers and discourages water extraction in excess. The Board retains power of inspection of the water abstraction facility and cancellation of license in case of violation of the terms and conditions of the license.

4. Description of Environment

This section describes the current environmental and socioeconomic conditions of the microenvironment and macroenvironment of the Project area.

The macroenvironment is part of Karachi West District, an administrative district of Karachi Division. Bounded on the north and northwest by Lasbella district of Balochistan Province, on the northeast by Karachi (East) district. On the east by Karachi Central, Karachi (West) and Karachi (South) district and on the South by Arabian Sea. District West incorporates areas of Mauripur, Harbour, Baldia, SITE, Mominabad, Korangi and Manghopir sub-divisions (Figure 4.1). Baldia Town is bordered by SITE Town and Orangi to the east and by Keamari Town to the north and west, with most of the western boundary formed by part of the RCD Highway.

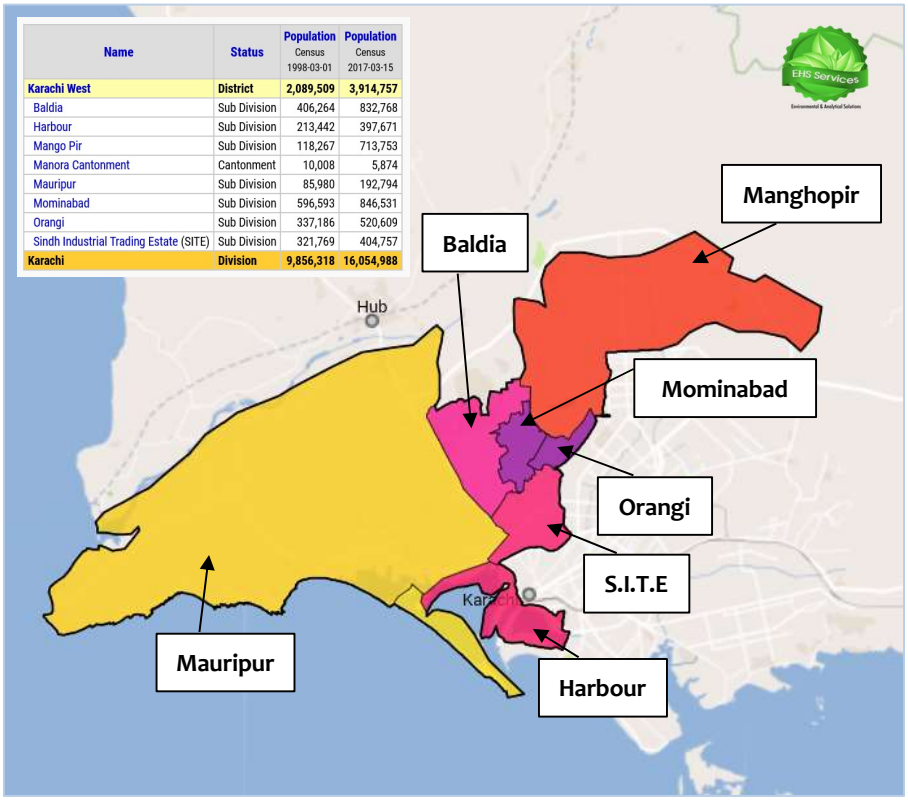


Figure 4.1: Karachi District West & Its Sub-Divisions

The microenvironment comprises proposed project site located at survey no. 318, UC-8, Plot A-26, Khyber Road, Etihad Town Northern bypass Karachi. The Northern Bypass in Karachi, Pakistan, is connected to several important roads

and highways, providing accessibility and connectivity to various parts of the city and surrounding areas.

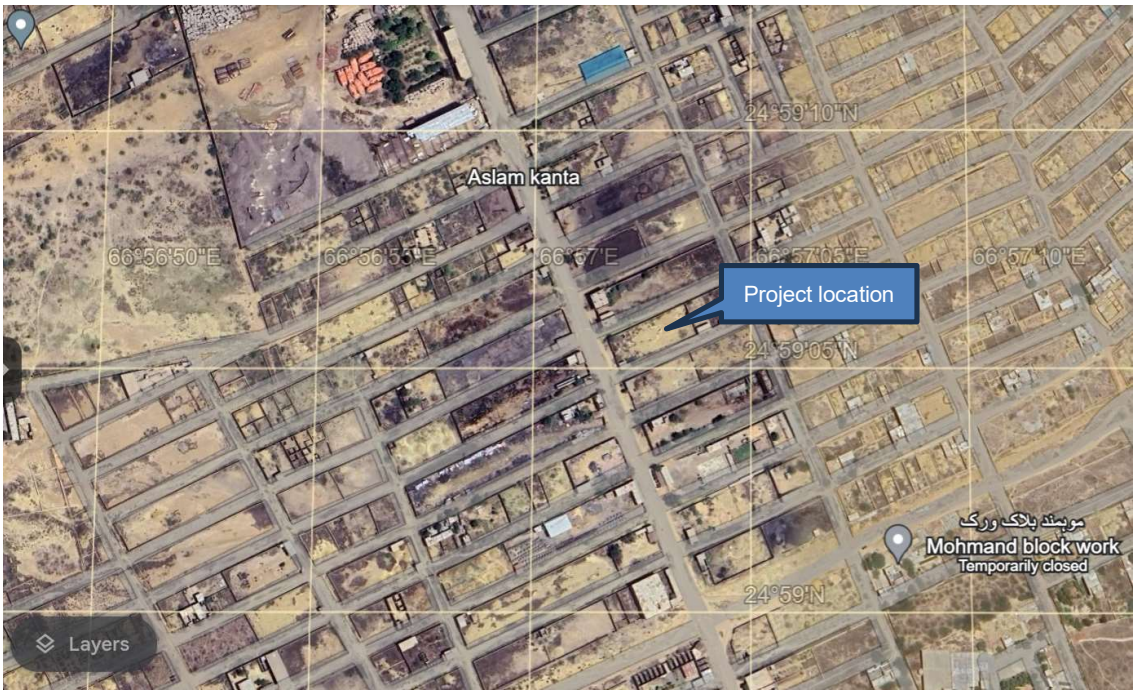


Figure 4.2: Location of the Project site

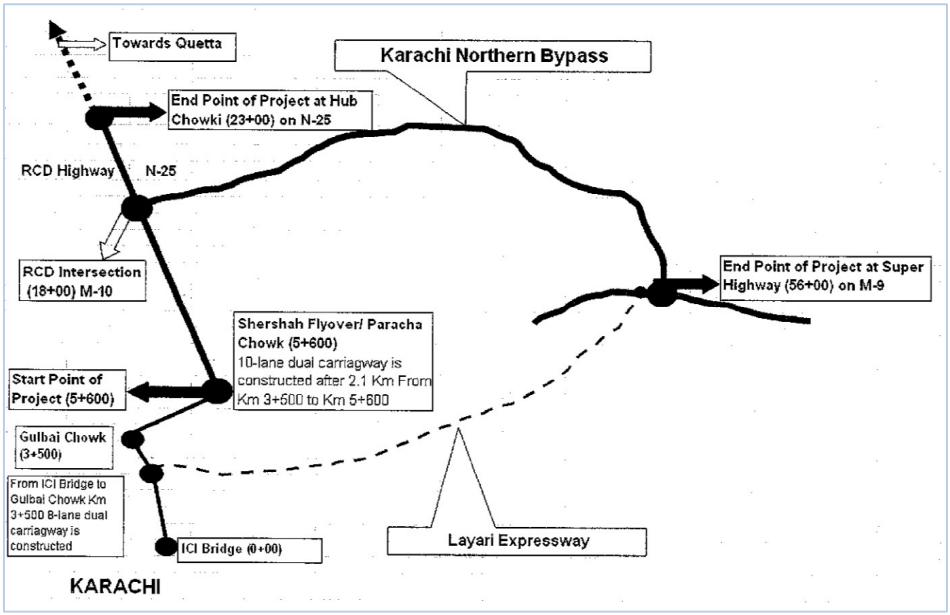


Figure 4.3: Karachi Northern Bypass (M-10) & Karachi to Hub Bypass (N-25)

4.1 Physical Resource

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 authentic secondary resources besides primary data collection for critical aspects. Respective departments were contacted by the project team members and information was collected with the help of checklist. Other studies and reports were referred and reviewed for the verification of information.

4.1.1 Climatic Condition

The climate of the macroenvironment is characterized as hot and dry during summer, and mild during winter with heavy, sporadic, rainfall during the monsoon. The southwest monsoon prevails from April to October. The monsoon is characterized by a reversal in wind direction during the remaining months; and heavy rainfall over most of the Indian Subcontinent. The hottest months are between mid-March to June. The winters are mild with temperature dropping to 10°C in January. Karachi receives approximately 217.3 mm of rain annually. Almost 80% of the rain is concentrated in the monsoon season. The general characteristics of the seasons based on this data is described as follows:

- **Summer (mid-March to mid-June):** Characterized by high temperatures, moderate rainfalls with moderate atmospheric humidity and high speed-winds that blow from southwest towards northeast.
- **Summer Monsoon (mid-June to mid-September):** Characterized by high temperatures, high rainfalls with high atmospheric humidity and high speed-winds that blow from southwest towards northeast.
- **Post-Monsoon summer (mid-September to mid-November):** Characterized by moderate temperatures, low rainfalls and low speed-winds that normally blows from southwest towards northeast with direction of wind changing in the end of post-monsoon summer from southwest to northeast.
- **Winter (mid-November to mid-March):** Characterized by low temperatures, dry conditions with low atmospheric humidity and significant reduction in wind speeds that blows from northeast to southwest with the direction of wind changing in the end of winter from northeast to northwest.

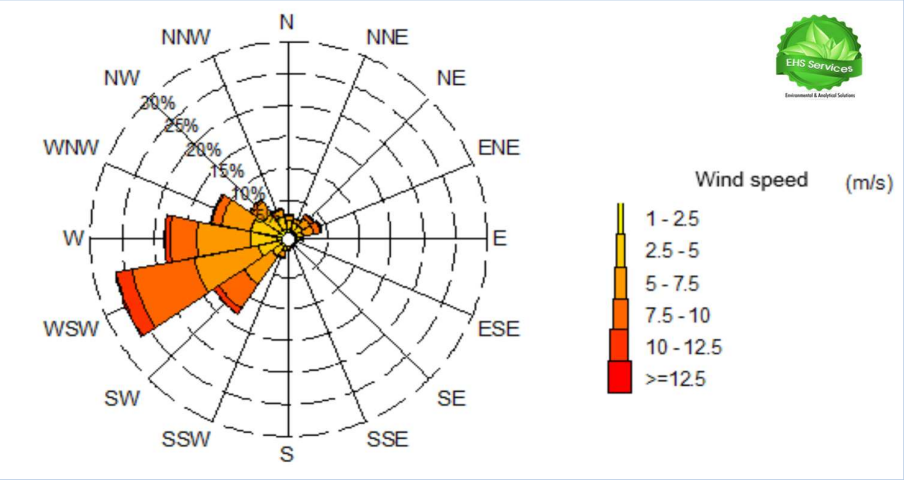


Figure 4.4: Annual Wind Rose

4.1.2 Geology & Geomorphology

Geologically, Baldia town rest on the limestone member of Gaj Formation which belongs to Miocene age (Figure 4.5). This limestone is interlayered by thin shale units which is served as ductile material during westward collision of Indian plate after Eocene time.

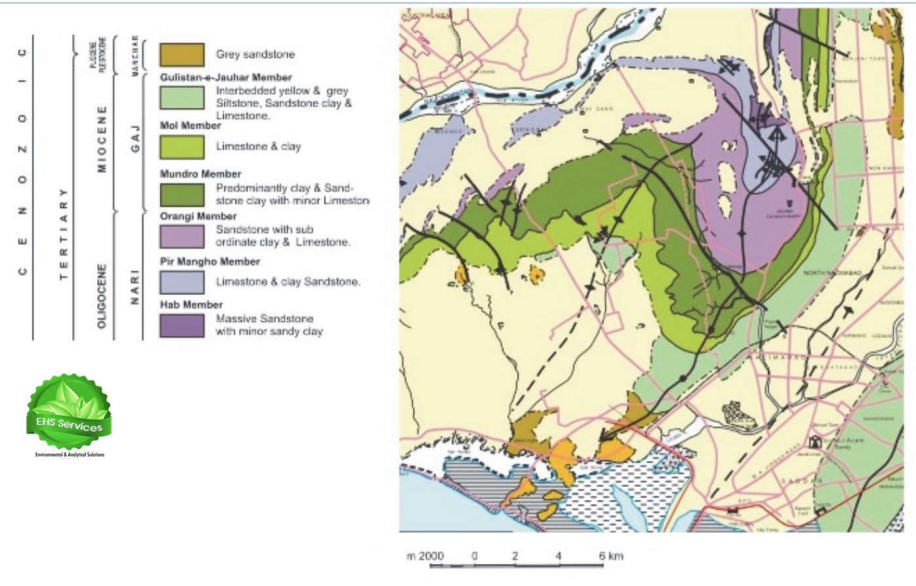


Figure 4.5: Geological map of study area

This resulted in the formation of several asymmetrical folds followed by multiple normal faults in Karachi and its suburbs. Baldia town is located between western limb of Manghopir anticline and Lalji syncline (Figure 4.6). The periphery of Lalji syncline is serving as catchment area for Baldia town basin where many streams are formed between dip and escarp slopes of limestone ridges. Groundwater table occurs at a depth of > 100 feet due to steep inclination of the rocks forming the confined aquifer system. The general groundwater flow direction is northwest to southeast.

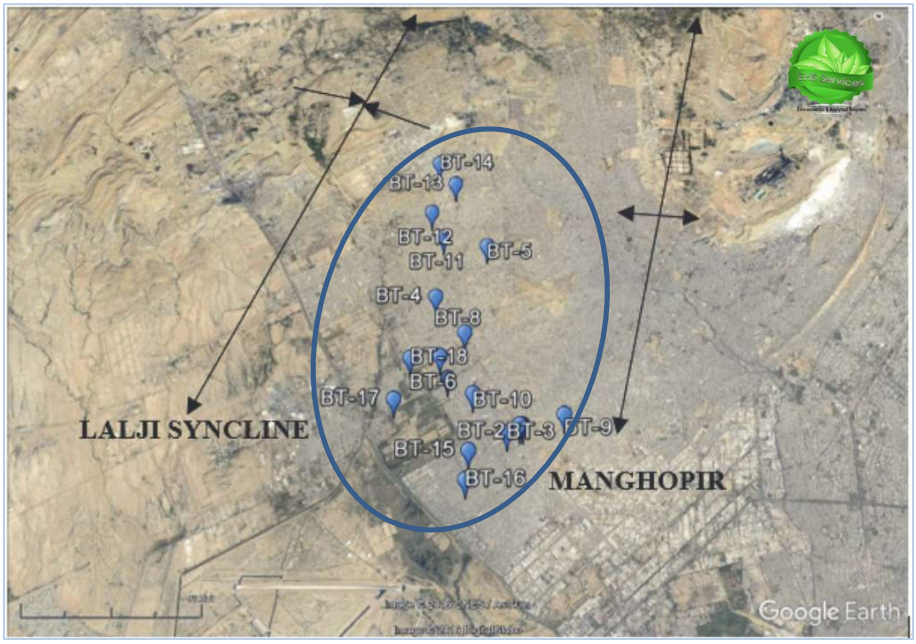


Figure 4.6: Sample location map of study area

Seismotectonics of the Area: 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.[1]

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. The entire Karachi Arc and surrounding areas are seismically active with

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

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 to 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.

According to a map created by the Pakistan Meteorological Department, the country is divided into 4 zones based on expected ground acceleration. The areas surrounding Quetta, those along the Makran coast and parts of the NWFP, and also along the Afghan border fall in Zone 4. The rest of the NWFP lies in Zone 3, with the exception of southern parts of this province, which lie in Zone 2. The remaining parts of the Pakistani coastline also lie in Zone 3. The remaining parts of the country lie in Zone 2. According to this classification, the Project site would be placed in Zone 2B.

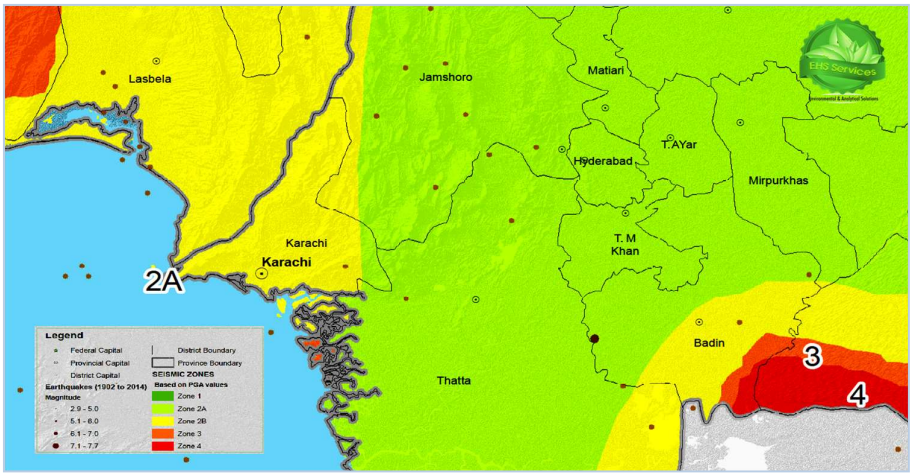


Figure 4.7: Seismic Zones between Karachi[2]

4.1.3 Ambient Air & Noise Quality

Primary source of air pollution on and along the major corridors of Karachi is transport sector, so the primary pollutants in ambient air quality in the City in general and project area in particular are directly linked with fuel consumption. Studies undertaken between 1987 and 1994 had raised concern on the deteriorating air quality and noise levels. Studies over the past decade, had quantified the problem and identified the tremendous growth in volume of traffic as the main factor responsible for increasing congestion all over Karachi roads and aggravating the problem. A 1990 survey[3] monitored CO at 9-10 ppm

[2] Map data source(s): PMD, GSP, Pakistan Engineering Council – Prepared by Al hasan Systems Private Limited
[3] Ghauri et.al. 1994

along the busy urban streets; maximum NO2 concentrations were 0.3-0.5 ppm during the daytime; with an ozone maximum around noon of 40 ppb and 50 ppb, below WHO's interim quality guideline. A 2005 study[4] that shows hourly readings over 24 hours for O_3, SO2, CO and NO2 measured at five locations in Karachi. O_3 concentrations were well within the WHO guideline of 100 µg/m³ 8-hr average; NO2 and SO2 also were well within the WHO guideline of 200 µg/m³ (1-hr average) and 20 µg/m³ (24-hr), respectively.

Finally, another report[5] quotes the World Bank's data with the following maximum values: PM2.5 201 µg/m³; SO2 173 µg/m³; NO2 122 µg/m³; O3 86 µg/m³; CO2 mg/m³. For reference, WHO's interim target for PM2.5 is 35 µg/m³, whereas its guideline is 10 µg/m³. WHO guideline for O_3: 100 µg/m3 8-hour mean. Both NO2 and SO2 are within WHO's guideline for short term average concentration. (200 and 400 µg/m³ respectively). Data by this same author show excessive levels of PM at major intersections, including some along the Karachi BRT corridor, as well as SO2, NO_X, O_3 and CO, all exceeding WHO limits, based on data taken by SUPARCO in 2004.

Karachi's air quality is nearly 5x above the safe level defined by WHO, and twice the value for daily exposure. That is also 3x the safe levels recommended by the Sindh Environmental Quality Standards for Ambient Air by the Sindh Environmental Protection Agency (SEPA).

24-hr ambient air monitoring was conducted at the project site. stationed its mobile lab at the project site on 15th July 2023 for 24 hours to collect samples & analyze the same for concentration of primary pollutants (Figure 4.8). The results are presented below:

Table 4.1: Ambient Air Quality of Project Site

S. #	Parameters	Unit	SEQS	Results		
				Min	Max	Avg.
1.	Nitrogen Oxide (NO)	µg/m³	40	2.1	10.5	5.9
2.	Nitrogen Dioxide (NO_2)	µg/m³	80	19.2	28.6	23.8
3.	Carbon Monoxide (CO)	mg/m³	5	1.2	1.9	1.5
4.	Sulphur Dioxide (SO_2)	µg/m³	120	6.3	8.6	7.4
5.	Ozone (O_3)	µg/m³	130	2.3	28.5	17.0
6.	Particulate Matter ($PM_{2.5}$)	µg/m³	75	51.2		
7.	Particulate Matter (PM10)	µg/m³	150	109.4		
8.	Suspended Particulate Matter (SPM)	µg/m³	500	288.1		
9.	Lead	µg/m³	1.5	BDL		
10.	Noise	dB(A)	75	58.2		

[4] Hashmi et.al.
[5] Kalwar 2014

Figure 4.8: Ambient Air monitoring of project site

Comparison of Air Quality data of the project site with that noted for rest of Karachi suggests that the level at the former site is lower than that observed for the other areas of Karachi. This can be attributed to the strong influence of the wind and is effective in the desired dispersion of pollutants. The dispersion so achieved places the site in the unpolluted airshed category and makes the project site suitable for siting the proposed waste management facility. However, it may also be noted that the levels of particulates exceed the safe limits prescribed by the world health organization (WHO).

The general observation during the reconnaissance survey suggests that it is a calm location with an average noise level ranging between 51.8 dB(A) and 59.7 dB(A). The average noise level at the site is raised either by the peak noise emission from traffic or by the hissing and rustling of the prevailing wind. At the boundary line the level was invariably 54 to 55 dB(A) when there was no traffic on road and the wind was also not blowing. The noise level was also found to rise if birds would chirp, or dogs would bark.

4.1.4 Water Resources, Water Quality and Drainage

4.1.4.1 Greater Karachi Bulk Water Supply System

To supply the city of Karachi with 280 MGD of water supply, the Greater Karachi Bulk Water Supply Scheme was designed in 1953. The scheme was modeled and divided into four equal phases on the basis of population projection till the year 2000. Each scheme, with the design rate of 70 MGD, comprised of open canals, covered conduits, a tunnel, siphons, pumping stations and mains to supply water from the Keenjhar Lake. The details are discussed below and shown in Figure 4.12.

1st Phase

- Proposed raw-water pumping at Dhabeji to bring 70 MGD of water from Keenjhar Lake and water treatment plant of 70 MGD at COD Hills, Karachi.
- Development of complete water conveyance system comprising of a 280 MGD lined canal, a conduit of equal capacity up to Pipri and of 140 MGD capacity up to Karachi.
- Work on 10 MG reservoir at COD Hills along with the distribution network.
- It started in 1954 and completed in 1961 at a total cost of PKR 185 million.

2nd Phase

- It included construction of a 70 MGD pump house at Dhabeji, laying of 84" dia pre-stressed pipe siphons, a 25 MGD pump house at pipri and two water treatment plants of 25 and 45 MGD along with 10 MG reservoirs at Pipri and COD Hills respectively.
- Work for this phase was awarded in 1969 and completed in early 1971 at a total cost of PKR 200 million.

3rd Phase

- It included the construction of a 70 MGD pumping station at Dhabeji, two pumping stations along with water treatment plants of 25 MGD capacity each at North East Karachi and Pipri, 84"dia pipe siphons, three balancing reservoirs and the distribution mains.
- - A reservation for supply of 22 MGD of un-filtered water to Karachi Steel has also been made under this phase.
- - Work for this phase started in 1975 and completed in 1978 with the total cost of PKR 750 million.

4th Phase

- Due to financial constraints, 4th Phase works were divided into two parts.
- Under this phase improvement of lined canal, modifications of the present Dhabeji Pumping Stations, laying of 84" dia pipe syphons, construction of a 25 MGD pump house and clarification units at Pipri were commissioned.
- Also, improvement of the secondary distribution network and installation of domestic meters in K.D.A. Scheme No.1 & 5 were taken up with the assistance of World Bank and all the works were completed in June, 1987 at a total cost of PKR 360 million.
- After this phase, the city's water supply increased by 50 MGD.

Hub Water Supply System

- The Hub dam was constructed by WAPDA on Hub River to from 1963-1981
- At Stage-I, 90 MGD pump house, two steel pressure mains one 20 MG reservoir, trunk mains and primary treatment of lake water by screening and chlorination were completed in August 1982 at a total cost of PKR 260 million.
- Stage-II included the improvement of secondary distribution network and construction of a 90 MGD water treatment plant.

5th Phase (Greater Karachi Bulk Water Supply Scheme)

- Karachi's water supply system has expanded considerably in this phase. As discussed in initial four phases, Karachi was getting 280 MGD of water.

- Then 100 MGD water were added to the system through K-II supply project which were completed in 1998 with the assistance of World Bank.
- Through a bulk water supply project, the city got another 40 MGD of water in 2000.
- K-III 100 MGD Water Supply Project, further added into the existing supply which were completed in 2006 with the assistance of GoP.
- Now, the K-IV water project has been planned to fill the gap between the city's demand and supply of water.
- Approved on July 10, 2014 with the proposed design capacity of supplying an additional 650 MGD of water to Karachi. K-VI will be completed in three phases at a cost of PKR 25.6 billion rupees.

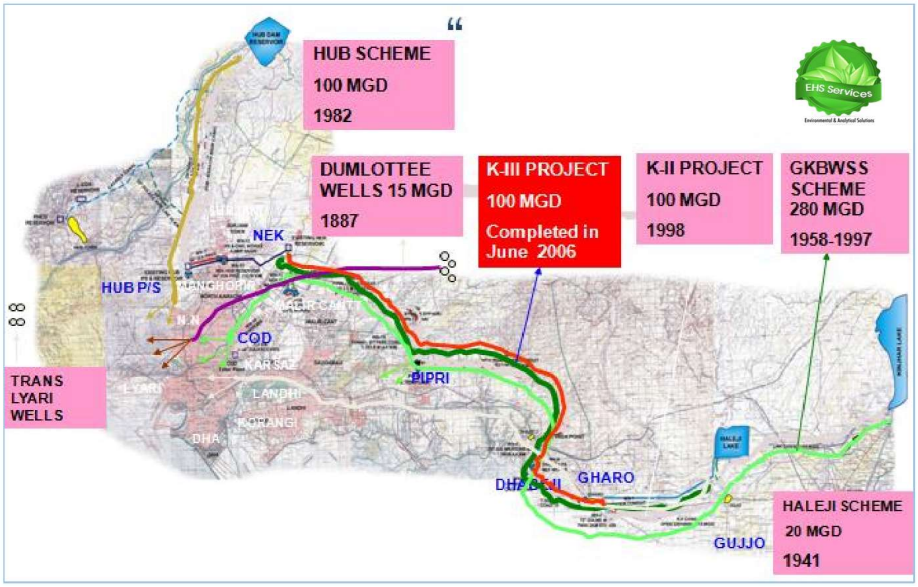


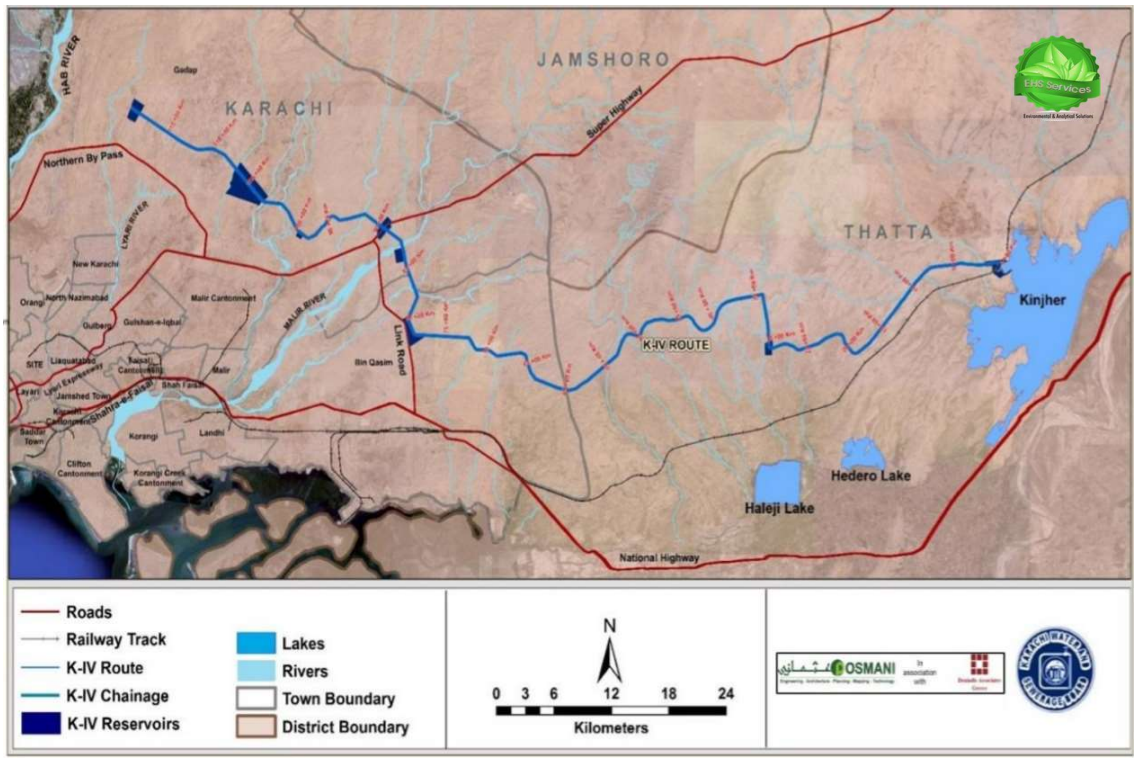
Figure 4.9: Water Supply System of Karachi (Glimpse from Past to Present)

4.1.4.2 Proposed Bulk Water Supply Scheme

K-IV is a municipal infrastructure project being jointly developed by the Provincial and Federal Governments in Karachi, Pakistan, to augment the city's daily water supply. This project is divided into three phases and each phase will increase water supply capacity. Details of K-IV are shown in Figure 4.10.

K-IV Project; Part of Greater Karachi Water Supply Scheme, Indus Water from Keenjhar Lake to Karachi City		
Phase	**Capacity**	**Proposed Completion Year**
K-IV Phase-1	260 MGD	Year 2018
K-IV Phase-2	260 MGD	Year 2022
K-IV Phase-3	130 MGD	Year 2025

Figure 4.10: K-IV Bulk Water Supply Schemes Karachi



4.1.4.3 Present Water Supply and Sewerage System

The water supply and sewerage system in the macroenvironment is managed by Karachi Water Supply & Sewerage Board (KW&SB). Present water supply system of Karachi City has a supply capacity of 560 mgd. Actually, as of the end of year 2006, the KW&SB supply bulk water of about 630 mgd beyond the capacity as shown in following Table. Out of 630 mgd, water of 209 mgd is supplied without filtration, which is equivalent to one third of actual supply amount of 630 mgd. Water is collected and treated by the conventional water treatment plants and distributed by a system which is at least 40-45 years old with some new distribution facilities in the city. The outdated system along with improper operation and maintenance causes the issue of revenue loss. In addition, there is no metering for retail customers and only 25 percent of commercial and industrial customers have a metered supply. The water supply is irregular due to power failure at KW&SB pumping stations which further increases the problems in water distribution system. Moreover, almost 40 per cent of the population lives in slums with limited water supply & poor sanitary infrastructure.

Figure 4.11 presents the detailed water distribution in Karachi.

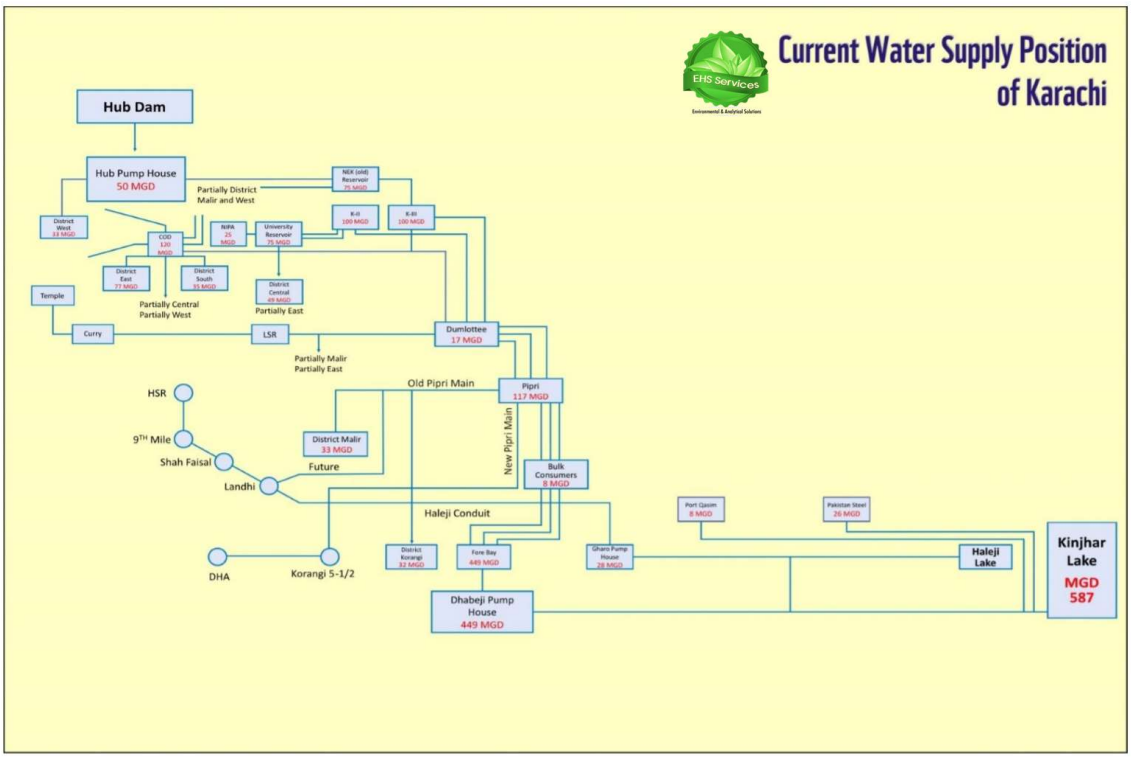


Figure 4.11: Current Water Distribution System in Karachi from Hub Reservoir and Keenjhar Lake

Table 4.2: Present Water Supply Capacity

Supplied from		*Rated Capacity*	*Actual Supply*
Gharo Filtration Plant		20 mgd	30 mgd
Pipri Filtration Plant	with Filtration	100 mgd	102 mgd
	without Filtration	-	32 mgd
Dumlottee Conduit (without Filtration)	from Wells	20 mgd	0 mgd
	from GK/K-III Systems	-	17 mgd
NEK Old Filtration Plant		25 mgd	5 mgd
NEK New Filtration Plant		100 mgd	100 mgd
COD Filtration Plant	with Filtration	115 mgd	104 mgd
	without Filtration	-	48 mgd
Hub Filtration Plant		80 mgd	80 mgd
Supply without Filtration (from K-III System)		100 mgd	95 mgd
Supply without Filtration (from GK System)		-	17 mgd
Total		560 mgd	630 mgd

4.1.4.4 Water Supply Network

Karachi water and sewerage board (KWSB) is the organization responsible for water transmission and distribution across the city. Indus river system authority

(IRSA) provides water to Sindh, therefore, this river indirectly becomes part of water supply system for the city. River Indus feeds water to the Lake Keenjhar. From Keenjhar, water through conduits goes to Haleji, Gharo, Port Qasim, Steel Mills and then to Dhabeji pumping station. From Dhabeji Pumping station, water is pumped to different pumping stations to supply water among all six districts of the city by using electrical pumping motors. Water from Hub Dam is supplied to Hub Pump House through Hub Canal and then supplied to NEK, Old Reservoir and different areas of the city. Karachi's water supply infrastructure comprises of 25 bulk water reservoirs, 150 pumping stations, 8 water-filtration plants, 75 kilometers of canals, over 11,000 kilometers of pipeline, 20 sewage-pumping stations, 3 sewage treatment plants, and over 250,000 manholes. Almost 1.13 million domestic connections and 9,317 bulk customers in Karachi are provided water supply and sewerage services (Figure 4.12). In informal settlements and industries, most of the water demand is met through non-piped systems, including private water tankers. Almost 24 hydrants have been licensed to the private parties by KWSB. Out of these 24 hydrants, only 10 are operational while the rest were closed as per a recent Supreme Court Order. unregulated hydrants are rampantly spread across the city. KWSB introduced amendments to discourage the illegal use of hydrants. Since 2009, it has dismantled over 948 illegal hydrants in an effort to confront the illegal use of water. Now six regulated and meter hydrants supply water to the city. Despite that, the issue of unregulated hydrants needs attention. There are two distribution channels for Karachi, mainly Northern and Southern Channels.

In an order passed on **April 17, 2019, the Sindh High Court directed the managing director of the Karachi and Water Sewerage Board (KWSB) to supply water to the residents of union councils in Baldia Town as per the board's rules.** The direction came during a hearing of a petition of Baldia Town residents against the failure of the KWSB to supply water to them. The petitioners' counsel submitted that the residents had not been supplied with water for the last three years despite clear directions of the court. He requested the court to direct the KWSB to provide water connections to the residents. The KWSB's counsel stated that the petitioners were residents of unauthorized areas, and all authorized colonies were being supplied with water from the Hub Dam. The court directed the KWSB counsel to ensure the supply of water to the petitioners strictly under the KWSB rules and regulations. **Earlier, the Supreme Court mandated judicial commission on water and sanitation on July 03, 2018 directed the KW&SB to lay pipelines in Baldia Town area to provide drinking water to the area people.**

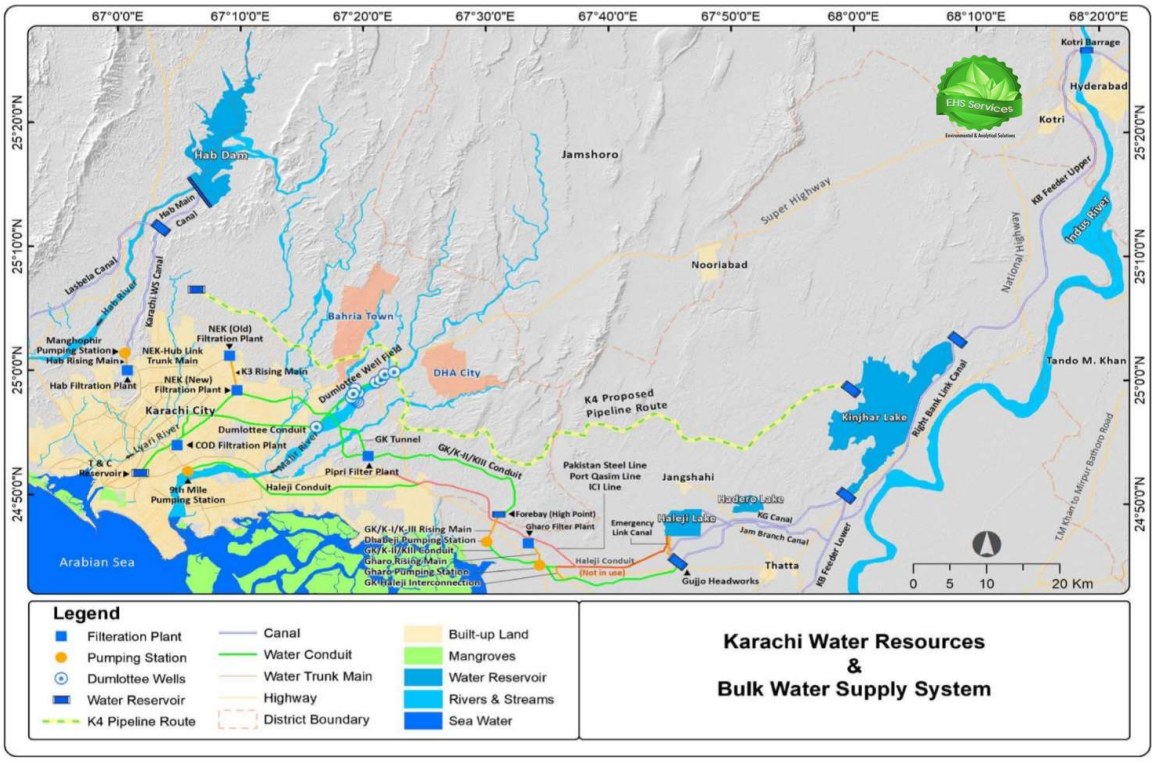


Figure 4.12: Karachi Water Resources and Bulk Water Supply System

4.1.4.5 Water demand and supply with past trends and future trends

Karachi mainly relies on River Indus for water supply due to the decreased level of water from Hub dam. Karachi receives approximately 580 MGD of water from River Indus, but requirement of the city is around 820-1200 MGD according to World Health Organization (WHO) standards. That means Karachi gets almost 50 per cent of its present requirement. Recent studies suggest that population will grow by 30 per cent from 2017 to 2030. This will translate in an increased water demand which will in turn put pressure on the already scarce water resources. Figure 4.13 shows water supply and demand gap till the year 2017.

Year	Population (Million)	Demand (MGD)	Supply (MGD)	Gap (MGD)
1998	11.33	567	410	157
2017	14.9	820	650	170

Figure 4.13: Water Supply and Demand Gap till the Year 2017

4.1.4.6 Surface water and Groundwater Quality Assessment

The shortage of water in Karachi city due to rapid increase in population and industrial activities, has forced people to meet their water requirements from alternative supplies such as privately-owned ground water sources which extract, process and sell groundwater at a very high commercial cost. However, the quality of groundwater is very poor in Karachi mainly due to the excessive pumping of groundwater by farmers, seepage of domestic wastewater in groundwater, huge amounts of chemical constituents in industrial wastewater and sea water encroachment, rendering it medically unfit for human consumption if consumed without prior treatment. A study conducted by PCRWR in 2015-2016 to assess of the water quality of cities of Pakistan revealed that out of 28 samples collected from surface and groundwater of Karachi, 24 were found contaminated with E.coli. This constitutes almost 86 per cent of the total water sources of Karachi rendering it unfit for consumption. The most probable source of bacterial contamination is the sewerage discharge, which is usually flowing in pipelines parallel to that of drinking and household water and poor maintenance and breakages in pipelines lead to the mixing of water supply with the sewerage water. Also, no significant improvement in the water quality was observed from the year 2002-2015. Another study analyzed the surface and groundwater samples of Karachi and found that almost 88 percent of the samples/sources had Lead values higher than the WHO recommended guidelines. According to a world bank study conducted in 18 towns of Karachi, blood lead levels greater than WHO guideline were found in 89 per cent of the samples. Increased lead levels have been related to learning disabilities in children resulting in socioeconomic problems for future generations.

A study was carried out by the Department of Geology, University of Karachi, Pakistan[6] to assess the groundwater quality for drinking purpose in Baldia Town, Karachi. For this purpose, groundwater samples (n=18) were randomly collected from various depths (> 100 feet) through boring wells after monsoon season. Data revealed that except two (BT-5, 8) which were turbid and smoky, rest of the samples were colorless, non-turbid and sweet in taste. Groundwater temperature fluctuates between 19-26˚C. The pH varies between slightly acidic to slightly basic (range: 6.8-7.3) where two third of total samples have pH < 7. All the samples have very high TDS content (range: 1240-16910 mg/L; mean: 6832 mg/L) which exceeded the national drinking water quality standard (1000 mg/L) set by PCRWR. Hardness values varied in the extreme range (1000-9500 mg/L; mean: 2366 mg/L). Relative abundance of major cations follows the order of Mg

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> Ca > Na> K while anions varied in the order of HCO3> SO4> NO3>Cl. Dissolved Fe+3 (mean: 0.01 mg/L) varies within WHO permissible limit (0.3 mg/L) while Mn showed concentration < 0.01 mg/L. Concentration of trace elements declined in the order of Ni > Zn > Cr > Co.

This study revealed that **groundwater of Baldia Town is not suitable for drinking purpose due to its very high hardness (mean hardness: 2366 mg/L) and salt content (Mean TDS: 6832 mg/l)**, which may cause different diseases and disabilities upon long term use. It is strongly influenced by semi-arid climate and water rock interaction which is manifested by geochemical signatures. High salt content is due to the excessive amount of major salts of Mg, Ca, Na and K while the high hardness is attributed to elevated concentration of bicarbonate and sulphate ions. The hardness of water is temporary (bicarbonate) which can be removed by boiling. Trace element geochemistry revealed that limestone dissolution (Ca, Zn) and ion exchange from shales (Ni, Co, Cr) are main natural processes to alter the chemistry of groundwater in study area. Despite the occurrence of industrial hub, anthropogenic contamination is not obvious which is due to the confined nature of shallow (depth < 200 ft) aquifers in study area.

4.1.4.7 Existing Sewerage Facilities and Drainage System

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.

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 in response to a constitutional petition. Treatment of sewage, a much-neglected issue, saw a revival under the commission. Thus, Sewage Treatment Plant-III (77MGD) was restored in June 2018. STP-I (100MGD) could not be completed in 2019 despite time-bound undertaking submitted to Judicial Commission (water). STP-IV (180MGD) is supposed to be operational by December 2020. Five industrial effluent treatment plants are scheduled to be built in the SITE, Trans-Lyari, F.B, Landhi and Superhighway areas.

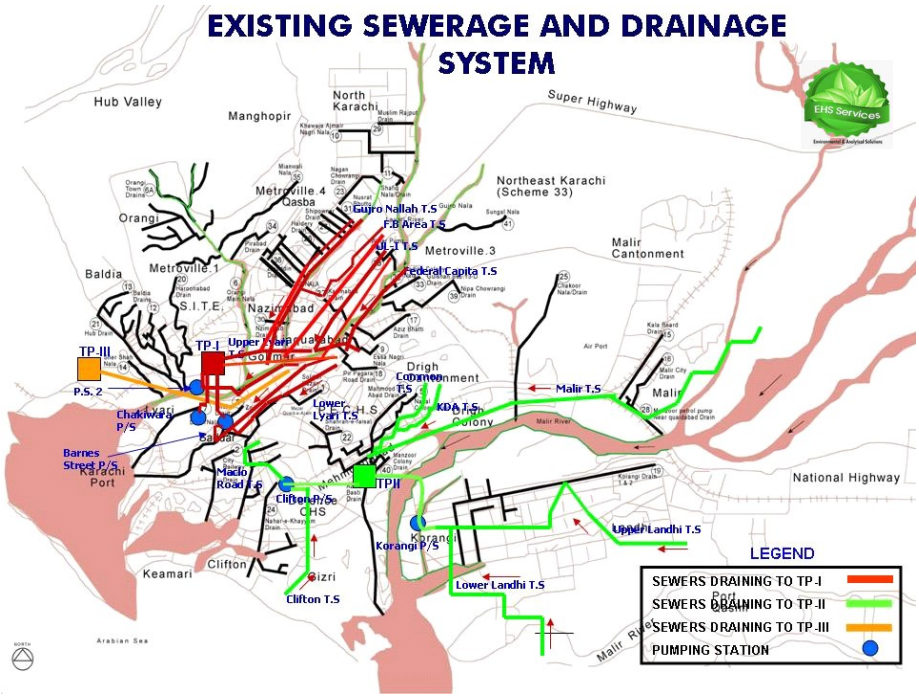


Figure 4.14: Existing Sewerage System of Karachi

4.1.4.8 Collection and Disposal Mechanism

The condition of sewerage system in Baldia Town is poor which is deteriorating day by day. Sewerage pipelines are broken sporadically in macroenvironment. When the drains are chocked, the sewerage water comes up and spills out in the study area. As a result, roads are severely damaged (cracked or pitted) or completely eroded away. Due to poor maintenance of the internal roads, most of the paved parts are washed out and unpaved surfaces are triggering infiltration of water in large amount. It becomes more pronounced during rainy season.

Sewage is gathered through pipes and uncovered channels and drained in water bodies through rivers and nullahs. Karachi's untreated wastewater, including domestic sewage and industrial wastewater is discharged into the Lyari and Malir rivers, and finally disposed to the nearest coastal belt. Out of the 475 MGD of wastewater generated, around 420 MGD of wastewater remains untreated and a part of it is drained into the sea through the 232 km network of Main nullah and 1000 km network of town drains. These nullahs mainly discharge into the two main rivers namely; Malir River and Lyari River.

Currently, there is a huge gap between wastewater generation and treatment. The wastewater generated in Karachi city is beyond the capacity of the existing

treatment plants. Approximately 417-425 MGD of wastewater is drained into sea water without any treatment.

4.1.4.9 Greater Karachi Sewerage Plan (S-III)

To improve the sewerage system of Karachi and reduce the pollution load on natural water bodies, KWSB is working on Greater Karachi Sewerage Plan (S-III). This project, through a well-integrated system of collection, treatment and sewage of wastewater from municipal and industrial sources, aims to improve the environmental conditions of Karachi. In this project, sewage will be transmitted to the River Lyari and Malir via a RCC before finally being disposed of in the sea. Following initiatives will be taken under this project

- Malir Trunk Sewer: 05 Contract Packages with overall length of 22.74 km
- Lyari Trunk Sewer: 08 Contract Packages with overall length of 33.32 km
- Upgradation and Capacity Enhancement of Sewage Treatment Plant from 51 to 100 MGD at Haroonabad SITE
- Upgradation and Capacity Enhancement of Sewage Treatment Plant from 54 to 180 MGD at Muaripur
- Construction of New Sewage Treatment Plant at Korangi of 180 MGD

According to the planning commission of Pakistan 862 Million Rupees were allocated to the project for the fiscal year of 2018-2019. The rehabilitation of the TPIII for 77 MGD has been done while five different packages of sewage transmission in the length of 20.151 km have substantially been completed.

4.1.5 Solid Waste Management System in Karachi

Even though Karachi is the seventh largest city in the world with a population of over 20 million[7], it does not have a proper hazardous & non-hazardous waste disposal system. The present state of lifting of solid waste in Karachi is also deplorable; the City has been turned into a heap of garbage. Due to unplanned growth of commercial-cum residential buildings, the environmental situation in Karachi has become alarming.

Karachi generates ~12,000 to 14,000 tons of solid waste[8], which includes domestic, industrial and hospital waste. ~9000 tons of solid is produced in the areas under DMCs, and remaining 3000 in the Cantonments, etc. Despite its needs & huge load, Karachi does not have Garbage Transfer Stations in all districts. The present situation in all commercial & industrial area is that the garbage is mostly found littered around the corners of the streets or dumped on

[7] KTIP
[8] some estimates put the range at 14,000 to 18,000 tonnes

make-shift sites even burnt openly during the day times and mostly during late hours causing huge health & safety risks for over 20 million population.

The Sindh government enacted Solid Waste Management, Act, 2014 and created a board called the Solid Waste Management Board (SSWMB) to establish "Integrated Solid Waste Management System" in all cities of the Province. The SSWMB is responsible for collection and disposal of solid waste and other wastes including municipal, Industrial and medical waste in the entire Province of Sindh. The SSWMB is maintaining two dumping sites namely Surjani Town and Gond Pass, where ~40% of garbage is dumped. Due to lack of implementation of (management & monitoring) system, the remaining garbage mainly ends up in water bodies or otherwise burnt. No work on engineered landfill site has been initiated so far even though waste management issues are aggravated and causing huge damages to the environmental & social outlook of the City.

In a span of about 5-years, the Sindh Solid Waste Management Board (SSWMB) could not expand its operations to all the 29 districts of the province; even in the Karachi City, where the SSWMB is functional, its performance does not seem to be praiseworthy because it has control over only 35 per cent of the city. District Municipal Corporations (DMCs) comprise 35 per cent of Karachi, while the District Council, which deals with 15 per cent of the city, controls the rural areas.

At present, DMCs have got following resources available to manage waste:

- The staff at DMC Malir is 336. Amount incurred on their salaries is Rs.13,800,000/-. Average monthly expenditure on repair and maintenance including Diesel is Rs.7,000,000/-. Garbage generated per day is 750 tons; of which 450 tons is lifted and dumped at Sharafi Goth, whereas Garbage backlog is 9000 tons per month. 27 different types of vehicles are being used for collecting solid waste.
- The staff at DMC Karachi Central is 3157. Amount incurred on their salaries is Rs.64,562,333/-. Average monthly expenditure on Diesel is Rs.14,272,244/-. Garbage generated per month is 59800 tons; but only 55536 tons is lifted and dumped on a site outside of the city. Garbage backlog is 4264 tons per month. 118 different types of vehicles are being used for collecting solid waste.
- The staff at DMC Korangi is 1544. Amount incurred on their salaries is Rs.36,656,764/-. Average monthly expenditure on operation & maintenance including Diesel is Rs.29,381,546/- Garbage generated per day is 1200 tons; 800 tons is lifted and dumped on site namely Jam Chakro. Garbage backlog is 400 tons per day. 59 different types of vehicles are being used for collecting solid waste.
- The staff at DMC Karachi East is 1531. Amount incurred on their salaries is Rs.42,696,863/-. Average monthly expenditure on operation & maintenance including Diesel is Rs.33,270,460/-. Garbage generated per day is 1200 tons,

which is lifted and dumped on a site outside of the city. 116 different types of vehicles are being used for collecting solid waste.

- The staff at DMC Karachi South is 2083 against total strength of 3372. Amount incurred on their salaries is Rs.45,842,134/-. Average monthly expenditure on operation & maintenance including Diesel is Rs.32,400,000/. Garbage generated per day is 1150 tons; 1100 tons is lifted and dumped on a site outside of city, Garbage backlog is 50 tons per day. 124 different types of vehicles are being used for collecting solid waste.
- The staff at DMC Karachi West is 1741. Amount incurred on their salaries is Rs.336,684,691/-. Average monthly expenditure on operation & maintenance including Diesel is Rs.1,266,144,157/-. Garbage generated per day is 1730 tons; 1210 tons is lifted and dumped on a site outside of the city, Garbage backlog is 520 tons per day. 88 different types of vehicles are being used for collecting solid waste.

In South DMC, SSWMB has jurisdiction over one road, while the adjacent road is under the control of military cantonment and another is covered by the Pakistan Railways. But unfortunately, there is a total lack of coordination among the departments. Afghan children collect garbage from houses and dump it at the nearest Kachra Kundi (dumping site). Before dumping the garbage, the children forage in it for precious items like glass, steel, plastic and paper.

The authorities are also responsible for cleaning storm water drains and excavate huge amounts of debris due to disposal of solid waste simply into the drains. SSWMB estimates that there has been a backlog of 1.6 million tonnes of garbage in the city that has accumulated over the years but due to limitation of technical & financial resources, the SSWMB was unable to lift all the garbage that was produced in the city.

The situation of industrial (hazardous & non-hazardous) waste management in Karachi is also unsatisfactory. For e.g. SITE Karachi consists of 2,600 Industrial units but the mechanism for disposal of waste is not in place. There are more than 65 different types of industries in the city including tanneries, foundries, metal processors, manufacturers of plastic, rubber, glass, ceramics, tiles, cement, textiles, pharmaceuticals, soaps and detergents, fish processing units, producers of fertilizers, pesticides, chemicals, and the makers of edible oils and cars. Several Sepa-certified private companies also offer solid waste disposal services to industries. The Sindh Solid Waste Management Board Act, 2014 does not absolve individual industries and industry associations of the primary responsibility to manage and remove their industrial waste, but it bars them from engaging private companies for the purpose.

In the absence of a unified citywide mechanism for the removal of industrial waste, what Karachi has is a mishmash. Hundreds of thousands of rag pickers, usually boys in their early teens, unregistered contractors and small companies

rummage through the trash to find anything reusable and saleable, all these together, by default, constitute the city's industrial waste disposal mechanism. The problem with this informal arrangement is that waste collectors are often unaware of the hazards they might be exposed to. They are also only concerned about what can be reused and sold. The rest is often thrown at open garbage dumps along roads.

According to the KMC's Municipal department, over 5,000 medical facilities are working in the City limits; this includes 20 secondary and tertiary care hospitals, but only 2% do have their own medical waste disposal system but none of them fully comply with WHO requirements. For e.g. Jinnah Post Graduate Medical Center (JPMC) has its own incinerator to burn medical waste but lacks implementation of WHO guidelines. Civil Hospital & Abbasi Shaeed hospital do not have any incineration site or proper system in place to segregate the infections and non-infectious waste.

It is fact that 85% of the total waste generated from health-care units comprises of non-hazardous waste. The 15% remains as hazardous material that may be infectious, toxic or radioactive because it includes injections, swabs, bandages, disposable medical devices, human tissue, organs or fluids, body parts, contaminated animal carcasses, syringes, needles, disposable scalpels, blades, expired, unused and contaminated drugs and vaccines among several other items. According to the World Health Organization, the average medical waste per patient on a daily basis is ~2 KG. KMC collects waste from 400 registered medical facilities @ Rs 50 per Kg which is incinerated at dumped at incineration facilities near at Mewa Shah Graveyard.

Figure 4.15: Treated and untreated wastewater discharged into a storm drain in Korangi (Source: Herald)

Figure 4.16: Tons of hazardous medical waste, syringes, blood vials washed up on the seashore on morning of September 02, 2019 (Source: Gulf News)

4.2 Description of Ecological Environment

4.2.1 Flora

The ecosystem of the macroenvironment was under forest cover of acacia and other xerophytes in the early 1920s. The tree cover was subsequently cleared for urban development & agriculture. The physical landscape was found fairly covered with grass and brushwood during the consultants' visits of the site. The present landscape has evolved under sub-tropical and arid conditions besides extended drought. The effects of aridity that are visible in the erosional work of the Sukhan nala and Malir River have been aggravated by extensive excavation of sand and gravel from the riverbeds to the extent of getting their rock bottom exposed. The entire area is barren land with scanty vegetation.

The impoverished ecosystem resulting from the non-availability of surface as well as groundwater has irreversibly reduced the biodiversity of the indigenous as well as introduced vegetation. There are even otherwise no habitats of the plants, large and small animals, birds or reptiles within 10 km of the site.

The ecosystem of the macroenvironment includes flat, sandy, plain dominated by low shrubs and no trees. Natural vegetation is restricted to depression areas

where moisture is available for greater part of the year and longer period of time. The native vegetation is of the desert scrub type comprising a wide variety of bushes and shrubs.

***Trees*:** Prospis juliflora is the most significant widespread species distributed in all types of habitats. Among the Acacia species, Acacia nilotica is the most common species, which is distributed in low alluvial depressions, plains and foothills associated with relatively low austere moisture regime.

Trees found in the macroenvironment during the surveys include *Acacia nilotica* (babul), *Acacia senegal* (khor), *Salvadora oleoides* (khabar) and *Prosopsis senegal* (kandi), *Acacia arabica* (kikar), *Tamarix gallica* (lai), *tamarix aphylla*, willo or bahan (*populus euphratica*), Neem (*azadrachta* indica) Aerua *javanica*, *Maerva arenaria*, *Abutilou sp*, *Amaranthus viridis*, *Cordia gharaf*, *Rhazya stricta*, karil (*capparis aphyila*), acacia or siris (*acacia lebbek*), pipal (*ficus religiosa*) & tamarind (*tamarindus indica*). Because of extensive deforestation and prolonged drought, only few of the above species are to be found in the macroenvironment and none in the microenvironment of the Project site.

Bush: Predominant bush species found in macroenvironment is Devi. In majority of cases, comparatively older plants have been cut to meet the fuel wood requirements in the area. Chali, Damral and Darathi (local names) are the bush species that are found in the area. No special medicinal value is associated with these bush species by the locals.

Grass: Wild grass is the only predominant grass species in the macroenvironment of project area. The dry topsoil due to drought conditions did not offer much chance for greenery to survive in the area.

***Crops*:** Agricultural activities were minimal in the macroenvironment until recently when the vegetable growers of the area started extracting groundwater from depth exceeding 100 m. Major vegetable crops grown here include Indian corn, Pumpkin, ladyfinger, Jawar, Gowar Moong (local name), Zucchini (local name: Tori), Bitter Gourd (Local name: Karela). Cereal crops e.g. Wheat is also grown but vegetables being ready cash crop are preferred here.

4.2.2 Fauna

The ecosystem in the macroenvironment had diversified fauna in the not too distant past when it had extensive forest cover over it.

Livestock: Donkey, Dog, Cat, Goat sheep but not many horses or camels are the major livestock found in the area. Local inhabitants in the macroenvironment

maintain stocks of cows, goats and sheep that were found grazing in the area. Large wild mammals are virtually absent in the areas adjacent to Project site.

Wildlife: No wildlife of significance is seen in the macroenvironment. Wild Hare, Fox, and Jackal that were quite common in the area, are still to be seen but their number and frequency of visits has substantially reduced now. The most common wildlife found in the area nowadays around is the Snake. However, no rare or endangered species have been reported in the area.

Birds: The most common birds found in the macroenvironment are sparrows, crows, robins and doves. Characteristic bird species that have adapted to the environment and are still to be found in the area include the Indian grey partridge *(francolinus pondicertanis)*, chest-nut-bellied sand grouse *(pterocles exustus)*, rock dove *(Columbia livia)*, indian little button quail *(turnix sylvatica)* and Eurasian roller *(coracias garrulous)*. Kites and vultures, the high-flying birds that used to abound in the Malir Valley were not spotted during the reconnaissance survey and were reported to have substantially reduced in number by the locals. Migratory birds such as ducks, geese, and waterfowl no longer visit this area.

Wildlife Reserves

There is no Wildlife Reserve in close proximity of project site & its macroenvironment. However, at a distance of approximately 35 kilometers northeast of the site, the Balochistan Wildlife Department has established a Wildlife Sanctuary around Hub Dam. Adjacent to and about 15 km in the farther northeast is the Khirthar National Park managed by the Sindh Wildlife Department.

Hub Dam has emerged as an important staging and wintering area for waterfowl in Pakistan. The waterfowls include greabes, pelicans, ducks, coots, waders, gulls, terns and cranes. More than 75 species of avifauna have so far been recorded at Hub Dam and its surroundings.

Cranes are usually observed during spring and autumn migration. Over 400 common cranes (Grus grus) were observed at the dam in March 1984 and 150 in October 1991. However, regular monitoring of the crane population during its migration passage has not been carried out by any agency. The birds are not equally distributed over the reservoir. The main concentration of birds is observed in areas adjacent to the spillway, and in the northeast and northwest extremity of the reservoir. The drought lasting over 8 years, dried up the Dam and that had reduced the bird population till recent times.

4.3 Socioeconomic Environment

Karachi is the biggest city district of Pakistan and plays a dominant role in the economy, politics and culture of Pakistan. The city is blessed with a strong industrial base, diverse ethnic populace, efficient financial institutions, cheap labor and powerful business/financial corporations. This city, compared to all other cities of Pakistan, generates maximum revenue for the Government. It has comparative advantage of being the only operational seaport of the country, which makes it the focus of all trade and business in Pakistan.

4.3.1 Administrative Division

In 2001, five districts of Karachi were merged to form the city district of Karachi. Under the devolution plan, the Local Government System was introduced in which Karachi was composed of 18 towns and 178 union councils.

Later, the City District Government of Karachi was dissolved into six (06) constituent districts, namely: Karachi East, **Karachi West**, Karachi Central, Karachi South, Korangi and Malir. These districts form the Karachi Division now. There are also six military cantonments, which are administered by the Pakistan Army. District Municipal Corporations, headed by Deputy Commissioners, work under Commissioner Karachi for administration. Malir Cantonment is the largest Cantonment in Pakistan, created back in 1942. Next to the Defence Housing Authority (Karachi), it has the largest number of Defence officers' housing schemes in Pakistan. An outline of existing condition of land holdings in Karachi is illustrated as follows.

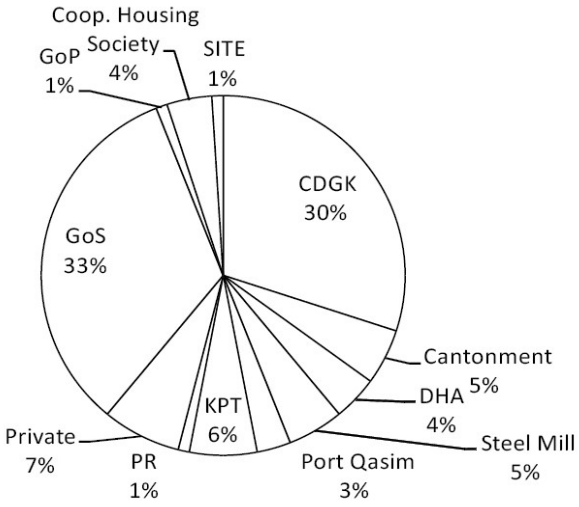


Figure 4.17: Land Holdings by Agency in Karachi (Source: KMP 2020)

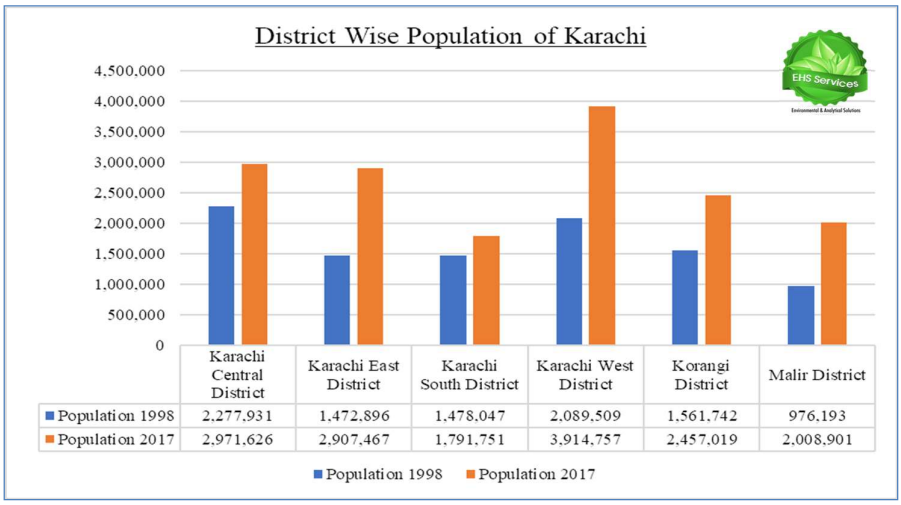
4.3.2 Land Use

The project site is in District West, Karachi. District West has emerged as the largest of Karachi's six districts in terms of population, number of registered voters and constituencies. This District incorporates areas of Mauripur, Harbour, Baldia, SITE, Mominabad, Korangi and Manghopir sub-divisions.

Baldia Town is located in district West on the outskirts of Karachi. The area saw a large influx of Pashtun migrants first in 1965. Since then there have been several waves of migration in the area; the most significant being the recent influx of IDPs as a result of a military-led operations in the region[9].

4.3.3 Demography

As per provisional census results of 2017 total population of Pakistan is 207,774,520 with an average annual growth rate of 2.40 from 1998 to 2017. In 1998, the total population of all districts that form the current Karachi district was 9,856,318 while according to the 2017 census population of Karachi city reached to 16,051,521 with an average annual growth rate of 2.60. In terms of overall %age population change District Malir observe highest, 105.79%, increase in population while lowest population increase is in the district south as 21.22%. District wise population is presented below:



	Karachi Central District	Karachi East District	Karachi South District	Karachi West District	Korangi District	Malir District
Population 1998	2,277,931	1,472,896	1,478,047	2,089,509	1,561,742	976,193
Population 2017	2,971,626	2,907,467	1,791,751	3,914,757	2,457,019	2,008,901

[9] C-37429-PAK-1

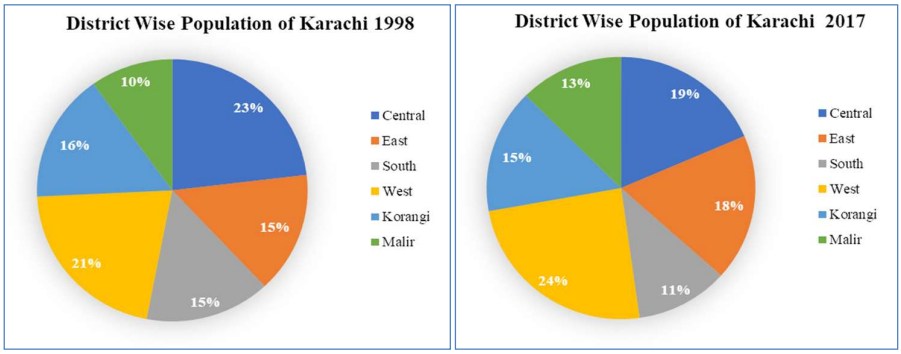


Figure 4.18: District Wise Population of Karachi

Table 4.3: Population Census Results 2017 – Karachi Division

Administrative Units		Households	Population 2017				Population 1998	Sex Ratio 2017	1998- 2017 Average Annual Growth Rate
			Male	Female	Transgender	All Sexes			
Karachi Division		**2,770,074**	**8,439,659**	**7,610,365**	**1,497**	**16,051,521**	**9,856,318**	**110.90**	**2.60**
	Rural	193,871	606,588	534,499	82	1,141,169	407,510	113.49	5.56
	Urban	2,576,203	7,833,071	7,075,866	1,415	14,910,352	9,448,808	110.7	2.43
Karachi Central District		**538,983**	**1,543,950**	**1,427,349**	**327**	**2,971,626**	**2,277,931**	**108.17**	**1.41**
	Rural								
	Urban	538,983	1,543,950	1,427,349	327	2,971,626	2,277,931	108.17	1.41
Karachi East District		**509,239**	**1,528,019**	**1,379,225**	**223**	**2,907,467**	**1,472,896**	**110.79**	**3.64**
	Rural								
	Urban	509,239	1,528,019	1,379,225	223	2,907,467	1,472,896	110.79	3.64
Karachi South District		**327,518**	**943,546**	**848,010**	**195**	**1,791,751**	**1,478,047**	**111.27**	**1.02**
	Rural								
	Urban	327,518	943,546	848,010	195	1,791,751	1,478,047	111.27	1.02
Karachi West District		**634,459**	**2,065,847**	**1,848,553**	**357**	**3,914,757**	**2,089,509**	**111.75**	**3.35**
	Rural	44,051	149,220	134,014	13	283,247	73,568	111.35	7.34
	Urban	590,408	1,916,627	1,714,539	344	3,631,510	2,015,941	111.79	3.14
Korangi District		**421,618**	**1,284,015**	**1,172,737**	**267**	**2,457,019**	**1,561,742**	**109.49**	**2.41**
	Rural								
	Urban	421,618	1,284,015	1,172,737	267	2,457,019	1,561,742	109.49	2.41
Malir District		**338,257**	**1,074,282**	**934,491**	**128**	**2,008,901**	**976,193**	**114.96**	**3.86**
	Rural	149,820	457,368	400,485	69	857,922	333,942	114.2	5.08
	Urban	188,437	616,914	534,006	59	1,150,979	642,251	115.53	3.11

4.3.4 Households and Average Household Size in Karachi

According to the provisional results of 2017 census the Karachi division has total 2,770,074 number of Households with and average household size of 5.79 and sex ratio of 110.90. District wise details are presented below:

Table 4.4: Households and Average Household Size in Karachi			
Administrative Units	**Households**	**Sex Ratio 2017**	***Average HH Size**
Karachi Division	**2,770,074**	**110.90**	**5.79**
Rural	193,871	113.49	5.89
Urban	2,576,203	110.70	5.79
District Central	**538,983**	**108.17**	**5.51**
Rural	-	-	-
Urban	538,983	108.17	5.51
District East	**509,239**	**110.79**	**5.71**
Rural	-	-	-
Urban	509,239	110.79	5.71
District South	**327,518**	**111.27**	**5.47**
Rural	-	-	-
Urban	327,518	111.27	5.47
District West	**634,459**	**111.75**	**6.17**
Rural	44,051	111.35	6.43
Urban	590,408	111.79	6.15
District Korangi	**421,618**	**109.49**	**5.83**
Rural	-	-	-
Urban	421,618	109.49	5.83
District Malir	**338,257**	**114.96**	**5.94**
Rural	149,820	114.20	5.73
Urban	188,437	115.53	6.11

Note: * Avg. HH Size drive from the Provisional Census Result - 2017 (Pakistan Bureau of Statistics)

4.3.5 Economic and Livelihood Conditions

Karachi is the largest city in Pakistan and represents almost 10% of the population of Pakistan. Its economy is about one-quarter that of the national Gross Domestic Product (GDP). Karachi produces about 30% of the manufactured goods, handles 95% of foreign trade and contributes more than 65% of the national revenue. The primary sector of Pakistani economy (agriculture) probably does not represent more than 1% of Karachi's Gross Regional Domestic Product (GRDP). The secondary sector (manufacturing, construction, electricity, gas) constitute one quarter of the metropolitan's economy. The tertiary sector (services) represents the remaining three-quarters of GRDP.

Karachi has seen a large increase in its labour force and labour force participation rate continues to increase. While higher than other areas of the country, it remains quite low at 30.4%. This can partly be explained by low female participation rate. Employment rate is quite high in this city. In terms of family characteristics, 85% are nuclear families while the remaining 15% live in joint families. 80% of the houses are owner occupied in the city.

District west is also one of the largest contributors to inland revenue, since it houses the city's largest industrial site, as well as the Karachi Port, Oil Terminal,

Deepwater Container Terminal and Fish Harbour. Valeeka Textile Mill, the largest factory in the district, was inaugurated by Quaid-e-Azam Muhammad Ali Jinnah.

Baldia is one of the most impoverished areas and most residents in the area tend to live here because housing rental costs are lower than other more central parts of Karachi.

4.3.6 Health Facilities

The total number of public and private sector health facilities in Karachi is 989. As per Health Profile of Sindh 2016, there is one doctor for every 3,029 patients, one nurse for every 7,282 patients and one bed for every 1,291 patients in Karachi. Details of these health facilities and doctors are presented below:

Table 4.5: Health Facilities in Karachi 2016

Health Facilities	No.	Beds
Government Hospitals	15	4,807
Departmental Hospitals	9	1,185
Private Hospitals	134	7,249
Local Bodies Hospitals	7	1,109
Dispensaries (Govt./Local Bodies/ Private/Missionaries)	643	267
MCHC (Govt./Local Bodies/ Private/Missionaries)	85	26
TB Clinic	23	-
BHUs	37	76
RHCs	6	94
Govt. Urban Health Centre	5	-
Govt. Urban Health Unit	10	-
Other Govt. (Trauma Centre/Homeo/Unani Shifakhana)	15	
Total	**989**	
Source: Health Profile of Sindh 2016 (BOS-Sindh)		

Table: 4.6: Population Served by

***Per Doctor:**	3,029
Per Nurse:	7,282
Per Bed:	1,291

Note: *It includes Physicians, Surgeons, Gynecologist, Pediatricians and Doctors/GMO
Source: Health Profile of Sindh 2016 (BOS-Sindh)

Table 4.7: No. of Doctors in Karachi 2016

Physicians	285
Surgeons	271
Gynecologist	217
Pediatricians	222
Doctors/GMO	5,320
Dentists	276

Nurses	2,627
Source: Health Profile of Sindh 2016 (BOS-Sindh)	

Few healthcare facilities near the project area include: Halai Ghanchi Hospital, M.S. Murshid Hospital & SHED Medical Centre.

Health costs related to air pollution in Karachi are estimated in the range of PRs 30-40 billion every year. The presence of high concentrations of pollutants in the air of Karachi causes multiple types of respiratory diseases among its residents. Twenty-three percent of the patients admitted to the Civil Hospital were diagnosed with respiratory tract infections (IUCN 2007). Open burning of industrial solid waste and the discharge of untreated liquid waste are serious hazards in Karachi. Recent fatalities occurred due to direct exposure of people to the burning of industrial toxic solid waste. A World Bank study looking at 18 towns of Karachi city revealed blood lead concentration exceeding the WHO guideline in 89 percent of the sampled sources (World Bank 2010).[10]

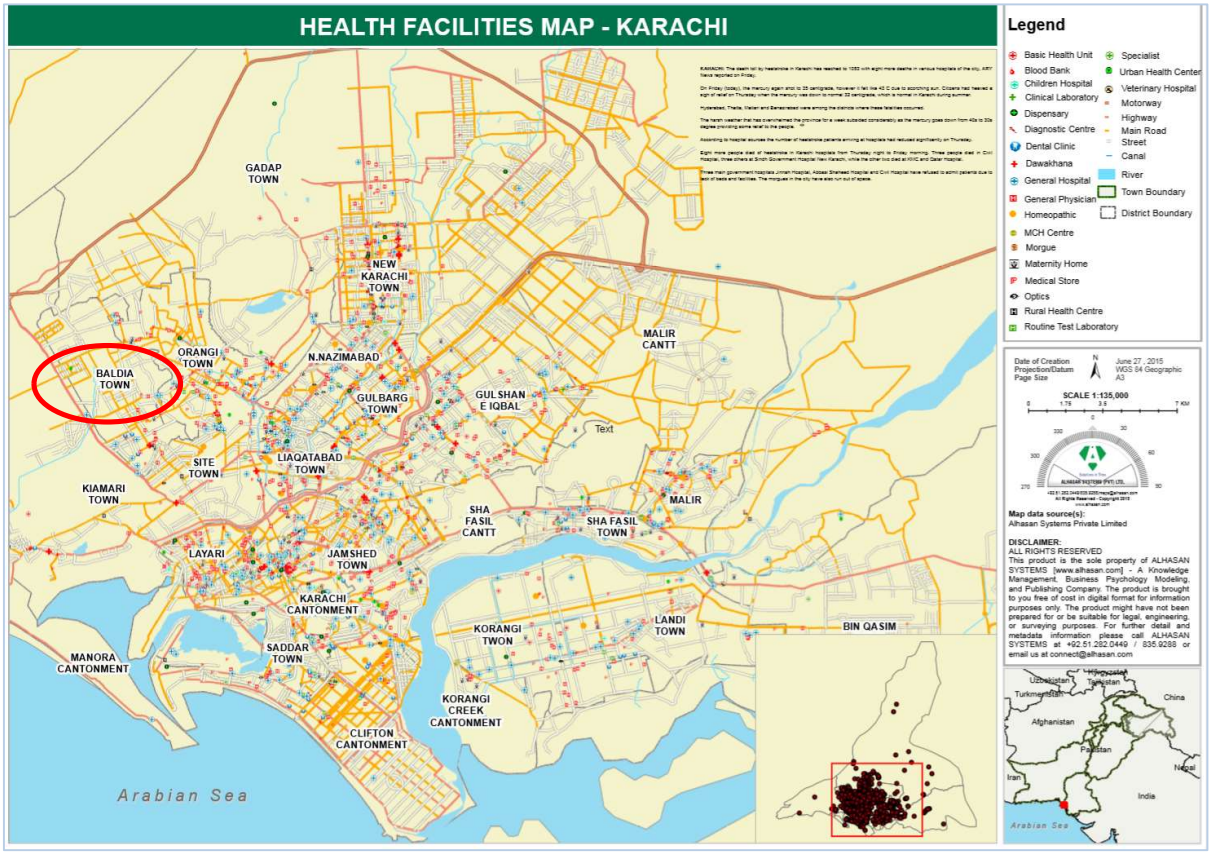


Figure 4.19: Health Facilities Map-Karachi

[10] Transforming Karachi into a Livable and Competitive Megacity http://dx.doi.org/10.1596/978-1-4648-1211-8

4.3.7 Education

According to the recent study of RSU-Sindh Management Information System the Karachi division has total 2,915 schools including primary, middle, secondary and higher secondary schools. District Malir and District Central has highest number of schools i.e., 613 schools in each district while District East has lowest, 267 number of Schools. District wise School data and enrolment stratus for 2015-2016 is presented below.

Table 4.8: District wise School data in Karachi 2015-16

Type of School	Central	East	South	West	Malir	Korangi	Total
Primary	372	169	331	280	488	377	2,017
Middle	100	30	75	42	75	57	379
Secondary	132	62	88	47	43	112	484
Higher Secondary	9	6	5	3	7	5	35
Total	613	267	499	372	613	551	2,915
Source: RSU-Sindh Management Information System (SEMIS)							

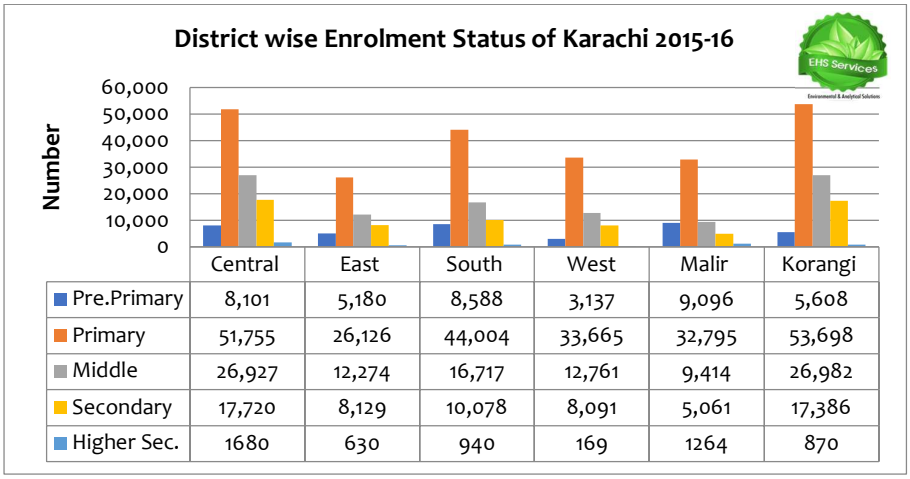


Figure 4.20: District wise Enrolment Status of Karachi 2015-2016

4.3.8 Solid Waste Management

Solid waste management of the area falls under the jurisdiction of DMC West. Garbage generated per day is 1730 tons; 1210 tons is lifted and dumped on a site outside of the city, Garbage backlog is 520 tons per day. 88 different types of vehicles are being used for collecting solid waste.

4.3.9 Traffic

Karachi district covers an area of 3,706.83 km^2 and is served by a well-established network of major roads. The total road length in Karachi city is approximately 10,000 km. Local roads accounted for 93%, while the highways and arterial roads for less than 5%.

The built environment of the project area includes the Karachi Northern Bypass (M-10). The Karachi Northern Bypass starts from the ICI bridge zero point of Mauripur road passing through SITE Ltd area and turns towards the RCD highway and moves northeast direction from Km 18+00 on RCD highway and terminates at Karachi – Hyderabad Motorway. The M-10/Karachi Northern Bypass is a 2-lane road of Karachi (one lane on each side). That connects the M-9 motorway to the Karachi Port and provides an easy access to the transporters and to the commuters who can go directly to the Karachi port without entering the main arteries of city.

4.3.10 Fire Services Condition in Karachi City

If we look at the statistical figure of Karachi fire station, we find that there are only 18 fire stations in Karachi out of which only 10 Fire stations have the capacity to control massive fires, and rest of the 8 fire stations need a backup in case of a huge fire. The Firemen and their equipment are not even capable to survive in critical conditions due to lack of manpower and proper machinery. The fire tending vehicle is also not properly managed; only 2 vehicles are available in each station for fighting. Karachi is under the outbreak of un-planned slum areas. 55 % of area of Karachi is under this menace because of which the fire brigade doesn't have ideal path accessibility towards the emergency spot in majority of the cases. Traffic is quite congested in these areas which make it difficult to provide immediate aid and response in an emergency circumstance.

5. Stakeholder Consultation

Stakeholder consultation is a means of involving all primary and secondary stakeholders in the project's decision-making process in order to address their concerns, improve project design, and give the project legitimacy.

Stakeholder consultation, if conducted in a participatory and objective manner, is a means of enhancing project sustainability. It is best to initiate the stakeholder consultation process at an early stage in a project cycle. This ensures that feedback from communities and other stakeholders directly or indirectly affected by the project can be used to adjust and improve the project's design, planning, and implementation, and help structure the project to be both environmentally and socially sound.

Sindh Environmental Protection 2014 mandates stakeholder consultation as an EIA tool to take onboard all primary & secondary stakeholders in the decision-making process. The objective is to address the concerns of the stakeholders as well as ecology. Stakeholder consultation, if conducted in a participatory and objective manner has been found to enhance the sustainability of the Project.

This EIA has conducted the stakeholder consultation meetings at the earliest stage of initiation of the environmental assessment process. The stakeholder consultation has ensured feedback from communities and other stakeholders directly or indirectly affected by the project.

5.1 Objectives of Stakeholders Consultation

Objectives of the public consultation process adopted for this Project are as follows:

- To inform primary as well as secondary stakeholders about the Project and project activities.
- To obtain feedback from primary and secondary stakeholders on the Project and project activities.
- To set-out the boundaries of the assessment by collecting information on relevant potential environmental & social issues of the Project & project activities, and to propose mitigation measures.

5.2 Identification of Stakeholders

Stakeholders are people, groups, or institutions that may be affected by, can significantly influence, or are important to the achievement of the stated purpose of a proposed intervention. The main stakeholders for the proposed Project include the following:

- Sindh Environmental Protection Agency (SEPA)
- Academia
- NGOs
- Environmental Activists
- Residents and business owners of the project area

Figure 5.1: Consultation with stakeholders

A variety of consultation tools were used to engage stakeholders and gather their feedback. A systematic approach was adopted, whereby stakeholders were initially contacted through official letters, followed-up through phone calls and emails and where possible, and meetings were held to solicit stakeholder concerns and recommendations. Consultation with the residents, businesses and public service institutions in the immediate vicinity of the project area was given priority to ensure they are informed regarding the project details and they have ample opportunity to share their concerns & comments.

5.3 Consultation Feedback

The comments, concerns and suggestions received from stakeholders during the consultation meetings have been collated in this section. Following are the observations of the stakeholders at the meetings arranged for consultations on the nature of the project & procedures followed for densification:

- Industries should be obligated to ensure that their hazardous waste is properly incinerated. Hazardous waste can pose significant risks to human health and the environment if not handled and disposed of properly. Incineration is one of the methods used for the treatment and disposal of hazardous waste.
- Proper incineration of hazardous waste involves subjecting the waste to high temperatures in controlled conditions, which helps to destroy or neutralize the hazardous components. This process can reduce the volume of waste and minimize the potential for contamination. However, it is important to note that not all types of hazardous waste can be safely incinerated, and certain waste streams may require alternative treatment methods.
- The responsibility for managing hazardous waste lies with the industries that generate it. They should adhere to applicable regulations, work with licensed waste management companies, and ensure that their waste is transported and incinerated by authorized and properly equipped facilities. Compliance with these regulations helps prevent illegal dumping, reduces the risk of environmental contamination, and protects public health.
- It is crucial for industries to recognize the importance of proper hazardous waste management, including the use of appropriate incineration facilities when necessary. By doing so, they can fulfill their responsibility to protect the environment and public health while complying with regulatory requirements.
- Locating an incineration facility away from sensitive receptors is generally considered best practice. When siting an incineration facility, several factors should be considered, including local regulations, land availability, transportation infrastructure, and community concerns. It is important to involve the community and conduct thorough environmental and health impact assessments to evaluate potential risks and address any concerns.

- Additionally, it is essential to implement appropriate emission control technologies and monitoring systems to minimize the release of pollutants into the environment. Regular monitoring and compliance with emission standards are crucial to ensure the facility operates within acceptable limits.
- Proper disposal or beneficial use of bottom ash generated from incinerators is essential to minimize its environmental impact. It is important to note that the appropriateness of each management option will depend on factors such as the composition and characteristics of the bottom ash, local regulations, and the availability of suitable markets or facilities for recycling or disposal. Therefore, a comprehensive evaluation and decision-making process is necessary to determine the most suitable method for managing bottom ash from incinerators.
- Controlling dioxin and furan emissions from incinerators is crucial for minimizing the impact on human health and the environment. Installing effective air pollution control devices, such as scrubbers and filters, can capture and remove dioxins and furans from the flue gas before it is released into the atmosphere.
- It is important to separate hazardous and non-hazardous waste streams before incineration. Hazardous wastes, including materials containing chlorinated compounds, are more likely to produce dioxins and furans during combustion. By properly segregating waste, the amount of chlorinated materials entering the incinerator can be minimized.
- Implementing a robust monitoring system to continuously measure dioxin and furan emissions is essential for early detection of any deviations or malfunctions in the incinerator. Real-time monitoring allows for prompt corrective actions and ensures compliance with emission standards.
- It is important to ensure that cyclones and scrubbers are properly designed, sized, and maintained to optimize their performance. Regular inspections, cleaning, and maintenance of these systems are necessary to ensure their effectiveness in controlling PM2.5 emissions. Additionally, monitoring the system's performance through continuous emissions monitoring is essential to detect any deviations or malfunctions promptly.
- SEPA should review SEQS and set emission limits for incineration devices on the lines of Punjab EPA. Average daily intakes due to emissions must be calculated, and from this cancer risks and number of additional cancers that would result must be derived.
- Emission of heavy metals should be monitored.
- Transportation of hazardous waste to incineration plants should be done through SEPA licensed waste contractors having all required certifications.
- Drivers should be trained & given awareness about handling of hazardous waste and on how to deal with emergencies during accidental spillages.
- Hospital waste must be brought to the incineration plant with specialized arrangements to avoid risk of exposure to waste handlers.
- The potential health effects of the development outlined in consultation with stakeholders, both positive and negative, were tabulated.

	Evidence	***Quantifiable?***
Anxiety	*Anxiety about environmental pollution has a negative effect on physical, mental and emotional health*[11] [12]	*No*
Employment	*Employment is associated with lower death rates, less heart disease and better mental health*[13]	*No*
Noise	*Background noise may cause stress and sleep disturbance*[14]	*No*
Occupational risks	*Exposure to air pollution, toxic substances and noise at work carries health risks*	*Partly*
Road accidents	*Road traffic results in deaths and injuries*[15]	*Partly*
Stack emissions	*Air pollution, especially fine particles, increases death rates and hospital admission rates for heart and lung conditions*[16] [17]	*Yes*
	Dioxins can damage the immune and reproductive systems[18]	*No*
	Dioxins and metals can cause cancer and other effects[19]	*Yes*
Use of landfill reduced	*Living near a landfill may increase the risk of congenital abnormalities and low birth weight*[20]	*No*
	Burning landfill gas in flares or engines causes air pollution and releases dioxins	*Yes*

[11] McCarron P, Harvey I, Brogan R *et al.* Self reported health of people in an area contaminated by chromium waste: interview study. *BMJ* 2000; 320:11–5.
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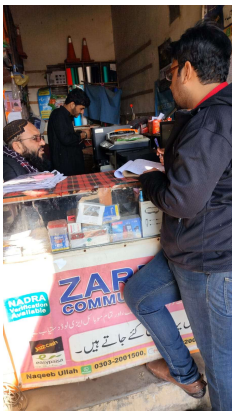
[19] Institute for Environmental Health. *Health Effects of Waste Combustion Products*. Leicester: IEH, 1997.
[20] Elliott P, Briggs D, Morris S *et al.* Risk of adverse birth outcomes in populations living near landfill sites. *BMJ* 2001; 323:363–8.

Pictorial Profile of Public Consultation at the Project Site



6. Screening of Potential Environmental Impacts and Mitigation Measures

This section presents the screening process that identifies the environmental aspects and makes assessment of impact of different activities on the physical, biological and social environment. The screening process has through review of literature, screening of potential environmental and social aspects raised by the stakeholders, 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. Mitigation measures have been proposed to reduce, minimize or compensate for the identified potential negative impacts and their adoption has been recommended.

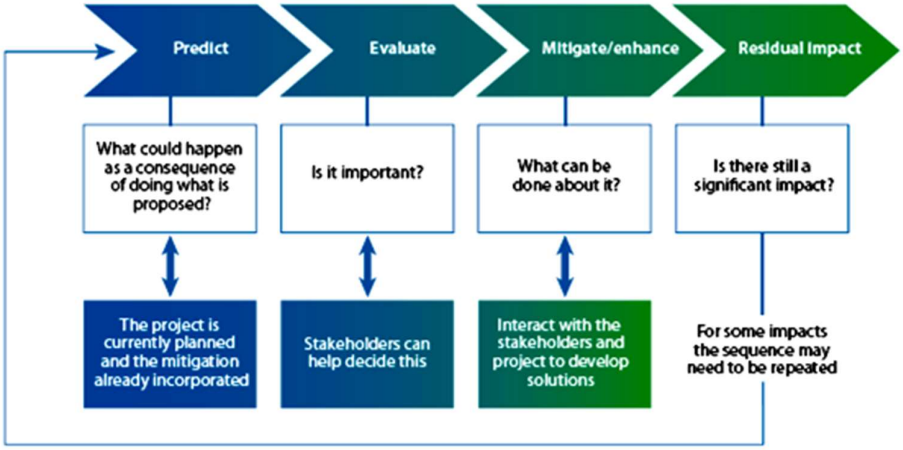


Figure 6.1: Impact Assessment Approach

6.1 Siting of Project

The proposed site for ECO Waste Management Services project has been selected in view of availability of necessary infrastructure and utilities for setting-up the treatment and safe disposal of Hazardous Waste generated from various industries.

The macroenvironment of District West has the largest industrial area. These industries generate considerable amount of incinerable Hazardous Wastes & generates significant amount of waste which can be recycled / reconditioned.

In view of the above, the selected location for the proposed project has been deemed appropriate.

The Site location has the following advantages:

- Site is located in the environs of an Industrial Area.
- Easy availability of infrastructure such as water and power.
- Well connected by Road infrastructure.
- Industries can avail the benefit of proposed common waste treatment facility for disposal of their incinerable hazardous waste & recyclable material.

6.2 Assessment of Impacts at the Construction & Operation stages

The impacts of construction phase are temporary in nature and subside once the construction activities get over. Major pollutants generated from construction, erection & commissioning activities are particulate matter (PM10 and PM2.5), NOx, SO2 & CO. Generation of dust from construction activities will be main cause of increase in PM10 and PM2.5. However, no major construction activity will be required at site for the proposed project. The impacts of construction phase on various environmental attributes are tabulated below:

Table 6.1: Construction Phase: Impact & Mitigation Measures

S. #	*Environmental Attribute*	*Impact*	*Mitigation Measures*
1.	*Land*	→ *The existing land cover of the proposed project site will have a minimal affect from site preparatory works for which clearance of shrubs, preparation of internal roads, excavation and paving of site for installing plant equipment and machineries is required.*	→ *The present land use of macroenvironment is for Industrial purpose.* → *Proposed greenbelt development & plantation will improve the aesthetics of the microenvironment.*
2.	*Soil*	→ *No significant adverse impact on the soil is anticipated from construction & installation work.*	→ *Excavated soil will be reused within site; storm water will be properly channelized to avoid water logging.*
3.	*Air quality*	→ *Dust generation* → *Exhaust emission from vehicles.* → *Exhaust from construction Machinery*	→ *Regular sprinkling of water will be done at the construction site.* → *No unpaved roads will be kept* → *Construction equipments and vehicles will be kept maintained to minimize automobile exhaust*
4.	*Noise levels*	→ *The noise produced during the construction, erection and commissioning activities may add to the existing ambient noise levels.*	→ *The machineries / vehicles will be kept in good order to reduce excessive noise.*
	Water quality	→ *Ground water as well as surface water contamination due to improper*	→ *Provision of KWSB water supply has been made and will be utilized*

		management / handling of construction wastes. → *Non-point discharges of solids* → *Improper discharge of Sewage generated from the construction work force stationed at the site*	→ *The construction in the project will be more related to mechanical fabrication, assembly and the erection; hence the water requirements would be small.* → *Septic tanks will be set up for disposal of sewage.*
	Ecology	→ *The impact on the surrounding ecology due to the project will mainly occur from the deposition of dust generated due to construction activities onto the nearby vegetation*	→ *No national park, wildlife sanctuary, biosphere reserve exists within the close proximity of the project site.* → *Agriculture fields dominate the terrestrial ecology in the area.* → *Adequate measures will be taken to suppress dust generated due to construction activities.* → *The incremental emission of air pollutants during construction phase is not likely to induce any significant changes in the terrestrial ecology.* → *No cutting of trees will be done.*
	Socioeconomic Environment	→ *The project will have positive impact on the socioeconomics of the area.* → *Local labour particularly unskilled labour will be employed based on eligibility, during construction as well as post-construction phase.*	→ *The locals would get opportunities for employment in the project. This includes drivers and labors involved in the handling of waste* → *The socio-economic conditions of the area are expected to improve.*
	Occupational & Community Health	→ *Over-exertion, and ergonomic injuries and illnesses, such as repetitive motion, over-exertion, and manual handling, are among the most common causes of injuries in construction activities.* → *Respiratory issues due to dust* → *High blood pressure etc. due to continuous working near noise generating machinery*	→ *PPEs such as dust masks & earmuffs will be provided to workmen to reduce occupational health hazards.* → *Implementation of administrative controls into work processes, such as job rotations and rest or stretch breaks will be done.* → *Sprinkling of water for dust suppression to minimize dust from vehicle movements & construction activities.*

Table 6.2: Identification of Impacts during Construction Phase							
Parameter/ Activity	***Air***	***Water***	***Land***	***Noise***	***Ecology***	***Health & Safety***	***Socioeconomic***
Site cleaning	√	x	√	√	√	√	x
Leveling and road laying	√	x	x	√	x	√	x
Earthwork	√	x	√	√	x	√	x
Transportation of construction materials	√	x	√	√	√	√	x
Civil work	√	√	x	√	x	√	x
Mechanical erection	√	x	x	x	x	√	x
Employment	x	√	x	x	x	√	√
Domestic Activities by workers	x	√	√	x	x	√	x
Greenbelt development	√	√	√	√	√	√	√
Note: (√): Possibility of Impact			***(x): No impact will occur***				
Short Term (-ve)			***Long Term (+ve)***				

Table 6.3: Identification of Impacts during Operation Phase							
Parameter/ Activity	***Air***	***Water***	***Land***	***Noise***	***Ecology***	***Health & Safety***	***Socioeconomic***
Waste storage and handling	√	√	√	x	x	√	x
Transportation	√	x	x	√	x	√	x
Process	√	√	√	√	x	√	x
Emergencies or disaster	√	√	√	√	√	√	x
Breakdown of critical systems	√	√	√	√	x	√	x
Employment	x	x	x	x	x	√	√
Infrastructure development & CSR activities	x	x	x	x	x	√	√
Greenbelt development	√	√	√	√	√	√	√
Note: (√): Possibility of Impact			***(x): No impact will occur***				
Short Term (-ve)			***Long Term (+ve)***				

6.2.1 Impact on Land use, Topography & Drainage

The study area is characterized by a relatively flat terrain. No additional impacts to land use will occur due to the construction or operation of the proposed incinerator project. Proposed greenbelt development & plantation will improve the aesthetics of the area. No surface drainage is modified/ diverted as such no disturbance is caused to the natural drainage system. Hence, the impact on the topography and drainage of the study area is negligible.

6.2.2 Impact on Soil

Potential impacts on soil quality due to proposed project activities are given below:

- Topsoil during site preparation: *soil erosion.*

- Construction & commissioning of the project: *compaction of soil & topsoil loss.*
- Fuel leakages on soil during vehicular activities: *compaction of soil & soil contamination.*
- Leakages due to storage and handling of fuel, solid hazardous waste- soil contamination.

The contractor shall be mandated to follow the SOPs with regard to handling, storage, transfer, use and final disposal of contaminants, if any by the proponent. Standard practices for handling of waste & no discharge of wastewater outside the plant premises will ensure no contamination of the soil and hence the impacts due to the facility on the soil quality are negligible. The impact will be confined to the core zone only.

Mitigation Measure

The following measures will be adopted during the construction stage to reduce the chances of soil contamination:

- Fuel oils, lubricants, and chemicals will be stored in covered dyked areas, underlain with impervious lining.
- Washing and maintenance of vehicles and equipment will only be carried out at designated areas.
- Regular inspections will be carried out to detect leakages in construction vehicles and equipment.
- Appropriate implements such as shovels, plastic bags and absorbent materials will be made available near fuel and oil storage areas for removal of oil and contaminated soil.
- Contaminated soil will be removed and properly disposed after treatment such as by incineration.
- Hazardous Substances Rules 2014 will be adhered to for storage, transfer, subsequent handling and final disposal of any chemicals/substances during the operation stage.

6.2.3 Impact on Air Quality

Air Pollutants emitted from the incinerator operations include: (1) particulate matter (PM), (2) metals, (3) acid gases, (4) oxides of nitrogen (NOx), (5) carbon monoxide (CO), (6) organics, and (7) various other materials present in wastes.

Particulate matter is emitted as a result of incomplete combustion of organics (i. e., soot) and by the entrainment of noncombustible ash due to the turbulent movement of combustion gases. Particulate matter may exit as a solid or an aerosol, and may contain heavy metals, acids, and/or trace organics.

Uncontrolled particulate emission rates vary widely, depending on the type of incinerator, composition of the waste, and the operating practices employed. Entrainment of PM in the incinerator exhaust is primarily a function of the gas velocity within the combustion chamber containing the solid waste. Controlled air incinerators have the lowest turbulence and, consequently, the lowest PM emissions; rotary kiln incinerators have highly turbulent combustion, and thus have the highest PM emissions.

The type and amount of trace metals in the flue gas are directly related to the metals contained in the waste. Metal emissions are affected by the level of PM control and the flue gas temperature. Most metals (except mercury) exhibit fine-particle enrichment and are removed by maximizing small particle collection. Mercury, due to its high vapor pressure, does not show significant particle enrichment, and removal is not a function of small particle collection in gas streams at temperatures greater than 150°C (300°F).

Acid gas concentrations of hydrogen chloride (HCl) and sulfur dioxide (SO_2) in MWI flue gases are directly related to the chlorine and sulfur content of the waste. Most of the chlorine, which is chemically bound within the waste in the form of polyvinyl chloride (PVC) and other chlorinated compounds, will be converted to HCl. Sulfur is also chemically bound within the materials making up medical waste and is oxidized during combustion to form SO_2.

Oxides of nitrogen (NOx) represent a mixture of mainly nitric oxide (NO) and nitrogen dioxide (NO_2). They are formed during combustion by: (1) oxidation of nitrogen chemically bound in the waste, and (2) reaction between molecular nitrogen and oxygen in the combustion air. The formation of NOx is dependent on the quantity of fuel-bound nitrogen compounds, flame temperature, and air/fuel ratio.

Carbon monoxide is a product of incomplete combustion. Its presence can be related to insufficient oxygen, combustion (residence) time, temperature, and turbulence (fuel/air mixing) in the combustion zone.

Failure to achieve complete combustion of organic materials evolved from the waste can result in emissions of a variety of organic compounds. The products of incomplete combustion (PICs) range from low molecular weight hydrocarbon (e.g., methane or ethane) to high molecular weight compounds (e.g., polychlorinated dibenzo-p-dioxins and dibenzofurans [CDD/CDF]). In general,

combustion conditions required for control of CO (i.e., adequate oxygen, temperature, residence time, and turbulence) will also minimize emissions of most organics. Dioxin/furan formation will be minimized by ensuring that incineration only takes place at temperatures above 800°C.

The technology of treatment of hazardous waste to be adopted in proposed project is thermal destruction based on Incinerator technology involving combustion & oxidation of waste at suitable high temperatures in primary & secondary combustion chambers followed by Quenching for control of dioxins followed by Air Pollution Control Equipments like Cyclone separator, Venturi Scrubber, Packed Bed Scrubber, HEPA filter leading to ID fan and Stack. Thus, a complete treatment system for burning of wastes including series of air pollution control equipments for control of emissions to atmosphere to have a complete process control. The entire system will be automated and controlled by online measurements and monitoring system.

Ambient air concentrations are estimated using *dispersion modeling*, in particular, screening-level models to estimate worst-case concentrations. This purpose of this modeling is to estimate maximum exposures that might occur to workers or others very close to the incinerator, and to assess the effect of stack height on these exposures. To support the application for the project, an assessment including an air dispersion modelling study and surrounding baseline levels on the ambient air quality was performed. Predictions were made for maximum ground level concentrations of the pollutants of concern. The AERSCREEN model was used to produce the estimates of "worst-case" 1-hour, "worst-case" 3-hour, 8-hour, 24-hour, and annual concentrations at breathing height, directly downwind. Concentrations are a function of the source parameters and meteorological parameters.

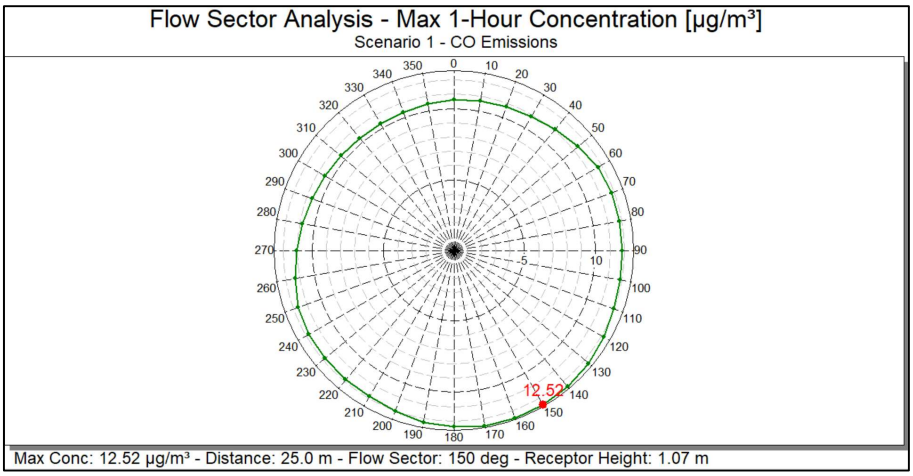
** STACKDATA **	METRIC	ENGLISH
Emission Rate CO:	0.0744 g/s	0.590 lb/hr
Emission Rate NOx:	0.3666 g/s	2.910 lb/hr
Emission Rate SO_2:	0.1491 g/s	1.183 lb/hr
Emission Rate HF:	0.669E-02 g/s	0.531E-01 lb/hr
Emission Rate HCL:	0.0744 g/s	0.591 lb/hr
Emission Rate TSP:	0.883E-04 g/s	0.701E-03 lb/hr
Stack Height:	6.00 meters	19.69 feet
Stack Diameter:	0.460 meters	18.11 inches
Stack Temperature:	1073.2 K	1472.0 Deg F
Exit Velocity:	18.000 m/s	59.06 ft/s
Stack Flow Rate:	6338 ACFM	
Model Mode:	RURAL	
Dist to Ambient Air:	1.0 meters	3.0 Feet

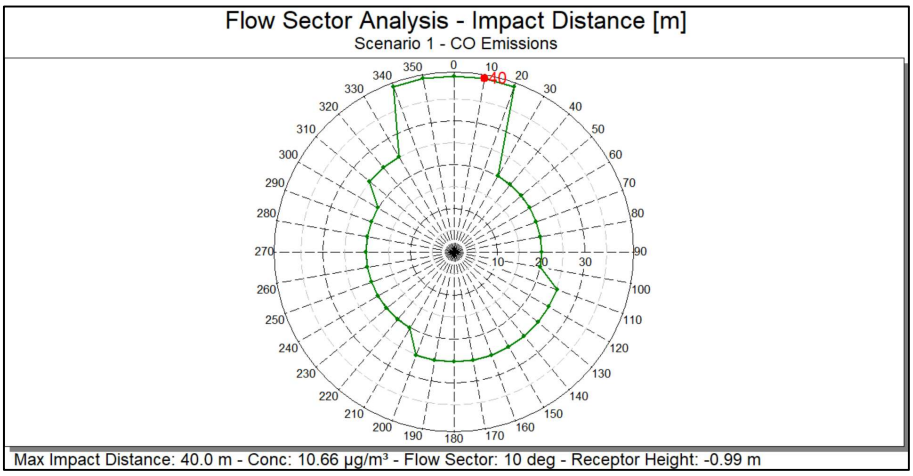
** TERRAIN DATA **

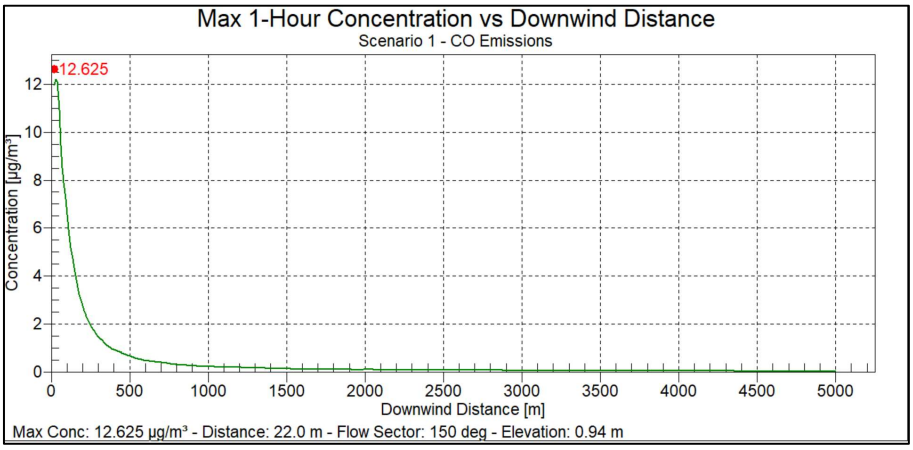
```
 Input coordinates are UTM
 Source Longitude:    66.95044 deg
 Source Latitude:     24.98486 deg
 UTM Zone:            42          Reference Datum: 4 (NAD 83)
 Source elevation will be determined by AERMAP

 Probe distance:    5000. meters       16404. feet

** METEOROLOGY DATA **

 Min/Max Temperature:  295.8 / 305.0 K   72.7 / 89.4 Deg F
 Minimum Wind Speed:   3.1 m/s
 Anemometer Height:    10.000 meters

 Albedo:               0.21
 Bowen Ratio:          1.62
 Roughness Length:     1.000 (meters)
24.98486111
```

Results of Dispersion Analysis: The maximum impact on the air-shed (MGLC) from the operation of proposed incineration process will be at 22 meters directed towards 150 degrees for all pollutants meaning that the emissions are contained well-within the boundary of the project site. The annual concentrations of the modelled pollutant levels will be CO → 1.262 µg/m³ (0.001262 mg/m³), NOx → 6.221 µg/m³, SO2 → 2.530 µg/m³, HF → 0.1135 µg/m³, HCL → 1.263 µg/m³ and TSP → 0.1499E-02 µg/m³.

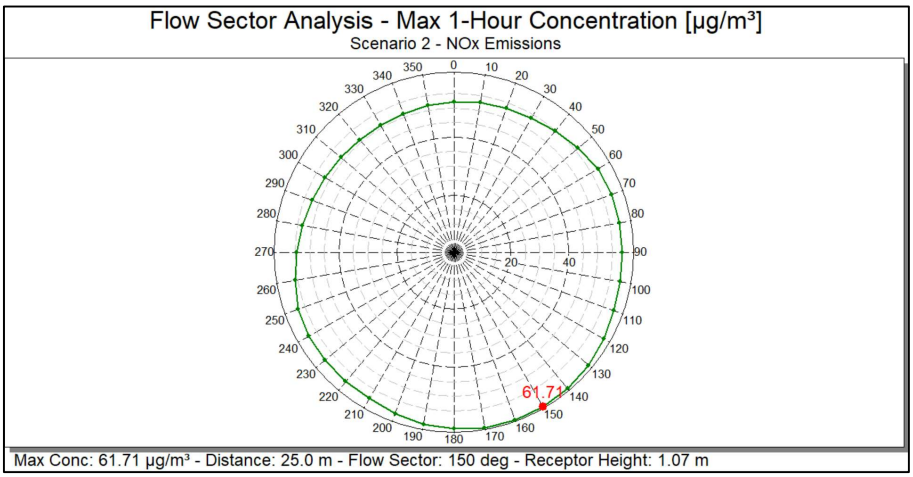
The detailed analysis is shown in the following tables and graphs.

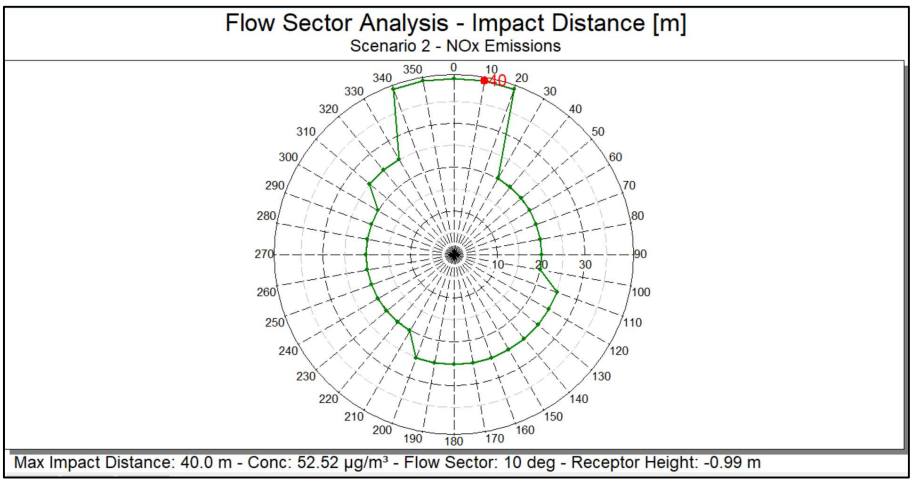


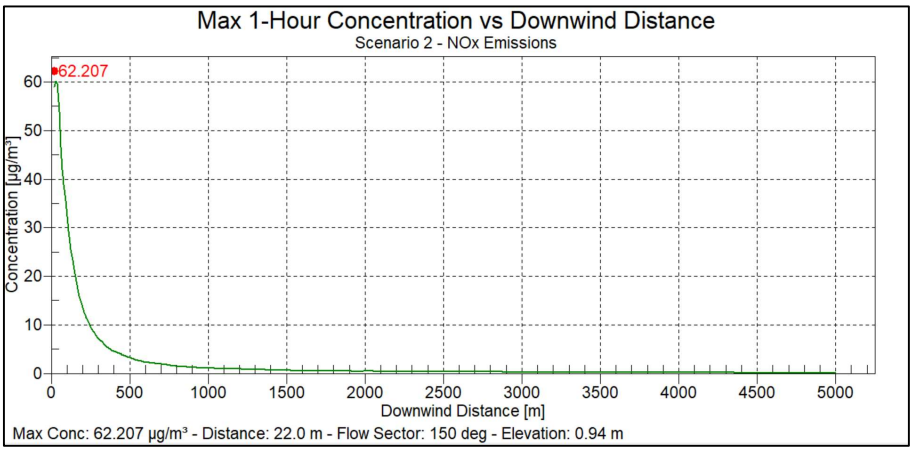




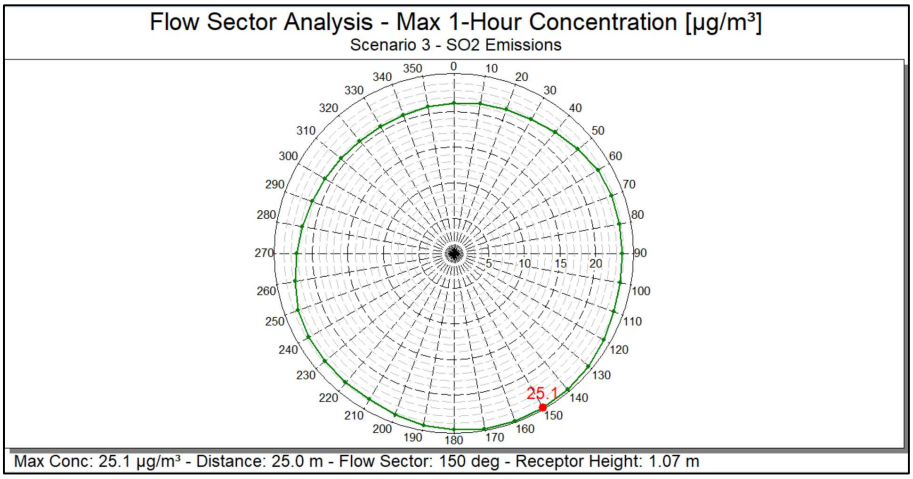
AERSCREEN MAXIMUM IMPACT SUMMARY (SCENARIO 1 - CO emissions)					
CALCULATION PROCEDURE	MAXIMUM 1-HOUR CONC (ug/m^3)	SCALED 3-HOUR CONC (ug/m^3)	SCALED 8-HOUR CONC (ug/m^3)	SCALED 24-HOUR CONC (ug/m^3)	SCALED ANNUAL CONC (ug/m^3)
ELEVATED TERRAIN	12.62	12.62	11.36	7.575	1.262
DISTANCE FROM SOURCE	22.00 meters directed toward 150 degrees				
RECEPTOR HEIGHT	0.94 meters				
IMPACT AT THE AMBIENT BOUNDARY	0.000	0.000	0.000	0.000	0.000

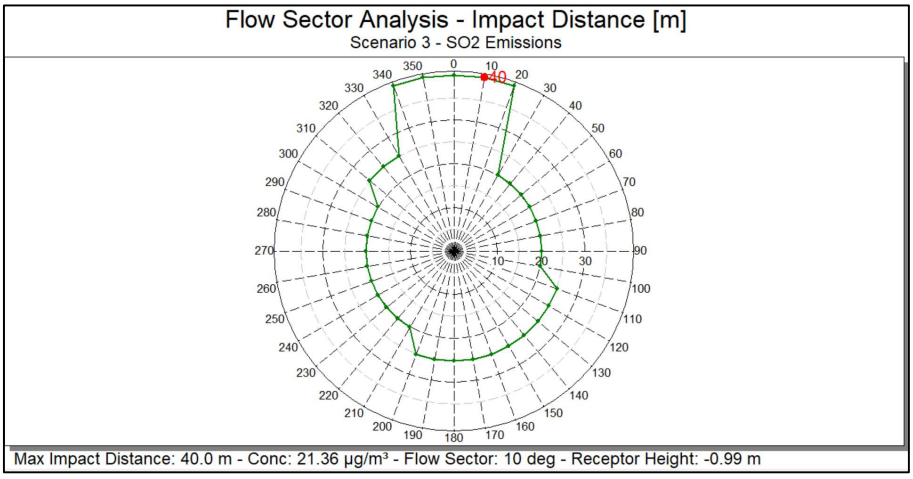

Flow Sector Analysis - Max 1-Hour Concentration [µg/m³]
Scenario 2 - NOx Emissions
61.71
Max Conc: 61.71 µg/m³ - Distance: 25.0 m - Flow Sector: 150 deg - Receptor Height: 1.07 m

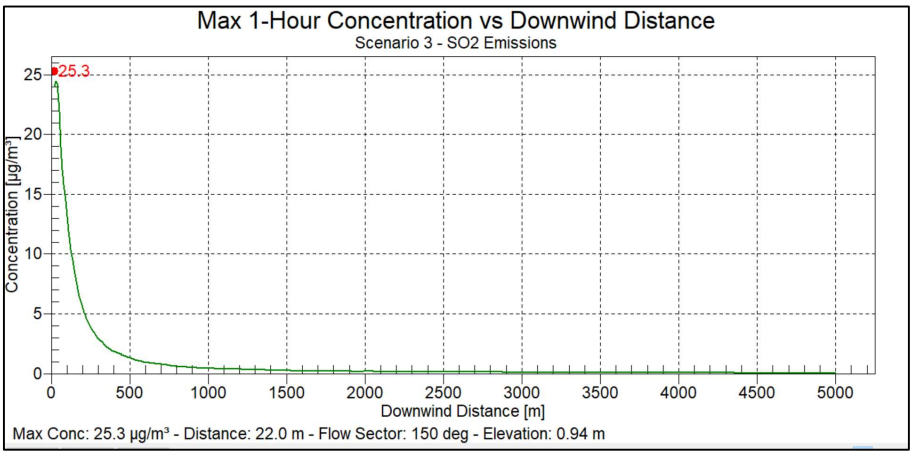

Flow Sector Analysis - Impact Distance [m]
Scenario 2 - NOx Emissions
40
Max Impact Distance: 40.0 m - Conc: 52.52 µg/m³ - Flow Sector: 10 deg - Receptor Height: -0.99 m


Max 1-Hour Concentration vs Downwind Distance
Scenario 2 - NOx Emissions
62.207
Concentration [µg/m³]
Downwind Distance [m]
Max Conc: 62.207 µg/m³ - Distance: 22.0 m - Flow Sector: 150 deg - Elevation: 0.94 m

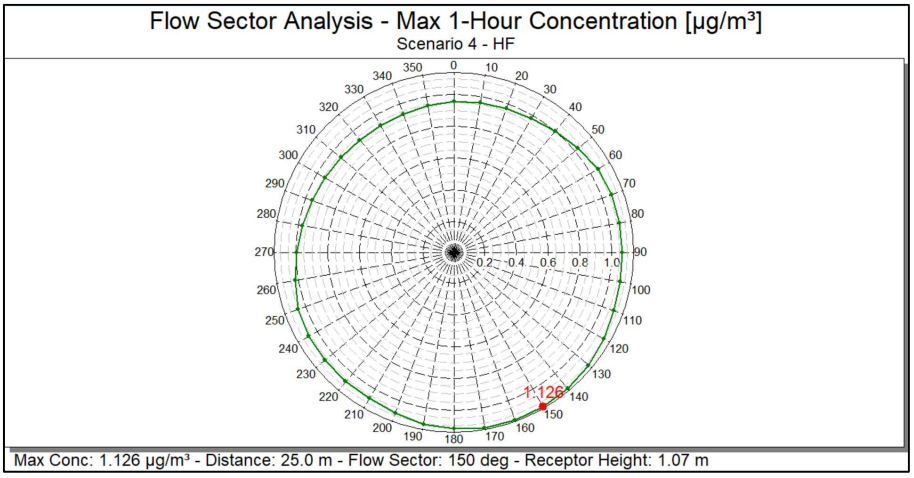
AERSCREEN MAXIMUM IMPACT SUMMARY (SCENARIO 2 - NOx emissions)					
CALCULATION PROCEDURE	MAXIMUM 1-HOUR CONC (ug/m^3)	SCALED 3-HOUR CONC (ug/m^3)	SCALED 8-HOUR CONC (ug/m^3)	SCALED 24-HOUR CONC (ug/m^3)	SCALED ANNUAL CONC (ug/m^3)
ELEVATED TERRAIN	62.21	62.21	55.99	37.32	6.221
DISTANCE FROM SOURCE	22.00 meters directed toward 150 degrees				
RECEPTOR HEIGHT	0.94 meters				
IMPACT AT THE AMBIENT BOUNDARY	0.000	0.000	0.000	0.000	0.000

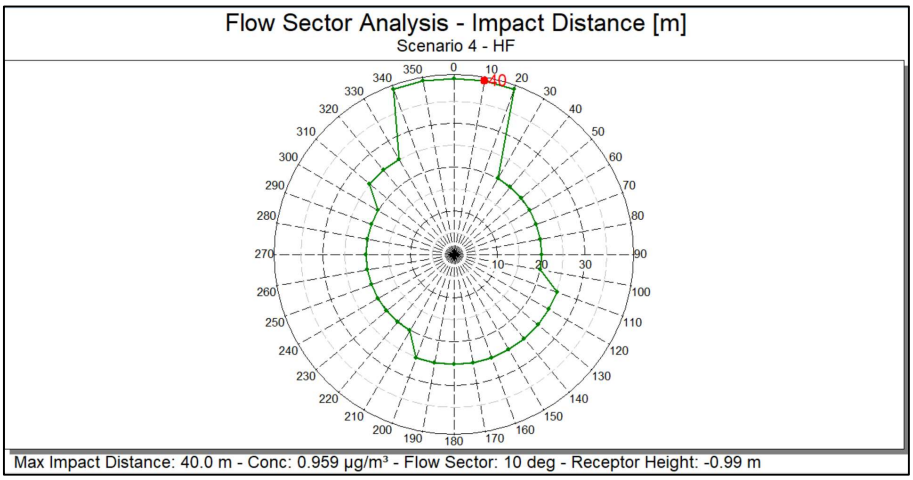


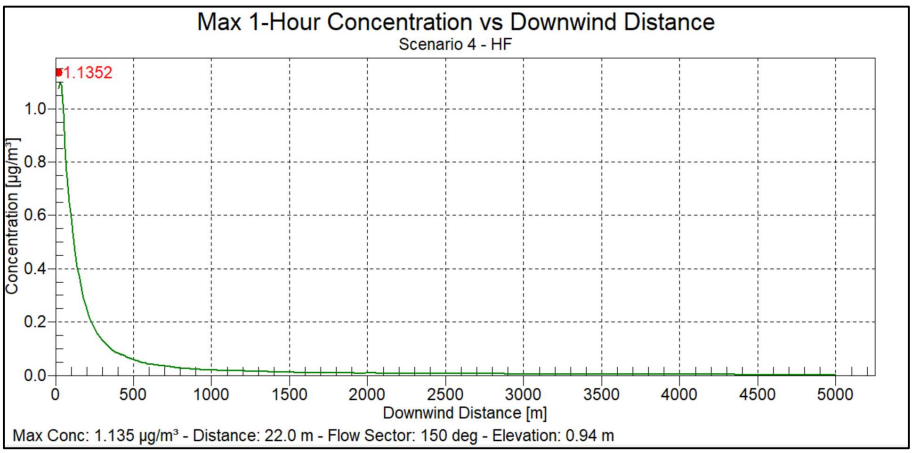




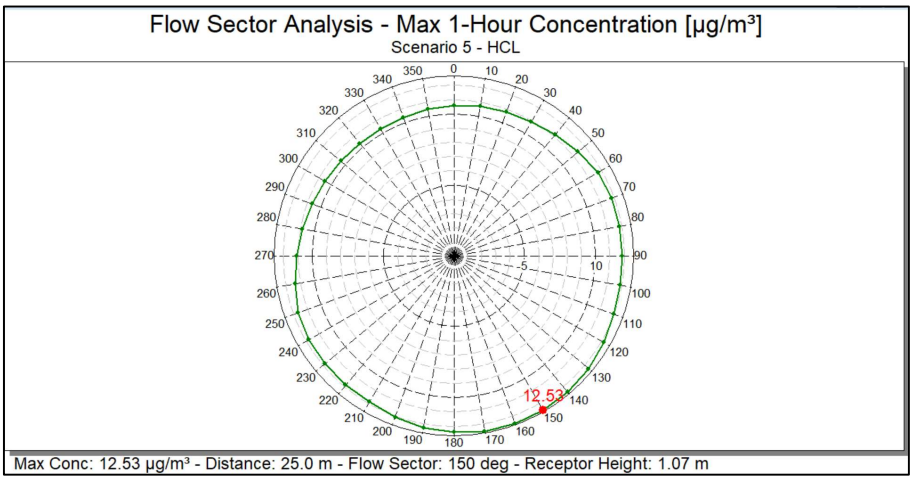
AERSCREEN MAXIMUM IMPACT SUMMARY (SCENARIO 3 – SO_2 emissions)					
CALCULATION PROCEDURE	MAXIMUM 1-HOUR CONC (ug/m^3)	SCALED 3-HOUR CONC (ug/m^3)	SCALED 8-HOUR CONC (ug/m^3)	SCALED 24-HOUR CONC (ug/m^3)	SCALED ANNUAL CONC (ug/m^3)
ELEVATED TERRAIN	25.30	25.30	22.77	15.18	2.530
DISTANCE FROM SOURCE	22.00 meters directed toward 150 degrees				
RECEPTOR HEIGHT	0.94 meters				
IMPACT AT THE AMBIENT BOUNDARY	0.000	0.000	0.000	0.000	0.000

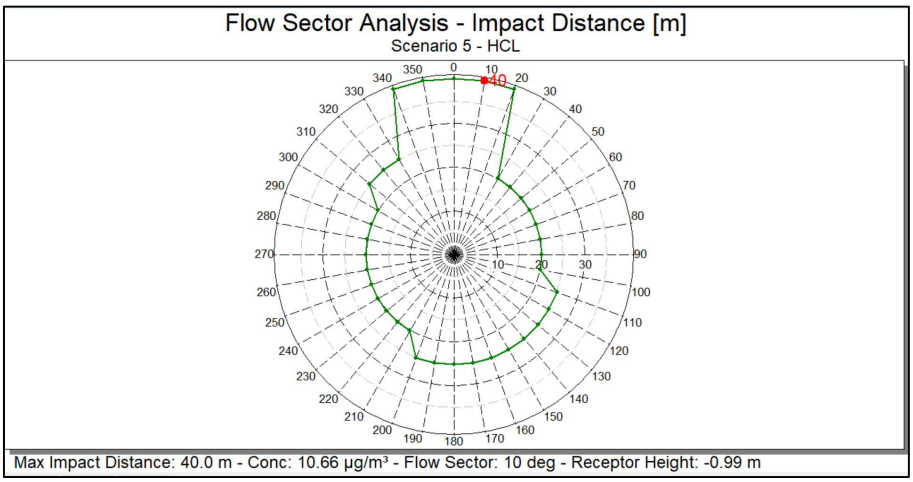


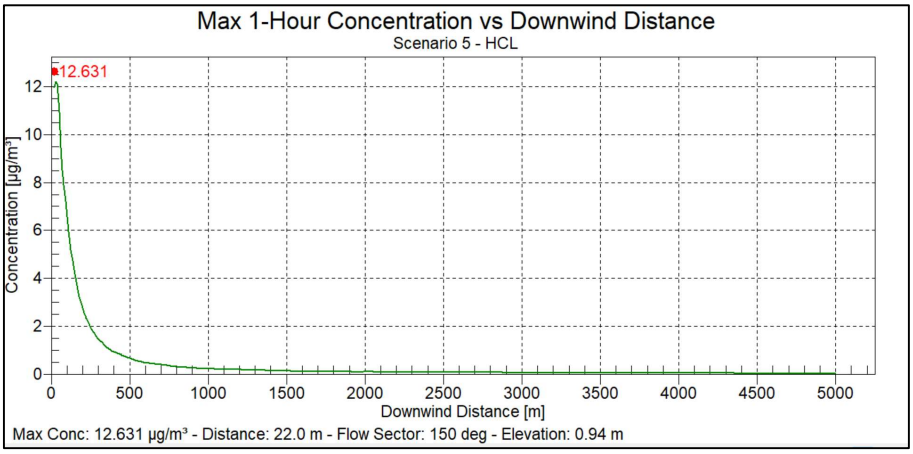




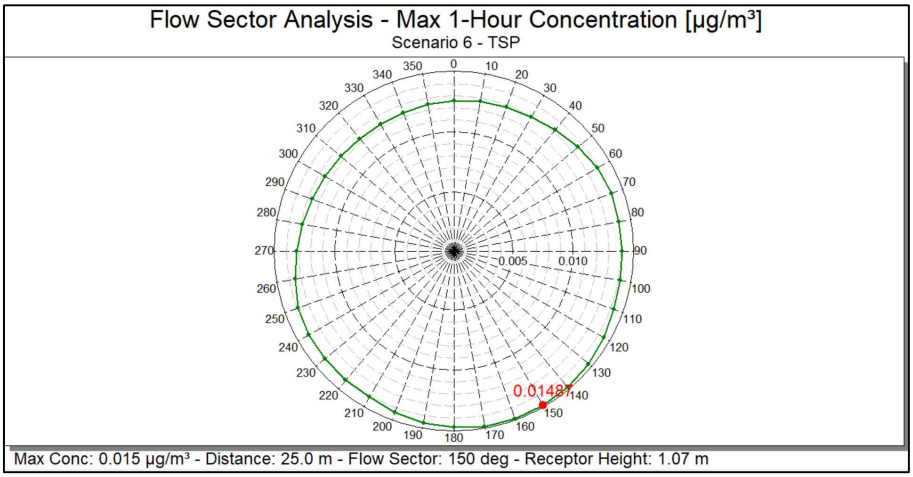
AERSCREEN MAXIMUM IMPACT SUMMARY (SCENARIO 4 - HF emissions)					
CALCULATION PROCEDURE	MAXIMUM 1-HOUR CONC (ug/m^3)	SCALED 3-HOUR CONC (ug/m^3)	SCALED 8-HOUR CONC (ug/m^3)	SCALED 24-HOUR CONC (ug/m^3)	SCALED ANNUAL CONC (ug/m^3)
ELEVATED TERRAIN	1.135	1.135	1.022	0.6811	0.1135
DISTANCE FROM SOURCE	22.00 meters directed toward 150 degrees				
RECEPTOR HEIGHT	0.94 meters				
IMPACT AT THE AMBIENT BOUNDARY	0.000	0.000	0.000	0.000	0.000

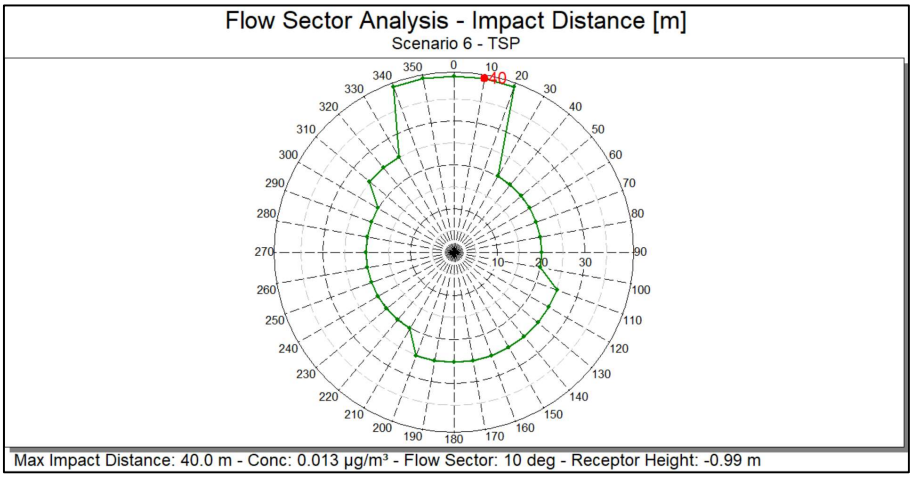

Flow Sector Analysis - Max 1-Hour Concentration [µg/m³]
Scenario 5 - HCL
12.53
Max Conc: 12.53 µg/m³ - Distance: 25.0 m - Flow Sector: 150 deg - Receptor Height: 1.07 m

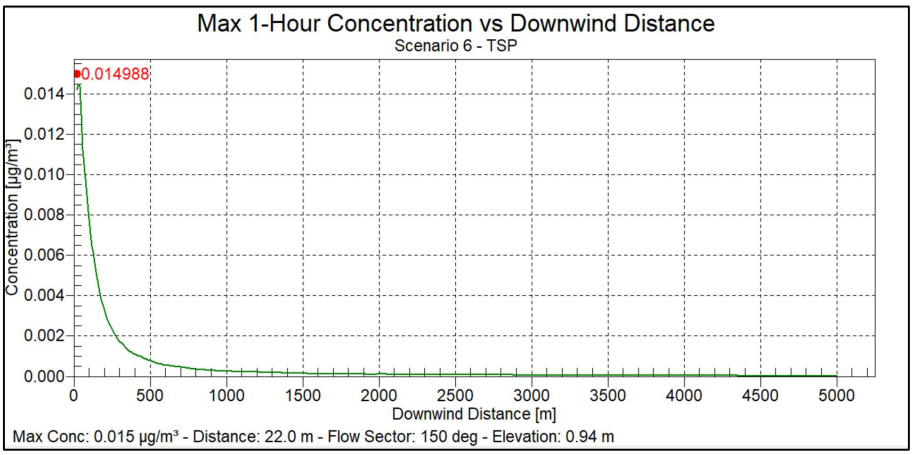

Flow Sector Analysis - Impact Distance [m]
Scenario 5 - HCL
40
Max Impact Distance: 40.0 m - Conc: 10.66 µg/m³ - Flow Sector: 10 deg - Receptor Height: -0.99 m


Max 1-Hour Concentration vs Downwind Distance
Scenario 5 - HCL
12.631
Concentration [µg/m³]
Downwind Distance [m]
Max Conc: 12.631 µg/m³ - Distance: 22.0 m - Flow Sector: 150 deg - Elevation: 0.94 m

AERSCREEN MAXIMUM IMPACT SUMMARY (SCENARIO 5 - HCL emissions)					
CALCULATION PROCEDURE	MAXIMUM 1-HOUR CONC (ug/m^3)	SCALED 3-HOUR CONC (ug/m^3)	SCALED 8-HOUR CONC (ug/m^3)	SCALED 24-HOUR CONC (ug/m^3)	SCALED ANNUAL CONC (ug/m^3)
ELEVATED TERRAIN	12.63	12.63	11.37	7.579	1.263
DISTANCE FROM SOURCE	22.00 meters directed toward 150 degrees				
RECEPTOR HEIGHT	0.94 meters				
IMPACT AT THE AMBIENT BOUNDARY	0.000	0.000	0.000	0.000	0.000







AERSCREEN MAXIMUM IMPACT SUMMARY (SCENARIO 6 - TSP emissions)					
CALCULATION PROCEDURE	MAXIMUM 1-HOUR CONC (ug/m³)	SCALED 3-HOUR CONC (ug/m³)	SCALED 8-HOUR CONC (ug/m³)	SCALED 24-HOUR CONC (ug/m³)	SCALED ANNUAL CONC (ug/m³)
ELEVATED TERRAIN	0.1499E-01	0.1499E-01	0.1349E-01	0.8993E-02	0.1499E-02
DISTANCE FROM SOURCE	22.00 meters directed toward 150 degrees				
RECEPTOR HEIGHT	0.94 meters				
IMPACT AT THE AMBIENT BOUNDARY	0.000	0.000	0.000	0.000	0.000

The following activities may cause impact on air quality during the operational phase:

Table 6.4: Operation Activity, Impact & Mitigation Measures			
S. #	***Activity***	***Impact***	***Mitigation Measures***
1.	*Transportation of waste to the facility from industry*	*Generation of dust and emission of HC & CO.*	→ *Water sprinkling for dust suppression* → *Properly covered vehicles for transportation* → *Regular & preventive maintenance of vehicles.*
2.	*Temporary waste material storage, stabilization & handling, dismantling & segregation*	*Particulate matter emissions & odour generation*	→ *Storage will be done as per Hazardous Substances Rules 2014* → *Standard operating will be* → *developed & implemented* → *Development of green belt for dust & odour suppression*
3.	*Incinerator operations*	*Generation of CO, NOx, SO2, HF, HCl, TSP, dioxin & furan*	→ *Adequate Air Pollution Control System will be installed like Bag Filter, Scrubbers, Mist eliminator, rapid*

			quencher, dioxin & furan control system, ID Fan, HEPA filter & appropriate stack height.
4.	*ETP operations*	*Generation of Odour*	→ *Development of green belt & landscaping with selection of plant* → *species for odor suppression*
5.	*Operation of DG set*	*Generation of SO2, NOx, HC, CO & PM emissions*	→ *D.G set is used as back-up power source.* → *Adequate Stack Height provided for proper dispersion of air pollutants*

6.2.3.1 Air Pollution Control Devices

Air pollution control system cleans the incinerator products of combustion. The functional requirements of flue gas cleaning system are:

- *Control the acid gas emissions*
- *Control of particulate emissions*

The incineration facility will be designed to ensure the wastes are destroyed in a safe, controllable and efficient manner:

- The combustion and flue gas cleaning system always operates under safe negative pressure. This prevents the escape of combustible products to atmosphere prior to being processed through the entire Incineration process.

- Both chambers are maintained at excess air condition at sufficient temperature and residence time to ensure the complete oxidation of wastes.

- The highly efficient air cleaning system traps the particulate matters and neutralizes the acidic gases prior to their release into the atmosphere

- System has got the inbuilt safety interlocks. If any operational parameter goes outside the pre-determined boundary limits, it will cause an automatic shutdown of portion / all of the Incineration System depending upon the particular upset parameter.

The air pollution control system includes:

- *Rapid quencher:* Rapid quenching system to prevent reformation of dioxins by rapidly lowering the flue gas temperatures, particularly from 500 °C to less than 200 °C & to cool down hot gases coming from incinerator.

- *Bag House:* Flue gases will be passed through bag filters for removal of particulates.

- *Wet alkaline scrubber (Venturi and Packed Bed):* Dry lime and activated carbon are injected for neutralization of acidic gases (HCl, HF, and SO2) and removal of organic constituents. Adsorption by activated carbon to remove any dioxin & furans, mercury (if present in waste feed) in the flue gases

- *Mist eliminator:* Often there is a need to eliminate the mist in the stack emissions, therefore, de-mister will be provided.

- *ID Fan:* to maintain the entire system in negative draft for proper removal of flue gases.

- *HEPA Filter:* The gases from the ID fan would be allowed to pass through a fine particulate filter in order to remove the very fine particulates before they are let out into the atmosphere though the chimney.

- *Stack:* Incinerator & DG Set will be provided with adequate stack height meeting for proper dispersion of cleaned gases in atmosphere.

- *Controls and monitoring:* Operation within the key parameters of the combustion process is assured by systems of monitors and computer controls. These systems make automatic adjustments to key functions as necessary. For example, if temperatures begin to drop below desired range; supplemental waste fuels are automatically injected. Conversely, if temperatures rise above the desired range, waste feeds rate is reduced.

6.2.3.2 Dioxins & Furan control

- To prevent reformation of dioxins, rapid lowering of the flue gas temperatures, particularly from 500°C to less than 200°C by adopting rapid quench will be done.

- To reduce the precursors essential for formation of Dioxins & Furans, complete combustion to the extent possible, will be ensured in secondary chamber by maintaining minimum temperature of about 1050 ± 50°C and a residence time of at least 2 seconds.

6.2.3.3 Odour control

- Suction hood to be provided in hazardous waste storage area.

- Flue gas shall be passed through wet scrubbing system involving removal of odour by absorption.

- Providing mask to the employees at the site to avoid health issues due to obnoxious odor.

- Development of vegetation growth to cover of the open areas of the site reduces odour. Good plantation cover forms a surface capable of absorbing and forming sinks for odourous gases. Leaves, with their large combined areas in a tree crown, sorbs pollutants on their surface, thus effectively reduce odourous compound concentrations.

- Adequate green belt will be developed, and good housekeeping practices will be followed.

6.2.3.4 Fugitive emissions/effluents & management

Fugitive emissions shall be controlled by taking following steps:

- All materials in liquid shall be charged into incinerator with pumps or under gravity through closed pipes.

- All process emissions will be passed through properly designed scrubber and finally released into atmosphere through adequate stack height.

- All pumps handling hazardous chemicals shall be provided with mechanical seals to prevent fugitive emission.

- Any spillage from drums etc. will be absorbed with saw dust/soda ash and moped clean. The contaminated absorbent will be safely disposed of along with hazardous waste.

- Storage tank will be provided with level gauge, dyke wall, automated loading and unloading for the chemicals to avoid human contact. All storage tanks will be designed and placed according to international standards.

- Measuring Instruments with sound alarm and having strategically placed sensing elements will be provided for alerting the personnel in case of any escape of gases.

6.2.3.5 Safeguards Taken in Design Stage

- All the waste handling vehicles shall be provided with spark arresters at the exhaust.

- Provision of standby arrangement for all critical equipments and pumps.

- Provision of standby ID fan

- Equipment will be designed, inspected stage wise, tested and certified by an independent third party in accordance with relevant codes and standards.

- A fire hydrant system is proposed to be laid that shall cover the entire plant area.

6.2.4 Impact of off-Site Traffic on Existing Infrastructure

M/s. ECO Waste Management Services has its own arrangements of vehicles for transportation of the waste. Adequate road transport facility is already available in the area which is sufficient to cater the needs of excess vehicular movement.

6.2.5 Impact on Water Resources and Quality

The daily freshwater requirement for the proposed project will be met through KWSB water supply connection already available at the site. No changes in water bodies or the land surface affecting drainage or run-off are envisaged. No disturbance is envisaged for water courses.

6.2.5.1 Wastewater Generation, Treatment and Disposal

The wastewater will be generated from:

→ Vehicle/Floor washing.
→ Scrubber.
→ Discarded container recycling; and
→ Laboratory

Effluent generation from the hazardous waste treatment & incinerator operations will be treated in effluent treatment plant. Treated water will be recycled into scrubbing process and reused for floor/vehicle washing, greenbelt & domestic (flushing) purpose. Zero discharge condition of wastewater will be maintained.

6.2.5.2 Impact on Surface Water & Ground Quality

Water contamination may occur due to:

- Discharge of untreated wastewater outside the project premises.
- Depletion of water sources due to use of surface water.
- Run-off contamination in case of any leakage from hazardous waste storage area.

However, no wastewater will be discharged outside the project premises hence impact on surface water quality will be negligible. The proposed project will properly utilize rainwater by implementing appropriate rainwater-harvesting mechanism.

Mitigation Measures

- Domestic wastewater will be discharged through septic tank into soak pit.
- All the hazardous waste will be stored as per guidelines in storage area with impervious flooring to control any leachate and prevent ground/surface water contamination. Drains connected to ETP will be provided around storage area, vehicle washing area.
- Periodical monitoring of Ground & surface water quality will be done.

6.2.6 Impact on Noise Levels

The major source of noise generating source during the operation phase of the proposed hazardous waste treatment & incinerator project are incinerator, diesel generator set, shredder, pumps and compressors, ID Fan, waste segregation & dismantling, vehicles etc.

Mitigation Measures

SEQS for noise level specifies the limiting value of an overall noise level for a specified area. However, OSHA standard calls for regulations of noise level around the noise emitting equipment.

- All equipments in the proposed project will be designed /operated to have a noise level not exceeding prescribed standard in line with the requirements of OSHA.
- Acoustic enclosures for considerable noise generating point sources such as DG Set will be provided for noise attenuation.
- Workers will be provided with suitable personal protective equipment (PPE) such as earmuffs and earplugs.
- Rotation of workers in the high noise area will be done.
- Green belt will be developed to reduce noise.
- Equipment will be maintained in good working order to reduce noise.
- All equipment will be operated within specified design parameters.

6.2.7 Impacts on Socio-Economic Environment

Small to medium scale incinerator projects are economical and environment friendly solutions for tackling the problem of Hazardous Waste.

While assessing the socio-economic and health impact of the people of surrounding villages of the project site it has been noticed that the proposed project will generate some job opportunities in the area during the construction & operation phase and also will solve the hazardous waste management problems in the macroenvironment of District West in particular.

The operation phase of the project will have positive impact in the surrounding areas. However, some side effects cannot be ignored which may arise for any developmental projects. The positive and negative impacts are highlighted in the following sections.

Positive Impact

1. *Employment Opportunities for Job Seekers:* The proposed project will require unskilled, semiskilled, and skilled people during its operation and construction phases which in turn would generate some direct and indirect employment which is a positive aspect of the project.

2. *Improvement of the living standard area due to CSR activities:* Nearby villages will get developed through Corporate Social Responsibility (CSR) activities of the company. Project proponent may provide health aid to local villages based on need and request from the respondents during the consultation process. This project will bring social change in the society with improved socio-economic life of the local people.

6.2.8 Support services

The site will not be complete until support facilities are put into place. These will include.

(i) Offices,
(ii) Sanitation facilities (toilets, bathrooms, hydrants, wastewater drains,
(iii) Health and safety provisions (fire extinguishers, hydrants, signage, exits, first Aid points etc.,
(iv) Security arrangements.

There are risks of fire outbreaks from proposed activities posing potential danger to not only the site, but also the neighboring land users. Heat is also a serious impact to the employees operating the incinerator. The general ambient heat around the entire premises is also likely to be relatively high extending the risk to more workers.

Mitigation measure

- All workers should be provided with protective gear. These include working safety boots, overalls, helmets, goggles, earmuffs, respirators/masks and gloves.
- Construction crew at the site will be sensitized on social issues such as drugs, alcohol, diseases.
- A first aid kit should be provided within the site. This should be fully equipped at all times and should be managed by qualified person.
- The contractor should have workmen's compensation cover.

6.2.9 Disturbance to Ecology

The project site does not form special habitat so there is no threat of habitat loss also. No trees will be uprooted. Greenbelt development will provide habitat to the existing species in later stage. Greenbelt will be developed with suitable native species only which have good air quality tolerance index. This greenbelt will serve as a habitat for many local faunal species in later stage.

Facts considered during selection of plant species for greenbelt development are:

- Type of pollutant (mainly air) likely to disperse from project activities.
- Adaptability of plant species to the local environment
- Biological–filter Efficiency: Absorption of gases, Dust capturing

7. Environmental Management Plan (EMP)

7.1 Introduction

Environmental Management Plan aims at formulation, implementation and monitoring of environmental protection measures during & after commissioning of project. The plan indicates the details as to how various measures have been or are proposed to be taken including cost components as may be required.

Following elements are the major components of Environment Management Plan:

- *Commitment and policy:* The project strive to provide and implement the environment management plan that incorporates all issues related to air, land and water.

- *Planning:* This head includes identification of environmental impacts, legal requirements and setting of environmental objectives.

- *Implementation:* This comprises of resources available to the developers, accountability of contractors, training of operational staff associated with environmental control facilities and documentation of measures to be taken.

- *Measurement and evaluation:* This include monitoring, corrective actions and record keeping.

This EIA has examined both negative and positive impacts of each stage of the proposed incineration plant. The mitigation measures proposed are based on a good understanding of the sensitivity and behavior of environmental receptors, case studies, legislative controls, guidelines, & expert advice.

7.2 Structure of the EMP

The EMP consists of the following section.

- Legislation and guidelines.
- Organizational structure and roles and responsibilities.
- Mitigation management's matrix
- Environmental monitoring programme
- Change management plan
- Training Programme

7.3 Legislation and Guidelines

The EIA has discussed in detail all the legislation and guidelines which has relevance to the project. M/s. ECO Waste Management Services shall ensure that the construction and operation of project is conducted in conformance to relevant legislations and guidelines and guidance is sought as and when required. ECO Waste Management Services shall also ensure that the key project management staff is aware of these legislations and guidelines. Sindh Environmental Quality Standards (SEQS) are provided in Chapter 2.

7.4 Organizational Structure and Roles and Responsibilities

7.4.1 Organizational Structure

The proposed project includes the following main organization:

- ECO Waste Management Services as the project proponent and owners of the EMP.
- Contractor(s) required during the operational phase as the executors of the EMP.

These organizations will have the following roles and responsibilities during the project activities.

7.4.2 Roles and Responsibilities

Project Proponent: As project proponents, ECO Waste Management Services will be responsible for ensuring the implementation of the EMP. HSE Manager will be responsible for the overall environmental performances during the proposed project. He/she will be responsible for ensuring the implementation of the EMP by ECO Waste Management Services and all project contractors. HSE Advisor will be appointed and be made responsible for implementation of the EMP and liaison with project contractor and stakeholders at site regarding environmental issues during the construction & installation phase. Further an IMC[21] will be taken onboard for monitoring EMP's compliance and provide technical support.

Project Contractors: For the proposed project, M/s. ECO Waste Management Services will appoint contractor(s) for different field and onsite operations. The contractor will be mandated to implement provisions of EMP and ensure

[21] Independent Monitoring Consultant

compliance with environmental and other codes of conduct required by ECO Waste Management Services. Overall responsibility of the contractor's environmental performances will rest with the HSE Advisor within the contractor's organization reporting to their management. The contractor's staff will have functional responsibilities to ensure implementation of or adherence to the EMP.

- **Co-ordination with Stakeholders:** M/s. ECO Waste Management Services will ensure that co-ordination with the regulators and other stakeholders on environmental & social matters is maintained throughout the project.

- **Monitoring:** M/s. ECO Waste Management Services and the contractors will ensure that monitoring of the project activities is carried out throughout the project. IMC will monitor all project activities during the construction and operation phase to keep a record of all non-conformances observed and report these along with actions to proponent for further action.

- **Emergency Procedures:** M/s. ECO Waste Management Services and the contractors will prepare contingency plans to deal with any emergency situation that may arise during the construction & operation and communicate these to the regulatory agencies if required by these agencies.

- **Approvals:** M/s. ECO Waste Management Services will be responsible for obtaining all relevant approvals such as approvals from relevant agencies.

- **Trainings:** The project proponent and contractors will be responsible for providing training to their staff members according to the training programme.

7.5 Communication and Documentation

ECO Waste Management Services and the contractor will ensure that the communication and documentation requirements specified in the EMP are fulfilled during the construction and operation phase.

Change Management: The EIA for the proposed operation recognizes that changes in the operation or the EMP may be required during the project activities and therefore provides a Change Management Plan to manage such changes. Overall responsibility for the preparation of change management statements will be with Proponent's site representative.

Restoration: ECO Waste Management Services along with the construction contractor will be responsible for the final restoration of work areas.

7.6 Maintenance of the EMP

EMP needs to be revised on timely basis to keep up to date as per the requirements comes up regularly. Therefore, outlining the responsibilities and activities associated with the maintenance of the EMP is essential. EMP revision procedures must include requirements for notification of the appropriate government and municipal agencies so that their role is also played in the overall management process.

7.7 Mitigation Management Matrix

The Mitigation Management Matrix will be used as a management & monitoring tool for implementation of the mitigation measures required by the EIA. Mitigation management matrix for construction and operation is provided in the table 7.1.

Table 7.1: Mitigation Matrix

S. #	Aspect	Mitigation Measures	Monitoring
1.	**Collection and transportation of hazardous waste**	▪ All the provisions corresponding to transportation of Hazardous Wastes under Hazardous Substances Rules 2014, will be duly complied with, in all respects. For collection and Transportation, about 10 nos. of vehicles will be provided. Type of vehicles used will be of required capacity (crane mounted containerized collection and loading vehicles /covered trucks / trucks having pneumatic loading / unloading arrangements). ▪ Experienced drivers will be employed for this purpose & adequate training will be given to every driver. As a practice, a trained driver and helper will accompany the transportation vehicle to ensure compliance of HSE management system. Drivers and helpers will be trained in emergency procedures to handle emergency situations & contain pollution and first aid in case of injuries. ▪ Washing of tanker/ container and disposal of effluent: each container/vehicle will be thoroughly washed prior to being sent to the industry for collection of wastes & post collection & unloading at site. The effluent water will be treated in the proposed effluent treatment plant. ▪ Vehicles will be painted preferably in blue color with white strip of 15 to 30 cm width running centrally all over the body. This is to facilitate easy identification.	Monitoring Compliance through IMC

		▪ Vehicle will be fitted with mechanical handling equipment as may be required for safe handling and transportation of the waste. ▪ The words "HAZARDOUS WASTE" will be displayed on all sides of the vehicle in Urdu & English. ▪ Name of the facility operator will be displayed. ▪ Emergency phone numbers will be displayed properly. ▪ Carrying of passengers is strictly prohibited and those associated with the waste haulers will be permitted only in the cabin. ▪ Transporter will carry inventory of the wastes during transportation as stipulated under the procedures. ▪ The trucks will be dedicated for transportation of hazardous wastes and they will not be used for any other purpose. ▪ Each vehicle will carry first-aid kit, spill control equipment and fire extinguisher. ▪ HW transport vehicle will run only at a controlled & safe speed to avoid any eventuality during the transportation of HW. ▪ The driver of the transport vehicle will have valid driving license for heavy vehicles and shall have experience in transporting the chemicals. Driver(s) will be properly trained for handling the emergency situations and safety aspects involved in the transportation of hazardous waste. ▪ Design of the trucks will be such that there is no spillage during transportation.	
2.	**Off-Site Transportation of Hazardous Wastes**	▪ It will be ensured that Hazardous Wastes (incinerator ash) are packaged in a manner suitable for safe handling, storage and transport. Labelling on packaging is readily visible and material used for packaging will withstand physical conditions and climatic factors. ▪ Information regarding characteristics of wastes particularly in terms of being Corrosive, Reactive, Ignitable or Toxic will be provided on the label. ▪ Hazardous Wastes transportation will be in accordance with the provisions of Hazardous Substances Rules 2014. ▪ All other records in respect of the handling, transportation & disposal of hazardous waste will be maintained properly and kept available to SEPA as & when required.	Monitoring Compliance through IMC

3.	**Storage Area/Shed**	▪ The storage area will be designed for average 30-day storage for solid as well as liquid wastes. ▪ Flammable, Ignitable, Reactive and Non-Compatible waste will be stored separately in the designated areas. ▪ Storage area will be provided with flame proof fittings, automatic smoke & heat detection system, adequate firefighting systems etc. ▪ Loading and unloading of Hazardous Wastes in storage sheds will only be done under the supervision of the well trained and experienced staff. ▪ Minimum of 1-meter clear space will be left between two adjacent rows of drums in pair for inspection. ▪ At least two routes to escape in the event of any fire in the area. ▪ Doors and approaches of the storage area will be of suitable sizes for entry of forklift and firefighting equipment. ▪ The storage area with concrete floor or steel sheet to prevent percolation of spills, leaks etc. and the floor will be structurally sound and chemically compatible with waste. ▪ The floor level will at least be 150 mm above the ground level. ▪ Containment measures such as proper slopes as well as collection pit to collect wash water and the leakages/spills, & treatment in ETP etc. ▪ Provision of peripheral drainage system connected with the sump so as to collect any accidental spills on roads or within the storage yards as well as accidental flow due to firefighting.	Monitoring Compliance through IMC
4.	**Storage of Drums/Containers**	▪ The stacking of drums should be restricted up to three, high on pallets (wooden frames). ▪ For Waste having flash point less than 65.5°C, the drums will not be stacked more than one height. ▪ No drums will be opened in the storage sheds for sampling etc. and such activity will be done in designated places outside the storage areas. ▪ Drums containing wastes will be labeled properly indicating mainly type, quantity, characteristics, source and date of storing etc.	Monitoring Compliance through IMC
5.	**Spillage/leakage Control**	▪ The storage areas will be inspected daily for detecting any signs of leaks or deterioration if any. ▪ Leaking or deteriorated containers will be removed and ensured that such contents are transferred to a sound container.	Monitoring Compliance through IMC

		▪ In case of spills/ leaks/ dry adsorbents/cotton will be used for cleaning instead of water. ▪ Proper slope with collection pits will be provided in the storage area so as to collect the spills/leakages. ▪ Adequate number of spill kits with compatible sorbent material in adequate quantity will be provided.	
6.	**Record Keeping and Maintenance**	▪ Proper records regarding the industry-wise type of waste received, characteristics as well as the location of the wastes that have been stored in the facility will be maintained.	Monitoring Compliance through IMC
7.	**Air & Noise Pollution**	▪ Vehicular emissions due to movement of construction machinery and vehicles. Water sprinkling will be done from time to time to reduce dust generation due to vehicular movements. ▪ Necessary acoustic enclosures, wherever feasible will be provided for all these facilities to limit the noise levels within prescribed limits. ▪ All materials in liquid shall be charged into incinerator with pumps or under gravity through closed pipes. ▪ All process emissions will be passed through properly designed scrubber and finally released into atmosphere through adequate stack height. ▪ All pumps handling hazardous chemicals shall be provided with mechanical seals to prevent fugitive emission. ▪ Any spillage from drums etc. will be absorbed with saw dust/soda ash and moped clean. The contaminated absorbent will be safely disposed of along with hazardous waste. ▪ Storage tank will be provided with level gauge, dyke wall, automated loading and unloading for the chemicals to avoid human contact. All storage tanks will be designed and placed according to international standards. ▪ Measuring Instruments with sound alarm and having strategically placed sensing elements will be provided for alerting the personnel in case of any escape of gases. ▪ All equipments in the proposed project will be designed /operated to have a noise level not exceeding prescribed standard in line with the requirements of OSHA. ▪ Acoustic enclosures for considerable noise generating point sources such as DG Set will be provided for noise attenuation.	Monitoring Compliance through IMC

		▪ Workers will be provided with suitable personal protective equipment (PPE) such as earmuffs and earplugs. ▪ Rotation of workers in the high noise area will be done. ▪ Green belt will be developed to reduce noise. ▪ Equipment will be maintained in good working order to reduce noise. ▪ All equipment will be operated within specified design parameters.	
8.	**Water Pollution**	▪ The effluent wastewater will be treated in the ETP & re-circulated for scrubbing & reused for vehicle/floor washing, greenbelt development etc. Domestic wastewater will also be treated at site.	Monitoring Compliance through IMC
9.	**Land Pollution**	▪ Impervious flooring will be provided at areas wherever handling/storage of waste will be done. Effluent generated due to container/vehicle/floor washing will be collected & treated in effluent treatment plant. No effluent will be discharged outside plant premises.	Monitoring Compliance through IMC

7.8 Environmental Monitoring Programme

The objective of the environmental monitoring during the construction & operation phase will be as follows:

- To check compliance of the contractors with the EMP by monitoring activities of the project on a daily basis. This will be called compliance monitoring.
- To monitor impacts of the operation in which there has been a level of uncertainty in prediction such as impacts of air pollution & noise etc. and to recommend mitigation measures if the impacts are assessed to be in excess of or different from those assessed in the EIA. The aim will be attained through effects monitoring.
- To achieve these objectives, the following monitoring programme will be implemented.

7.8.1 Compliance Monitoring

Compliance monitoring will be carried out to ensure compliance with the requirements of the EIA and to document and report all non-compliances. The mitigation management matrix provided in the EMP will be used as a management and monitoring tool. The proponent will make regular checks on the contractor's works; keep records of all non-compliances observed during the

execution of the project activities; & the details of all remedial actions taken to mitigate the project impacts.

7.8.2 Effects Monitoring

The effects monitoring requirements have been detailed in Table 7.2. An independent monitoring consultant (IMC) will be responsible to carry out the required effects monitoring during the construction and operation phase.

Table 7.2: Environmental Monitoring Plan

Aspect	Parameters	Locations	Frequency
Air Quality	During Construction Phase: All parameters defined in SEQS for AAQ During Operation Phase: ▪ Temperature ▪ Carbon Monoxide ▪ Excess oxygen ▪ Pressure ▪ Total Particulate Matter ▪ HCl ▪ HF ▪ SO_2 ▪ NOx ▪ TOC ▪ Loss on Ignition (LOI) ▪ Mercury ▪ Heavy Metals ▪ Dioxins and furans	▪ Activity areas ▪ Stack	Monthly
Drinking Water Quality	Parameters defined under Drinking Water Quality Standards	Drinking water sources	Monthly
Wastewater Quality	BOD, COD, DO, TSS, TDS, pH, NO_3, SO_4, Oil & Grease) ▪ Daily quantities of treated effluent disposed ▪ Quantity and point of usage of treated wastewater ▪ Treated wastewater quality	Discharge Points	Monthly
Noise Levels	Decibels [dB(A)Scale]	Activity areas	Monthly
Soil Contamination	pH, EC, Colour, TDS, TOC, TSS, PAH, heavy metals (such as Pb, Cd, Cu, Zn, Cr, Hg, Ni), CN, F, As and Mn.	Contaminated sites	Monthly
Solid Waste Handling	Daily quantity of waste received	Waste handling areas	Monthly
Accidents	▪ Date and time of the accident ▪ Sequence of events leading to accident ▪ Chemical datasheet assessing effect of accident on health and environment ▪ Emergency measure taken ▪ Step to prevent recurrence of such events	Throughout the site and associated activities areas	Monthly

Table 7.3: Cost Estimates for Environmental Management		
S. No.	**Item**	**PKRs.**
1	Water Sampling & Testing	100,000.00
2	Wastewater Sampling & Testing	80,000.00
3	Vehicular Emission Testing	15,000.00
4	Air Quality Monitoring	50,000.00
5	Purchase of PPEs	100,000.00
6	Maintenance of Equipment	100,000.00
7	Waste Disposal	100,000.00
8	EHS Training	25000.00
	Sub Total	**Rs. 570,000.00**

7.9 Emergency Response Plan

Emergency may be defined as a sudden event causing or 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". Any emergency starts as a small incident that may become a major accident if not controlled in time. At the initial stages, the fire organization chart shall need to be put into action. If the incident goes beyond control, the Main Incident Controller will need to actuate the on-site plan at the appropriate stage as considered necessary. During idle shift/ holidays, the security personnel will combat the incident as per the fire organization chart below and at the same time inform various emergency controllers for guidance and control the situation. An emergency organization chart is prepared by appointing key personnel and defining their specific duties that will be handy in emergency.

Emergency organization is set up specifying duties and responsibilities of all to make best use of all resources to avoid confusion while tackling the emergency. Figure below provided detailed information on emergency organization chart.

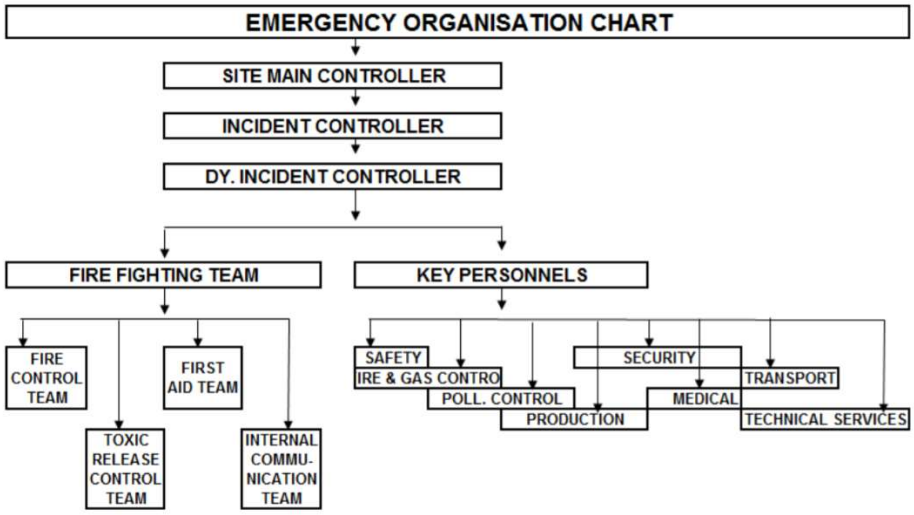


Figure 7.1: Emergency Organization Chart

Dangerous Situations: These are defined as the following:

- Any fire or explosion in the facility
- Any smoke outside/inside installation
- Strong persisting smell of H_2S within the facility
- Any fire in the service buildings
- Fire or explosion in the process area
- Fire in the hazardous waste storage area

Emergency Response for Incinerator Plant

Basic Actions:

- Immediate action is the most important factor in emergency control because the first few seconds count.
- Take immediate steps to stop fire and raise alarm simultaneously.
- Stop all operations and ensure closure of all isolation valves.

- As fires develop and spread quickly, so all out efforts should be made to contain the spread of fire.
- Plant personnel without any specific duties should assemble at the nominated place.
- All vehicles except those that are required for emergency use should be moved away from the operating area in an orderly manner at prenominated route.
- Electrical system except the lighting and firefighting system should be isolated.
- If the feed to the fire cannot be cut off, the fire must be controlled and not extinguished.
- Start water spray systems in the areas involved in or exposed to secondary fire risks.

Actions in the Event of Fire

- Extinguishing fires: A small fire at a point of leakage should be extinguished by enveloping with a water spray or a suitable smothering agent such as CO_2 or DCP.
- Firefighting personnel working in or close to un-ignited vapour clouds or close to fire, must be protected continuously by water sprays. Fire fighters should advance towards the fire downwind if possible- BE CAREFUL TO AVOID H_2S EXPOSURE.
- In case the only valve that can be used to stop the leakage is surrounded by fire, it may be possible to close it manually. The person attempting the closure should be continuously protected by water sprays, fire entry suit, water jet blanket and SCBAs etc. The person must be equipped with a safety belt and a manned lifeline. In case of rapid increase in decibel level, evacuate the area, as there would have been over pressurization.

Post Emergency Follow Up

- All cases of fire occurrence, no matter how small, must be reported promptly to the Coordinator for follow up.

- Under no circumstances should fire extinguishing equipment once used be returned to its fixed location before it is recharged/ certified fit by the Fire chief/ Safety Manager.

- Used fire extinguishers must be laid horizontally to indicate that they have been expended.

Important and Emergency Telephone Numbers	
	Karachi (0213)
Edhi Ambulance	115
Civil Hospital	992 15960
Edhi Welfare Centre	241 3232
Police Emergency	15
Rescue Service	1122

7.10 Change Management Plan

The EIA for the proposed project recognizes that changes in the operation or the EMP may be required during the construction and operation and therefore provides a Change Management Plan to manage such changes. The management of changes is discussed under two separate headings, Additions to the EMP and Changes to the Operation and the EMP.

Changes to the EMP

The EIA and the EMP have been developed based on the best possible information available at the time of the EIA study. However, it is possible that during the conduct of the proposed operation additional mitigation measures based on the findings of environmental monitoring during the operation may have to be included in the EMP. In such cases following actions will be taken:

- A meeting will be held between ECO Waste Management Services and the concerned project contractors. During the meeting, the proposed addition to the EMP will be discussed and agreed upon by all parties.
- Based on the discussion during the meeting, a change report will be produced collectively, which will include the additional EMP clause and the reasons for the addition.
- The report will be signed by all parties and will be filled at the site office: A copy of the report will be sent to ECO Waste Management Services and contractor head offices.
- All relevant project personnel will be informed of the addition.

Changes to the Operation

The change management system recognizes three orders of changes:

First Order: A first order change is one that leads to a significant departure from the project described or the impacts assessed in the EIA and consequently require a reassessment of the environmental impacts associated with the change. Example of first order change includes change in location of proposed project. Action required in this case will be that the environmental impacts of the proposed change will be reassessed by ECO Waste Management Services and sent to the SEPA for approval.

Second Order: A second order change is one that does not result in the change in project description or impacts that are significantly different from those detailed in the EIA. Example of second order changes includes extension in the site area. Action required for such changes will be that ECO Waste Management Services will reassess the impact of the activity on the environment & specify additional mitigation measures if required and report the changes to SEPA.

Third Order: A third order change is one that does not result in impacts above those already assessed in the EIA, rather these may be made site to minimize the impact of an activity such as:

- Increase in project workforce;
- Change in layout plan.

The only action required for such changes will be to record the change in the Change Record Register.

7.11 Training Programme

Environmental training will form part of the environmental management system. The training will be directed towards all personnel for general environmental awareness.

Objectives: The key objective of training programme is to ensure that the requirements of the EMP are clearly understood and followed throughout the project. The trainings to the staff will help in communicating environmental related restrictions specified in the EIA and EMP.

Roles and Responsibilities: The contractors will be primarily responsible for providing environmental training to all project personnel on potential environmental issues of the project. The contractors will be responsible to arrange trainings and ensure the presence of targeted staff.

Training Programme: The environmental awareness, EIA and EMP training will be carried out during the project activities.

Training log: A training log will be maintained by tine contractors. The training log will include:

- Topic
- Date, time and location
- Trainer
- Participants

Training Needs Assessment: In addition to the training specified in the training log special/additional trainings will be provided during the project activity. The criteria to assess the need of training will be based on the following:

- When a specified percentage of staff is newly inducted in the project
- When any non-compliance is repeatedly reported refresher training will be provided regarding that issue.
- When any incident/accident of minor or major nature occurs. Arrival of new contractor/sub-contractor.
- Start of any new process/activity.

Training Material: The contractors will develop & prepare training material regarding environmental awareness, sensitivity of the area, EIA, EMP and restrictions to be followed during the project. Separate training material will be prepared for each targeted staff.

8. Conclusion

The proposed project design has integrated mitigation measures with a view to ensuring compliance with all the applicable laws and procedures. From the foregoing, it is concluded that the proposed hazardous waste incinerator project is at appropriate location in as far as land use and interactions with human social and economic setting is concerned. There are no extensive habitations in the neighborhood, no significant sensitive environmental features are found within the vicinity and the area is not fully zoned giving an opportunity to isolate the location for this purpose in future. However, there are certain social concerns that touch on general environmental pollution, groundwater contamination, health of the workers, attraction of human settlements in future and soil contamination. For this reason, appropriate preventive measures have been included in the project design, planning, construction and operation stages.

During the project construction & operation phases, the proponent and contractor will avoid inadequate/inappropriate use of natural resources, conserve nature sensitively and guarantee a respectful and fair treatment of all people working on the project, general public at the vicinity and inhabitants of the project. In relation to the proposed project, mitigation measures that will be incorporated during construction phase, the development's input to the society and cognition that the project proponent is economically and environmentally sound, this development will be considered beneficial and important. The proposed development is a timely venture to tackle City's Hazardous Waste Management problems through a dedicated facility.

This study recommends that the proposed project be allowed to go ahead provided the outlined mitigation measures are adhered to. Major concerns should nevertheless be focused towards minimizing the occurrence of impacts that would degrade the general environment. This will be achieved through close follow-up and implementation of the recommended Environmental Management and Monitoring plans (EMPs).

Annexures

SINDH ENVIRONMENTAL PROTECTION ACT, 2014

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The Sindh Environmental Protection Act, 2014

SINDH ACT NO. VIII OF 2014

Extra ordinary, Published by Authority

Karachi, Thursday March 20, 2014

PART-IV

PROVINCIAL ASSEMBLY OF SINDH

NOTIFICATION

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.

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.

Preamble.- 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:

PART – I

It is hereby enacted as follows:-

1. Short title and commencement.- (1) This Act may he called the Sindh Environmental Protection Act.

(2) It extends to the whole of the Province of Sindh.

(3) It shall come into force at once.

2. Definitions.- 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, odour, 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 systematic 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" 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 unfavourably 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 Quantity 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

3. Establishment of the Sindh Environmental Protection Council.- (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.

4. Functions and Powers of the Council.- (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

5. Establishment of the Sindh Environmental Protection Agency.- (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.

6. Functions of the Agency.- (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 nongovernmental 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.

7. Powers of the Agency.- 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

8. Establishment of the Sindh Sustainable Development Fund.- (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 nongovernmental 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.

9. Management of the Sindh Sustainable Development Fund.- (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 subsection (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.

10. Accounts.- (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

11. Prohibition of certain discharges or emissions and compliance with standards.- (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.

12. Prohibition of import of hazardous waste.- No person shall import hazardous waste into Sindh province or its coastal, internal, territorial or historical waters, except acquiring prior approval of the Agency.

13. Handling of hazardous substances.- 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.

14. Prohibition of action adversely affecting Environment.- (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.

15. Regulation of motor vehicles.- (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.

16. Certified Environmental Laboratory.- (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

17. Initial environmental examination and environmental impact assessment.- (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.

18. Strategic environmental assessment.- (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.

19. Environmental monitoring.- (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.

20. Environmental Audit and Review.- (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

21. Environmental Protection Order.- (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

22. Penalties.- (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.

23. Offences by body corporate.- 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).

24. Offences by Government Agencies, local authorities or local councils.- 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

25. Environmental Protection Tribunals.- (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.

26. Jurisdiction and powers of Environmental Protection Tribunals.- (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.

27. Appeals to the Environmental Protection Tribunal.- (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.

28. Appeals from orders of the Environmental Protection Tribunal.- (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.

29. Jurisdiction of Judicial Magistrate.- (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 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

30. Appeals from orders of the Judicial Magistrate.- 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

31. Public participation.- (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

32. Power to make and amend schedule.- The Agency may, by notification in the official Gazette, make and amend the schedule.

33. Indemnity.- 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.

34. Dues recoverable as arrears of land revenue.- Any dues recoverable by the Agency under this Act and rules or regulations shall be recoverable as arrears of land revenue.

35. Act to override other laws.- The provisions of this Act shall have effect notwithstanding anything inconsistent therewith contained in any other law for the time being in force.

36. Power to make rules.- 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.

37. Power to make regulations.- (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.

BY ORDER OF THE SPEAKER
PROVINCIAL ASSEMBLY OF SINDH
G.M.UMAR FAROOQ
SECRETARY
PROVINCIAL ASSEMBLY OF SINDH

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Sindh Environmental Protection Act, 2014

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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 100ug/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 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 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

The Sindh Environmental Protection Agency (Environmental Assessment) Regulations, 2021

GOVERNMENT OF SINDH

SINDH ENVIRONMENTAL PROTECTION AGENCY

[Karachi dated, the 3rd 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);

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*Published in the Sindh Govt. Gaz., Extr., Pt. I, P. No. 879, dt. Sept. 9, 2021.

(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.

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 5 km 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 100 mgd.

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 : 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
			Yes/No	Yes/No
12.	Have estimates of the following been reported, especially Quantitative Analysis?	Water balance	Estimated	Reported
		Solid waste	Yes/No	Yes/No
		disposal	Yes/No	Yes/No
		Liquid waste	Yes/No	Yes/No
13.	Source of power		Power requirement	
14.	Labour force (number)	Construction : 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	