محافظة القليوبية

وزارة الدولة لشئون البيئة
جهاز شئون البيئة

Environmental Management Plan for Al Safa Industrial Zone

Livelihood and Income from the Environment Program
Lead Pollution Clean-up in Qalyoubia

April 1, 2008

This publication was produced for review by the United States Agency for International Development. It was prepared by Millennium Science and Engineering Inc., in cooperation with Chemonics International.

Table of Contents

1. Introduction

The United States Agency for International Development (USAID)-funded LIFE-Lead Pollution Clean-up in Qalyoubia Project (LIFE-Lead) is being implemented by Millennium Science & Engineering, Inc. in association with Chemonics International (MSE/Chemonics). This document provides an Environmental Management Plan (EMP) for the Al Safa Industrial Zone (ASIZ).

The planning and design of the ASIZ was initiated by the USAID-funded Cairo Air Improvement Project (CAIP) in 1999 and completed under the Egyptian Environmental Policy Program (EEPP) in 2004. The site development plan was designed to accommodate approximately 100 land plots of various sizes ranging from 500 to 15,000 square meters. An Environmental Impact Assessment (EIA) for the zone was prepared in February 2000. The EIA included a framework for an Environmental Management Plan (EMP) that set conditions for locating and operating foundries within the ASIZ using cleaner production technologies according to an air modeling exercise.

The goal of the EMP is to secure environmentally sound industrial development in the ASIZ and achieve effective management of the foundries environmental performance. The EMP places emphasis on the health, safety, and work requirements to be achieved through requiring the foundries to abide by relevant Egyptian laws and regulations.

The EMP is based on the assumption that the ASIZ is dedicated to house metal foundries. Lead smelters will not be allowed within the ASIZ. The EMP will need to be revised in the future if other industrial sectors are relocated to the ASIZ.

2. Settings of Al Safa Industrial Zone

The Al Safa Industrial Zone (ASIZ) was established in 2000 by the Governorate of Qalyoubia (GOQ) by the Governor's Decree No. 134/2000 with an area of approximately 142 feddans in Khanka District. The zone has a Board of Directors (BOD) headed by the Governor and includes the following:

- Heads of selected departments (i.e., Legal and Investment Departments) within the GOQ.
- Heads of directorates (i.e., Housing and Utilities, Roads and Transportation) within the GOQ and the Electricity Company.
- Representatives of the EEAA and the General Authority of Industrial Development.
- The assistant Secretary General and the Head of the Local Popular Council of the GOQ.

The Head of Investment Department in the GOQ was assigned the responsibility of the BOD's Secretary.

The ASIZ is accessed from a main road off the Cairo-Ismailia Agricultural Road. It is bordered on the east side by the Masaken Abu Zaabal residential area beyond the vacant land that is designated for future residential development. The north side of the zone is bordered by land owned by the Egyptian Army and dedicated for a solid waste recycling project. A residential area is located north of the army land and to the northeast of the ASIZ.

A large lead smelter[1] is located to the south of the ASIZ, at its entrance and is surrounded from the southeastern direction by a licensed landfill. A radio station with high voltage cables is located along the southeastern property boundary of the zone. Railroad tracks border the site to the west. The location of the bordering properties is illustrated in Figure 1.

Figure 1: Surroundings of Al-Safa Industrial Zone

1 Residential area including a school
2 Land affiliated to the Army
3 Planned future residential area
4 Railway's Club
5 Residential area
6 Training center
7 Railroad tracks
8 Radio station land
9 Awadallah Lead Smelter
10 Licensed landfill

The infrastructure of the ASIZ is nearly complete. The status of the infrastructure is described in the following:

- The main roads have been paved and other inner roads have been graded.
- The electricity network is complete with electricity transformers in place.
- The wastewater and potable water network is established.
- The administrative building has been constructed and includes a fire station and an ambulance service.

[1] This is the largest secondary lead smelter in Egypt.

Currently, one iron foundry is in operation in the ASIZ (Figure 2). Land has been allocated for five additional foundries that are currently under construction. The distribution of these foundries was not according to EIA prepared in 2000 for the ASIZ.

Figure 2: Current Occupancy of Al Safa Industrial Zone

1	Iron foundry, cupola
2	Iron foundry, induction
3	Copper foundry, crucible
4	Copper foundry, crucible
5	Iron foundry, cupola
6	Copper foundry, crucible

3. Environmental Management Roles and Responsibilities in the ASIZ

The purpose of the EMP is to minimize the environmental impacts of the industrial zone on the surrounding area and to ensure sound working conditions and safety throughout the zone. This will be undertaken through a system which includes proper planning, compliance monitoring, and corrective actions. The EMP identifies a number of partners responsible for its implementation including the following:

- Zone management.
- Foundries located within the ASIZ.
- Regulatory agencies.
- Service providers.

3.1 Zone Management

Zone Management's role is to ensure sound environmental management within the ASIZ and to minimize pollution affecting the ASIZ whether from its foundries or from external sources such as the neighboring landfill. In that respect, Zone Management has responsibilities in different phases including the location of foundries and overseeing construction and operation from a compliance standpoint.

3.1.1 Responsibilities when Locating Foundries

The Zone Management is responsible for the following when locating foundries within the ASIZ:

- Locating foundries according to set conditions indicated in Section 4.1.
- Ensuring that each facility prepares, submits, and receives approval from the EEAA of an EIA. Zone Management will provide foundries with the EIA forms and with conditions included in this EMP.

- Receiving the facility's individual EIA and determining if it abides by the ASIZ's requirements and submitting it to EEAA via the GOQ for review and approval.

- Establishing a contract with each of the facilities to be located in the ASIZ which states that the facility needs to comply with the EMP.

3.1.2 Responsibilities during the Construction and Operation Phases of a Foundry

The ASIZ management should follow-up on the environmental performance of the ASIZ and ensure that conditions included in the contract are met. This is undertaken through data collection, walk-through, monitoring, and investigating complaints during both the construction and operational phases.

Zone Management is also responsible for coordinating with the foundries and other concerned entities to resolve environmental problems and achieve sound environmental management of the zone. It is also responsible to provide needed central facilities such as fire and ambulance services.

3.2 Foundries

The role of the foundries is to achieve environmental compliance with the laws and regulations and coordinate with the zone and other foundries in order to ensure sound environmental management of the ASIZ. Each foundry is required to allocate environmental responsibilities to one of its staff. This staff member will be responsible for ensuring facility compliance with Egyptian laws and regulations and the EMP as well as maintaining the required documentation included in Section 8.

3.2.1 Responsibilities before Construction

The foundries shall be responsible for the following during the planning and design stage of the facility construction:

- Abiding by the conditions included in the EMP.

- Preparing an individual EIA per the requirements of Law 4/1994 taking into consideration the requirements of the EMP.

- Complying with all requirements of existing Egyptian environmental laws and regulations as well as those promulgated in the future.

3.2.2 Responsibilities during Construction

The foundries shall be responsible for the following during construction:

- Abiding by the conditions included in the EMP and the foundry's specific EIA.
- Ensuring sound environmental management practices during construction activities.
- Complying with all requirements of applicable Egyptian environmental and occupational health and safety laws and regulations.

3.2.3 Responsibilities during Operation

The foundries shall be responsible for the following during facility operation:

- Abiding by the conditions included in the EMP as well as the foundry's specific EIA.
- Coordinating with Zone Management to enhance environmental management of the facility.
- Providing compliance information and data to the Zone Management.
- Complying with all requirements of applicable Egyptian environmental and occupational health and safety laws and regulations

3.2.4 Responsibilities at Closure

The foundries shall be responsible for complying with the requirements of existing Egyptian environmental laws and regulations regarding closure and facility remediation as well as those promulgated in the future.

3.3 Regulatory Agencies

Regulatory agencies include the EEAA and related Regional Branch Office (RBO), the GOQ and related Environmental Management Unit (EMU), and the Environmental Unit in the Khanka District as well as the Ministry of Manpower. The role of these agencies is to ensure that the foundries comply with the Egyptian environmental regulations. The agencies are responsible to check the environmental compliance of the foundries and for taking remedial actions in cases of non-compliance.

3.3.1 Responsibilities before Construction

Before construction of the foundry, the EEAA will review each foundry EIA and either approve, approve with conditions, or disapprove.

3.3.2 Responsibilities during Construction

The Licensing Committee of the GOQ has the responsibility to ensure that construction of the foundry complies with the licensing conditions including those of the EIA. The operation license is not granted until the foundry is in full compliance with the conditions of its EIA.

3.3.3 Responsibilities during Operation

EEAA, the EMU, and Ministry of Manpower have responsibilities during facility operation, according to their respective mandates. Their responsibilities include the following:

- Site inspection of environmental and health and safety conditions.
- Review of the environmental register, hazardous waste register, incident registers, and other health and safety registers.
- Take measurements of effluents, emissions, work environment, and noise levels.
- Investigate environmental complaints.
- Implement relevant actions according to the results of the inspection and the specific enforcement procedures of each agency.

3.4 Service Providers

Service entities provide services related to potable water, wastewater, and electricity supply networks in return for their fee. Accordingly, they are also responsible for the maintenance and management of the service-related utilities such as electricity cables, and wastewater and potable water networks.

3.5 Relation between Different Parties

Interaction between the parties involved in the zone should be geared towards creating relationships conducive to solving existing or potential problems. Relationships need to be developed between the foundries and Zone Management and the foundries, regulatory agencies, and service providers as described below.

3.5.1 Relationship between Foundries

Coordination should be undertaken between foundries through an agreed upon forum to discuss and resolve common and mutual problems, address needs for cooperation and coordination, especially regarding emergency situations, as well as to discuss the adequacy of central services provided by the ASIZ.

3.5.2 Relationship between the Zone Management and Foundries

This relationship is governed by the contract between the foundries and Zone Management. In general, it is a cooperative relationship aiming to maintain a sound level of environmental management in the ASIZ. In principle, this will include the following:

- The foundry should undertake its responsibilities according to the contractual agreement with Zone Management and should take actions needed to comply with applicable environmental laws and regulations.
- The Zone Management will not interfere in the facility's operations unless they has impact on the environment of the ASIZ or its overall environmental performance.

- The foundries are expected to cooperate with Zone Management regarding activities that are aimed at ensuring sound environmental management within the ASIZ.

Tools that could be assumed by Zone Management include:

- Contractual enforcement
- Awareness and promotion for environmental management.
- Incentives for foundries implementing environmental protection practices.
- Seeking finance programs and donors to help foundries to implement pollution control measures (including cleaner production and pollution abatement equipment).

3.5.3 Relationship of Zone Management with Regulatory Agencies

The Zone Management reserves the right to inform the regulatory agencies of violations to Egyptian laws and regulation caused by the foundries. Zone Management could also seek the support of these agencies to correct violations or to provide environmental monitoring.

3.5.4 Relationship of Zone Management with Service Providers

The Zone Management will acquire information regarding the service supply from the service agencies, as well as the service quality from the foundries. They will inform the service agencies of needed service maintenance, improvement, or modification based on their analysis and the identified needs of the foundries.

3.6 Institutional Set-up on Environmental Management in the Zone Management

Zone Management will be established to manage the day-to-day operations of the ASIZ. Zone Management will operate under the supervision of the ASIZ Board of Directors (BOD). An Environmental Unit will be established within the Zone Management to undertake its environmental responsibilities. The Environmental Unit team will have the appropriate scientific background, preferably science or engineering.

A professional team of three and 1 secretary headed by a unit manager is sufficient to undertake needed responsibilities of the ASIZ once the zone is fully occupied. One member of the unit should be experienced in safety and emergency planning issues.

The environmental unit will be trained to effectively undertake its responsibilities. The training will include the following:

- Introduction to ASIZ setting, principles of the ASIZ EMP, and importance of sound environmental management.
- Egyptian environmental laws and regulations.
- Overview on environmental issues related to foundries.
- Roles and responsibilities regarding environmental management in the ASIZ.
- Management of wastewater.
- Management of potable water and electricity.

- Waste management including both solid and hazardous waste.
- Ambient air and noise management.
- Individual EIAs for foundries.
- Emergencies.

4. Environmental Management Requirements when Locating Foundries

The compliance of environmental management requirements is essential for the successful operation of the ASIZ. The requirement for sound environmental management are provided below.

4.1 Requirements for Locating Foundries

The location of the foundries within the ASIZ is based on an air modeling exercise that predicts the ambient environmental conditions of the zone to avoid future undesirable impacts. Annex 1 includes a detailed report of the air modeling exercise. The model investigated several scenarios so as to reach the optimum layout that ensure the protection of ambient air quality.

In order to maintain a acceptable ambient air quality in and around the ASIZ, zone Management shall abide by the following:

- The distribution of different types of foundries in the zone will follow the rules indicated in figure 3.
- The production capacity of foundry furnaces shall not exceed 1.0kg/hr/m^2 of the plot area.

Figure 3: Distribution of Foundries in ASIZ

1 Iron foundry, cupola/induction
2 Iron foundry, induction
3 Copper foundry, crucible
The numbers with no circle indicate foundries that have been already allocated.

4.2 EIA Requirements for Foundries

Each facility relocating to the ASIZ shall prepare an individual EIA which abides by the requirements of the ASIZ EMP. Since the ASIZ has an EMP detailing the environmental safeguards to be followed by foundries, the EIA category of the facility will be Category A, which is less strict than its original Category B[2].

Zone Management will provide the EIA forms to be used by the foundries (Annex 2). The forms can also be accessed at the EEAA website or the EEAA headquarters (EIA Central Department). Zone Management will provide the conditions included in the ASIZ EMP that must be taken into consideration in the individual EIA.

Foundries shall abide by the conditions included in the approved EIA.

[2] Note that this catgeorization is based on EEAA updated EIA Guidelines currently being finalized in which the EIA requirements for Category A is much higher than in the current EIA system.

4.3 Contractual Agreement

The ASIZ management will establish a contractual agreement with the facility to allocate land for its premises. The contract will include general legal environmental conditions with which foundries must abide and will refer to the EMP as a contractual condition. The approval of the facility EIA will include further specific environmental conditions that are relevant to the facility.

The liability of the facility regarding non-compliance with the above mentioned conditions and the related contract enforcement actions will be indicated in the contract.

5. Environmental Management Requirements during Facility Construction

The construction of all foundries will not be undertaken at one time. It is therefore imperative to protect the existing foundries through maintaining sound environmental management during construction activities.

Foundries under construction shall ensure that operating foundries are not negatively affected by their construction activities. All precautions shall be taken during construction to ensure minimum impacts on the environment and on neighboring foundries. Foundries shall make contractors aware of the environmental management requirements and shall commit them to abide by the requirements in the contract.

5.1 Construction Waste Requirements

Construction waste includes rocks, sand, concrete, wood, metal, cardboard, plastic, glass, rubber, and gypsum as well as waste oil, considered as hazardous waste. The facility shall be responsible for sound disposal of all types of construction wastes. No accumulation of waste in the zone will be allowed. Hazardous waste such as waste oil will be collected and stored until collected by a contractor for recycling or disposal. The proper disposal of hazardous waste is the responsibility of the facility.

The ASIZ Management may consider using rock, sand, concrete, and/or other inert waste from construction activities as fill material within the ASIZ. The facility will be directed by Zone Management as to the type of materials that will be used and the location of the fill area.

5.2 Wastewater Requirements

Only domestic wastewater is generated during construction. Foundries shall instruct contractors to direct their workers to suitable sanitary facilities on-site. Contractors are encouraged to provide portable sanitary facilities, when possible.

5.3 Air Emissions Requirements

Air emissions result from construction activities such as excavation, earthmoving and land filling, stone cutting and concrete processing as well as the loading and unloading of construction material and waste. Foundries shall take all precautions to minimize dust during construction. At a minimum, these precautions shall include the following:

- The soil surface shall be kept humid through water spraying to control the level of dust during earthmoving.

- Trucks carrying construction waste shall be covered during their trip from the construction site to the final disposal location.

5.4 Noise Level Requirements

Noise is emitted as a result of different construction activities. Foundries shall use proper equipment and shall undertake preventive maintenance to minimize noise. Equipment, such as generators, should have noise suppressant bases and workers should be equipped with personal protective equipment (PPEs).

6. Environmental Management Requirements during Facility Operation

Environmental requirements are imposed during the operational phases of the foundries. These requirements/conditions are related to the environmental aspects of operations and include air emissions, noise, wastewater, and solid and hazardous waste disposal as well as the utilization of potable water and electricity. The achievement of sound environmental management at the ASIZ will entail actions that should be taken by both the foundries and Zone Management.

6.1 Air Emissions

There are different sources of air emissions within the ASIZ. These soures include the following:

- Point source emissions from furnaces and ladle heating
  Emissions depend on the type of fuel and include carbon monoxide, carbon dioxide, sulfur dioxide, particulates, and heavy metals. No sulfur dioxide is emitted from induction furnaces.

- Fugitive emissions as a result of charging scrap into the furnace, and mold sand preparation as well as moving vehicles.

The foundries use the following three types of furnaces:

- Cupola Furnace: The cupola is a vertical cylindrical shaft furnace that is typically used in iron foundries. The mechanism by which melting is accomplished is heat released through the combustion of fuel (e.g., coke, liquid fuel or gaseous fuel) that is in direct contact with the metallic portion of the charge. In a cupola furnace, coke is either used as a fuel or as a process additive with liquid or gaseous fuels to increase the percentage of carbon in the metal. One of the advantages of a cupola furnace is that counter-flow preheating of the charge is an inherent part of the melting process where the upward flowing hot gases come in close contact with the descending charge, allowing direct and efficient heat exchange to take place. The main disadvantage of using coke, about 3% sulfur content, as a fuel is the emission of high sulfur dioxide concentrations.

- Crucible Furnace: Indirect-fired crucible furnaces are usually used in copper and aluminum foundries with small to medium production. Before any metal is added to the crucible, fluxes should be added so that melting takes place, and a cover is formed to keep the molten metal separated from the atmosphere.

- Induction Furnaces: Induction furnaces are either horizontal or vertical, cylindrical, refractory-lined vessels. Heating and melting occur when the charge is energized with an alternating current. The heating is rapid and uniform and the metal temperature can be accurately controlled. Induction furnaces have lower emissions per ton of metal melted than the other furnaces types.

Foundries shall cooperate with the ASIZ Management in order to ensure the following:

- Environmental compliance of the zone's ambient air quality within the limits set by Egyptian environmental laws and regulations.
- That air emissions from the foundries do not negatively affect the ambient air.

The ASIZ Management will ensure that external sources do not negatively affect the environmental quality of the ASIZ.

6.1.1 Actions to be Taken by the ASIZ Management

The ASIZ will take the actions needed to ensure that the environmental quality of the ASIZ is not impacted by emissions from the facilities operating within the zone or from external sources. In that respect, Zone Management will provide the following:

- Keep all roads paved and regularly maintained.
- Set and enforce speed limits inside the zone.
- Undertake visual observations and periodic ambient monitoring at selected locations in the zone. Monitoring results will be analyzed in conjunction to results of periodic monitoring and inspection of individual foundries to identify sources affecting the air quality of the ASIZ.
- Investigate complaints submitted by foundries or the public in relation to air pollution.
- Direct polluting sources to take needed corrective actions and take relevant corrective actions when needed according to the contract conditions.

6.1.2 Actions to be Taken by the Foundries

All foundries shall abide by the requirements of Law 4/1994 in terms of emission limits and stack heights. Foundries shall, at a minimum, abide by the following technical conditions depending on the type of foundry:

- Ferrous foundries shall abide by the following conditions:
  - Cupola furnace shall only use coke and not normal coal.
  - Natural gas shall be used when it is available.
  - Both cupola and induction furnaces shall have stacks with a minimum height of 25 meters.
  - The installation for ladles preheating must be equipped with hoods, a flue gas suction system, and a stack with a minimum height of 25 meters.
  - Stack diameters should be not be less than 25cm for induction furnaces, 50cm for cupola and 30cm for ladle preheating installation.

- It is possible to connect more than one furnace to the same stack.

- Dust emissions and carbon monoxide emissions from the furnaces and ladle pre-heating stacks shall be with the allowed limits specified by law 4/1994 and its executive regulations.

- Sulfur dioxide emissions from the furnaces and ladle pre-heating shall not exceed 250mg/m^3. A wet scrubber of an efficiency of at least 80% must be installed to reach this concentration. This concentration will be adhered to in case of cupola furnaces that use coke even if natural gas is connected to the ASIZ.

- Pollution abatement equipment shall be maintained in good operating conditions at all times.

* Non-ferrous foundries will abide by the following conditions:

  - No heavy fuel oil (mazot) is allowed.

  - Natural gas shall be used when it is available.

  - Crucible furnaces should be connected to a stack with a minimum height of 25 meters.

  - The installation for ladles preheating must be equipped with hoods, a flue gas suction system, and a stack with a minimum height of 25 meters.

  - Stack diameters should be not be less than 25cm for induction furnaces, 50cm for crucible and 30cm for ladle preheating installation.

  - It is possible to connect more than one furnace to the same stack.

  - Dust emissions and carbon monoxide emissions from the furnaces and ladle pre-heating stacks shall be with the allowed limits specified by law 4/1994 and its executive regulations

  - Sulfur dioxide emissions from the furnaces and ladle pre-heating shall not exceed 250mg/m^3. A wet scrubber of an efficiency of at least 80% must be installed to reach this concentration.

  - Preventive maintenance for pollution abatement equipment.

Sand preparation and blasting should be undertaken indoors. A suction system should be in place. It consists of three components; a hood or enclosure, to capture emissions that escape from the process, a dust collector, that separates entrained particulate from the captured gas stream, and a ducting or ventilation system, to transport the gas stream from the hood or enclosure to the air pollution control device.

The sand blasting equipment shall be of the integrated self-contained type that includes a suction system. Blasting grids are recommended.

In order to prevent soil contamination due to airborne dust and industrial processes, all foundries shall have a concrete floor.

Each facility shall have a monitoring plan as per the requirements of Law 4/1994 (Section 7). Results of the monitoring plan must be documented in the environmental register of the facility and must be provided to Zone Management upon request.

6.2 Wastewater

Wastewater generated from the foundries results from domestic uses, washing activities, and/or cooling as well as wet scrubbing. Wastewater will be discharged to the zone sewer network and then to the public sewer system.

Foundries will cooperate with the ASIZ Management to ensure that the wastewater generated from the ASIZ is within the allowable limits for the discharge to the public sewer system. The foundry will be responsible for the construction and operation of treatment systems to meet the requirements of the Ministerial Decree No. 44/2000 for the discharge of effluent to the public sewer system, if needed.

6.2.1 Actions Taken by the ASIZ Management

The ASIZ will check that the wastewater generated from the ASIZ is in compliance with the requirements of the Ministerial Decree No 44/2004 for the discharge of wastewater effluent to the public sewer system and provide adequate service to the foundries. Zone Management will provide the following services:

- Mobilize preventive maintenance programs in coordination with the wastewater network manager to prevent leakage, over-flowing, or failure of the system. The network operator will be notified when corrective actions are needed.
- Monitor the quality of wastewater discharged from the zone to the public sewer system as well as the network conditions. This will be done through measurements and visual observations.
- Inspection results of individual foundries will be obtained from regulatory agencies.
- The data collected will be analyzed for compliance with the wastewater standards from individual foundries, as provided by the foundries, to identify pollution sources.
- Take actions to address problems in cooperation with the wastewater network manager.

6.2.2 Actions to be Taken by the Foundries

Each facility shall take the needed precautions to ensure that the wastewater it generates complies with the allowable limits of the Ministerial Decree No. 44/2000 for discharge to the public sewer system. The facility shall, at a minimum, provide the following:

- Pre-treat its industrial wastewater resulting from cooling, washing, and scrubbing before discharge to the public sewer system.
  - Wastewater from the wet scrubber must be neutralized before being mixed with the other industrial wastewater.
  - Wastewater must pass through a settling tank to remove solids and then a water/oil separator prior to discharge to the public sewer system.

- Cooling water should be recycled to the maximum extent possible prior to discharge.

Each facility shall have a monitoring plan as per the requirements of Law 4/1994 (Section 7). Monitoring results shall be documented in the environmental register and provided to Zone Management.

6.3 Solid Waste

Foundries within the ASIZ generate different types of solid wastes. These wastes may include the following:

- Slag[3] that results from the melting process.
- Dust produced from pouring areas, preparation of sand, shakeout, and the handling raw materials.
- Spent sand that can no longer be used.
- Municipal solid waste.

The foundries will cooperate with the Zone Management in order to provide the following:

- Prevent accumulation of industrial solid waste.
- Ensure safe transportation of solid waste.
- Maintain cleanliness of the streets within the ASIZ.
- Minimize generated solid waste.

6.3.1 Actions to be Taken by the Zone Management

The ASIZ management will be responsible for outsourcing street cleaning. The ASIZ will monitor solid waste activities through routine walkthroughs to observe any accumulated solid waste and check the compliance of the waste transportation contactors. The monitoring results will be analyzed together with complaints and inspection results of individual foundries obtained from regulatory agencies. Sources of accumulated waste within the ASIZ will be indicated and the facility will be notified to remove the accumulation.

6.3.2 Actions to be Taken by the Foundries

The foundries will pay fees for street cleaning per the rates established by Zone Management. Each foundry shall be responsible for the disposal of the solid waste it generates and for preventing cross contamination with hazardous waste. The foundry shall agree with a contractor to transport the waste to a licensed disposal facility and shall ensure the following:

- That vehicles are clean and maintained in good working order.
- The waste in the vehicles is covered to prevent dispersion.
- Loading and unloading of solid waste is carried out in such a manner that the contents will not become airborne or leak from the truck.

[3] Note that the slag of copper smelters is considered as a hazardous waste per the Ministry of Industry List (Decree 162/2002).

Each facility shall have a monitoring plan per the requirements of Law 4/1994 (Section 7). Results of the monitoring plan will be documented in the environmental register of the facility and will be provided to Zone Management.

6.4 Hazardous Waste Management

According to Decree No 162/2002 of the Ministry of Industry, the following waste generated by foundries is considered hazardous:

- Waste oil.
- Containers of hazardous substances such as paints used for finishing.
- Dust resulting from pollution abatement equipment.
- Slag resulting from copper smelters.
- Skimming of aluminum.

The foundries will cooperate with Zone Management to ensure the following:

- Segregation of hazardous waste from non-hazardous waste is maintained.

- Hazardous waste is handled according to the requirements set by Egyptian environmental legislation and guidelines particularly with regard to transportation and storage.

6.4.1 Actions to be Taken by Zone Management

Zone Management will provide the following:

- Monitor hazardous waste through visual observations and the investigation of complaints or other incidents. Inspection results of individual foundries will be obtained from regulatory agencies

- Analyze monitoring results to ensure facility compliance with Egyptian laws and regulations.

6.4.2 Actions to be Taken by the Foundries

Foundries will be fully responsible for proper hazardous waste disposal. The foundries shall have agreements with certified contractors for periodic collection of hazardous waste for transportation to the hazardous waste disposal site. The temporary on-site storage of hazardous waste shall follow the requirements included in Law 4/1994 and its executive regulations. Waste oil may be resold to contractors for recycling or properly disposed. The facility shall comply with the following:

- Hazardous waste shall not be mixed with the solid waste.

- Aluminum skimming and copper slag will be recycled and reused in the furnace as much as possible.

- Agreements between foundries of different product quality are encouraged to exchange slag to be recycled as much as possible.

Each facility shall have a monitoring plan as per the requirements of Law 4/1994 (Section 7). Results of the monitoring plan will be documented in the environmental register and will be provided to Zone Management.

6.5 Potable Water Management

The foundries use potable water for cleaning, quenching, and cooling of electric furnaces and machinery as well as for domestic purposes. The foundries will cooperate with the Zone Management in order to ensure adequate water supply to the foundries and to minimize its consumption.

6.5.1 Actions to be Taken by Zone Management

Zone Management will ensure the implementation of a plan for periodic maintenance of the water network in coordination with the service provider and foundries to minimize leakage and other malfunctions.

Zone management will have a monitoring program to follow-up on the network operating conditions. This will be undertaken through monitoring the potable water supply to the estate and measuring the peak load for the ASIZ. Water networks will be inspected for leakage and for required maintenance. The monitoring results will be reviewed and the need for maintenance and/or service upgrading will be indicated and communicated to the water network service provider.

6.5.2 Actions to be Taken by the Foundries

Foundries are responsible to inform Zone Management when the quantity and quality of the potable water supplied is not acceptable. In order to maintain the potable water system, the foundries are responsible for the following:

- Implementing water conservation measures such as using cooling water in quenching and in washing floors.
- For on-site maintenance of its potable water connections and fittings.

6.6 Electricity Management

Foundries consume electricity in electric furnaces and machinery as well as in lighting. The foundries will cooperate with Zone Management in order to ensure adequate electricity supply to the foundries and to minimize its consumption.

6.6.1 Actions to be Taken by Zone Management

Zone Management will inform the energy supplier if maintenance is needed. Zone Management will have a monitoring program to follow-up on the network conditions. This will be undertaken through the following:

- Monitoring the electricity supply to the facility.
- Timing the peak load for the ASIZ through measurements using meters installed on the main cable to the ASIZ.

- Inspecting electrical control boxes and cables in coordination with the electricity company.
- Investigating complaints from the foundries.

The monitoring results will be analyzed and the required maintenance/replacement will be indicated and communicated to the electricity company.

6.6.2 Actions to be Taken by the Foundries

Foundries are encouraged to correct their power factor. Power factors range from 0 to 1.0, with a higher value representing a better power factor. Increasing the power factor will result in increased capacity in the existing electrical distribution systems. This can help to offset or reduce expenses for additional system capacity. Foundries are also encouraged to adopt energy conservation practices.

Foundries using induction furnaces might consider having a stand-by generator.

6.7 Noise

Noise sources at the facility level include machinery and handling of scrap. Noise is also generated due to vehicle movement. Foundries will coordinate with Zone Management to minimize ambient noise and take the needed actions related to prevention, minimization, and control of noise from foundries.

6.7.1 Actions to be Taken by Zone Management

The Zone Management will set speed limits within the ASIZ and will implement preventive maintenance to the road network in the ASIZ. Zone Management will perform periodic ambient monitoring at pre-determined locations in the zone. The monitoring will include the following:

- Inspection results of individual foundries will be obtained from regulatory agencies.
- Ambient noise measurements will be undertake and the results will be reviewed and compared to the limits set by Law 4/1994.
- Through observations and complaint investigation, potential external sources that might affect the noise levels in the ASIZ will be indicated. Sources affecting the noise levels of the estate will be notified to undertake needed actions.

6.7.2 Actions to be Taken by the Foundries

The foundries shall take all precautions to minimize the noise generated from their activities to comply with set limits included in Law 4/1994 and its executive regulations. The foundries will also abide by the additional requirements of Law 12/2003 which include the following:

- Compliance with manufacturer's operating speeds for rotating equipment.
- Ensuring proper tuning of machinery and exclusion of high noise emission machinery, if possible.
- Avoiding the use of old machinery with high noise levels.

- Ensuring proper lubrication of moving parts lubrication to reduce noise levels.
- Ensuring proper operation and loading the machines and equipment.
- Enclosing the noise source, whenever possible.
- Using noise suppressant bases for machinery, when applicable.
- Implementing preventive maintenance programs for machinery.

Each facility shall have a monitoring plan as per the requirements of Law 4/1994 (Section 7). Results of the monitoring plan will be documented in the environmental register and will be provided to Zone Management.

6.8 Emergency Preparedness

Emergency situations affecting the ASIZ arise from incidents occurring at the facility level and could affect neighboring foundries or properties. These emergency situations could be related to fires as well as other situations that pose a hazard to human life, property, and the environment. The foundries will cooperate with the ASIZ Management to provide the following:

- A comprehensive well-formulated emergency plan for the ASIZ.
- The required capabilities needed in case of emergencies, either from the facilities, ASIZ or from external entities.
- Each facility has needed capabilities to address facility-level emergencies.

6.8.1 Actions to be Taken by Zone Management

Zone Management will prepare an emergency plan addressing major emergency situations at the zone level in coordination with the foundries. The ASIZ management is expected to direct the operations in the case of an incident at the zone level, which will be indicated in the plan. The zone-level plan will integrate the individual emergency plans of the foundries which will be prepared according to the requirements of Article 3 of Decree No 211/2003. It will provide guidance for the following situations:

- Potential hazards at the estate level.
- Description of the incident scenarios.
- Probability of the incident.
- Expected magnitude and extent of the incident.
- Possible consequences of the emergency event.
- Prevention and protection plan.
- A continuously updated inventory of capabilities and equipment that could be used at an emergency event at the foundries.
- Preparedness plans.

- Prediction and early warning systems.
- Response plan including required supplies/equipment, responsibilities of the different concerned parties in all stages, working groups, communication, alarms and mobilization, and evacuation and aid plan.
- Post-incident plans including rehabilitation and restoring the pre-incident status, disposal or cleaning of contaminated supplies/equipment, evaluation and follow-on activities, documentation, and reporting.
- Communication with public emergency bodies (i.e., police, ambulance, fire department, and other concerned entities).
- Individuals or groups responsible for communicating with outside institutions and higher authorities.
- Arrangements for periodic simulations to check the effectiveness of the plan. The simulations will be planned to minimize disruption of foundry operations.

The emergency plan will be reviewed annually and after incidents occur. Evaluation is also needed in case of specific changes in the zone such as the operation of new foundries or new conditions that might introduce additional hazards. Zone Management will coordinate with the concerned regulatory entities to ensure the periodic review of the foundries emergency plans to ensure effectiveness and indicate deficiencies.

The Zone Management will make available central emergency rescue and abatement facilities including an ambulance and fire station. External support might be needed depending on the emergency and the emergency capabilities inside the ASIZ. The Zone management will:

- Undertake Periodic review of hazards and the emergency preparedness systems. This shall occur at a minimum at one time per year. The review will also be undertaken after each emergency incident and with the establishment of new foundries.
- Incorporation of lessons learned from previous emergencies.
- Definition of the similarities between hazards in different foundries that may lead to increased risks.
- Identification of hazards that require outside aid because they exceed the collective capabilities within the ASIZ.
- Evaluation of the effectiveness of the individual facility emergency plans based on the review of the responsible regulatory agencies.

6.8.2 Actions to be Taken by the Foundries

Foundries shall prepare individual emergency plans as per the requirements of Labor Law 12/2003. The plans shall be updated annually and after each emergency incident.

Given that the industrial estate emergency plan is formulated on the basis of the ASIZ’s plan, any change due to changes in the circumstances of the establishment should be communicated to the zone. The zone will take such changes into consideration during the update of its overall plan.

7. Environmental Monitoring Plan

The monitoring program is an essential element of the environmental performance of the ASIZ. It provides information for periodic review and adjustment of the Environmental Management Plan as necessary to ensure that environmental protection is achieved through early detection of negative environmental impacts.

The monitoring results will be used to identify and implement corrective actions in order to maintain compliance with environmental laws and regulations. It will also ensure the implementation of appropriate mitigation measures and proper and timely revision of Environmental Management Plan for the zone and Plans for the foundries.

7.1 Monitoring Undertaken by Zone Management

Monitoring will be undertaken by the Zone Management with the goal of following up on the environmental status of the ASIZ. Table 1 provides the monitoring plan at the ASIZ level. For each aspect to be monitored, the plan provides the parameters to be monitored and monitoring methods as well as the frequency of the monitoring. The results of the monitoring will be compared to the legal requirements and conditions to provide an overview on the environmental performance of the ASIZ. Zone Management will contract a certified laboratory to undertake the periodic measurements or coordinate with regulatory agencies to obtain the needed information.

Table 1: Monitoring Undertaken by Zone Management

Aspect	Location (s)	Parameter	Monitoring Method	Monitoring Frequency
Ambient air quality	TBD	PM10, CO, SOx, NOx	Gas analyzer	Once every 3 months
Wastewater	Final outlet of the estate	Parameters of Decree 44/2000	Analysis, grab sample	Once every 6 months
	network	Status of the network	Visual observation	Continuous
Ambient Noise	TBD	Noise intensity	Noise meter	Once every 3 months
Solid waste	Within the ASIZ	Accumulations	Walk-through and visual observation	Continuous
	Transportation Vehicles	Vehicles status and cover	Visual observation	Continuous
Hazardous waste	Allover the estate	Accumulations	Walk-through and visual observation	Continuous
Water	Main inlet of the ASIZ	Water flow	Water flow meter	Continuous
Electricity	Main inlet of the ASIZ	Electricity flow	Electricity flow meter	Continuous

7.2 Monitoring Undertaken by the Facility

As a requirement of Law 4/1994, each facility will be required to undertake measurements for specific parameters to ensure their compliance with environmental laws and regulations. Table 2 provides a framework for a monitoring plan for the foundries. For each aspect to be monitored, the plan provides the parameters to be monitored, monitoring methods, and the frequency of the monitoring. The results of the monitoring will be compared to the legal requirements, EMP conditions, and the conditions in the foundry EIA to provide an overview on the environmental performance required for the foundry. The foundry will contract a certified laboratory to undertake the periodic environmental measurements. The results of the monitoring will be documented in the environmental register of the foundry.

Table 2: Monitoring Plan at the Facility Level

Aspect	Location	Parameter	Monitoring Method	Monitoring Frequency
Air Emissions from stacks	Induction Furnace	PM, total heavy metals	Gas analyzer, dust collector	Once every 3 months
	Other Melting furnaces	PM, CO, SOx, NOx, total heavy metals		
	Additional parameter for copper foundries	Cu		
	Ladle Preheating	PM, CO, SOx, Nox	Gas analyzer, dust collector	Once every 3 months
Wastewater	Final wastewater outlet of the facility	Parameters of Decree 44/2000	Analysis, grab sample	Once every 6 months
Work environment emissions	Melting and pouring area	CO, SOx, NOx	Gas analyzer, dust collector	Once every 3 months
	Molding and core making area	CO, SOx, PM10	Gas analyzer Dust collector	
Noise	Melting and pouring, molding and core making, compressor areas	Noise intensity	Noise meter	Once every 3 months
Solid waste	NA	• Quantities of solid waste generated • Disposal methods • Ensure safe transportation and disposal by contractor	Observations and documentation	Continuous
Hazardous waste	NA	• Sound storage of hazardous waste on-site • Sound disposal of hazardous waste by contractor	Observations and documentation	Continuous

Aspect	Location	Parameter	Monitoring Method	Monitoring Frequency
Water consumption	NA	Water consumption	Water bills	Monthly
Electricity	NA	Electricity consumption	Electricity bills	Monthly

8. Documentation

Both the Zone Management and the foundries will maintain the environment related documentation as described below.

8.1 Documentation to be Maintained by the Foundry

The foundries must maintain the following documentation as per the requirements of Egyptian environmental laws and regulations:

- Approval of the EIA for the foundry.
- Conditions that the foundry must comply with per the ASIZ EMP.
- Environmental register per the requirements of Annex 3 of the executive regulations of Law 4/1994 and including the self-monitoring results.
- Hazardous waste register per the requirements of Annex 3 of the executive regulations of Law 4/1994.
- Incidents statistics as per the requirements of Law 12/2003.
- Foundry emergency plan.
- Maintenance records for emergency equipment.

8.2 Documentation to be Maintained by Zone Management

Zone Management will maintain the following documentation to follow-up on the environmental status of the ASIZ:

- Foundry-based documents:
  - Monitoring results of the foundry.
  - Approval of the EIA for the foundry.
  - Conditions that the foundry must abide with according to the EMP and foundry EIA approval.
  - Incidents and non-compliance records.
- Other documents:
  - EMP of the ASIZ as well as Egyptian environmental laws and regulations

- Layout of the ASIZ and location of each foundry as well as a map including sources of air emissions, wastewater, and noise within the ASIZ and the surrounding area.

- Infrastructure-related documents including:
  - Information related to the wastewater network; type, diameter, length, and flow direction and capacity of the pipes, layout of the network, manhole types and location identifying the connected foundries, system management as well as main equipment lists and related specifications.

  - Information related to the water network; type, diameter, length, and flow direction and capacity of the pipes, layout of the network as well as main equipment lists and related specifications.

  - Maintenance schedules for networks.

- Forms and information about the emergency drills to evaluate emergency plans and observations of the drills. Documentation of incidents and complaints and their investigation and outcome.

- Monitoring results of ambient measurements and monitoring for air quality, noise levels, and wastewater quality and quantity from the final outlet of the ASIZ.

- List of complaints.

9. Review and Updating of the EMP

The EMP will be reviewed annually by the ASIZ Management based on the results of monitoring, follow-up on environmental problems, and the changes in the type and number of foundries located in the zone. Modifications to the EMP will be discussed with the foundries and with EEAA to obtain their comments and commitment to the changes.

Annex 1
Air Modeling for Al Safa Industrial Zone (ASIZ)

1. Introduction
This annex describes the mathematical modeling undertaken to investigate the ambient air quality conditions. The annex provides a background on the model used and presents the different alternatives considered as well as the results acquired.

2. Location and Surrounding Topography
The Al Safa Industrial Zone (ASIZ) was established in 2000 by the Governorate of Qalyoubia (GOQ) by the Governor's Decree No. 134/2000 with an area of approximately 142 feddans in Khanka District. The ASIZ is accessed from a main road off the Cairo-Ismailia Agricultural Road. It is bordered on the east side by the Masaken Abu Zaabal residential area beyond the vacant land that is designated for future residential development. The north side of the zone is bordered by land owned by the Egyptian Army and dedicated for a solid waste recycling project. A residential area is located north of the army land and to the northeast of the ASIZ. A large lead smelter is located to the south of the ASIZ, at its entrance and is surrounded from the southeastern direction by a licensed landfill. A radio station with high voltage cables is located along the southeastern property boundary of the zone. Railroad tracks border the site to the west. The location of the bordering properties is illustrated in Figure 1.

Figure 1: Surroundings of Al-Safa Industrial Zone

1	Residential area including a school
2	Land affiliated to the Army
3	Planned future residential area
4	Railway's Club
5	Residential area
6	Training center
7	Railroad tracks
8	Radio station land
9	Awadallah Lead Smelter
10	Licensed landfill

3. Air Emission Sources and Characteristics

The ASIZ will include a number of processes and items that are sources of emissions to atmosphere. These include:

- Point source emissions from furnaces and ladle heating. Emissions depend on the type of fuel and include carbon monoxide, carbon dioxide, sulfur dioxide, particulates, and heavy metals.

- Fugitive emissions as a result of charging scrap into the furnace, and mold sand preparation as well as moving vehicles. These are area sources.

The model only considers point sources emissions since area source emissions are controlled through measures included in the EMP.

Box 1: Types of air pollutant emission sources

Air pollution emissions sources are commonly characterized as either point, line, area or volume sources.

Point source - A point source is a single, identifiable source of air pollutant emissions.
Line sources - A line source is one-dimensional source of air pollutant emissions.
Area source - An area source is a two-dimensional source of diffuse air pollutant emissions.
Volume source - A volume source is a three-dimensional source of diffuse air pollutant emissions.

The primary sources and types of atmospheric emissions are identified in Table 1.

Table 1: Atmospheric Emissions and Sources

Source / Activity	Emission Type	Substances Emitted
Induction Furnace	Point Sources	PM10, HM
Cupola Furnace	Point Sources	PM10, SO_2, CO, HM
Crucible Furnace	Point Sources	PM10, SO_2, CO, HM
Ladle Pre-heating	Point Sources	PM10, SO_2, CO, HM

The emitted pollutants could negatively impact public health as shown in the following:

- **Carbon Monoxide:**

It is absorbed by lungs; impairs physical and mental capacitors; affects fetal development; aggravates. It reduces blood oxygen-carrying capacity, causing dizziness, weakness, headache. Concentrations above 1000 ppm can be fatal within one hour.

- **Sulfur Dioxide:**

This compound is harmful to plant and animal life, as well as many building materials. It is classed as mild respiratory irritant. Inhalation of low concentrations causes burning pain in chest.

- **Particulate Matter (PM):**

Particulate is a term used to describe dispersed airborne solid and liquid particles which are larger than 0.0002 µm but smaller than 500 µm. Small particles generally have low settling velocities while larger particles have higher settling velocities.

The presence of particulate matter in the atmosphere can have an adverse effect on health and amenity. Larger particles tend to be deposited within the nose, and throat areas, while smaller particles having aerodynamic diameter of less than 10 µm can reach into the alveolar region of the lung, affecting lung function.

4. Air Pollution Dispersion Modeling

Air Pollution Dispersion Modeling is the mathematical simulation of how air pollutants disperse in the ambient atmosphere. The models are typically employed to determine whether existing or proposed new industrial facilities are or will be in compliance with the National Ambient Air Quality Standards (NAAQS). The models also serve to assist in the design of effective control strategies to reduce emissions of harmful air pollutants.

The dispersion models require the input of data which includes:

1. Meteorological conditions such as wind speed and direction, the amount of atmospheric turbulence (as characterized by what is called the "stability class"), the ambient air temperature and the height to the bottom of any inversion aloft that may be present.
2. Emissions parameters such as source location and height, source vent stack diameter and exit velocity, exit temperature and mass flow rate.
3. Terrain elevations at the source location and at the receptor location.
4. The location, height and width of any obstructions (such as buildings or other structures) in the path of the emitted gaseous plume.

4.1 Meteorological data and modeling

The Fifth-Generation Pennsylvania State/National Center for Atmospheric Research (NCAR) Mesoscale Model (MM5) is used in this study to generate the meteorological inputs to the air quality model. MM5 is a limited-area, non-hydrostatic, terrain-following sigma-coordinate model designed to simulate or predict mesoscale and regional-scale atmospheric circulation. It has been developed at Pennsylvania State and NCAR as a community mesoscale model and is continuously being improved by contributions from users at several universities and government laboratories.

Box 2: MM5 Model

The model solves the set of atmospheric dynamical and physical governing equations. It also includes parameterization treatments for more complicated physical and dynamical processes; such as precipitation physics, planetary boundary layer process, surface layer process, and atmospheric radiation. MM5 include a multiple-nest capability, non-hydrostatic dynamics, which allows the model to be used at a few-kilometer scale, multitasking capability on shared- and distributed-memory machines, a four-dimensional data-assimilation capability, and multiple physics options. Nesting technique means that the model can run on regional scale (large) area with emphasize on local scale (small) area. The regional model uses initial and boundary conditions extracted from a global model and the local uses boundary conditions extracted from the outputs of the regional one. The regional and local area meshes are set to start run at the same time where each mesh has its own initial meteorological data, topography, land use and surface fields.

4.1.1 Data Required to Run the MM5 Modeling System

Since MM5 is a regional model, it requires an initial condition as well as lateral boundary condition to run. Grided data for the entire time period that is being modeled are needed in order to produce lateral boundary condition for a model run.

Two dimensions grided data for: Topography, vegetation data, land use, mean sea-level pressure, 10m wind speed and directions, 2m temp., soil humidity, soil wetness and temp.

Three dimensions grided data for: Wind, temperature, relative humidity and geopotential height and at the standard atmospheric pressure levels: 1000, 850, 700, 500, 400, 300, 250, 200, 150, 100 Hectopascal.

Also, **Observation data** that contains soundings and surface reports could be included.

4.1.2 Meteorological Data Sources

According to World Meteorological Organization, there are many regional centers covering the world (Cairo is one of them) each one collects the observed meteorological data from surrounding countries and resubmit the collected data to global centers which collect all data of the world and resubmit it to the regional ones. All this process use well-known wireless frequencies and is opened to every country. Egypt has 104 different meteorological stations of different types. Meteorological station observes every 12, 6, 3 or every one hour and any observation should be done within the last ten minutes of the previous hour. In addition to ground observations there are meteorological ships, rockets, aircrafts, radars and satellites observations. All available data are being collected and processed for quality assurance in the global centers. The Global center in Washington, which is called National Center for Environmental Predictions (NCEP), continue processing on the global observation and produce global forecasts covering ten days and make the first five available on the internet to be used by regional and local centers for more accurate processing and predictions. NCEP broadcasts global model outputs as girded data to be used for initial and boundary conditions by World Area Forecast centers WAFS. The WAFS's horizontal resolution is 1.25^{o} in latitude and longitude (at Equator) on 12 standard vertical pressure levels.

4.1.3 MM5 Nest and Areas setup

MM5 is run on 1-way nested regional and local meshes. The resolutions of the regional and local meshes are 30km and 10km, respectively. The modeling domain covers the area between longitudes 23^{o} : 40^{o} E and latitudes 22^{o} : 35^{o} N, more attention is paid to the closer area to the factory location between longitudes 30^{o} : 32^{o}E and latitudes 29^{o} and 31^{o}. The vertical resolution is 32 levels between ground surface and 100HPa (~16km aloft).

Figure 2: MM5 nested areas

4.1.4 Modeled Time Span

The modeling exercise covered a one year time span starting Jan , 1st 2005 and ending Dec 31st, 2005. The meteorological inputs were prepared for this time frame using MM5 meteorological model.

4.2 Climate and Dispersion Meteorology

The key parameters affecting dispersion of air emissions are summarized below.

- **Dry deposition** is the removal of gaseous or particulate material from the pollution plume by contact with the ground surface or vegetation (or even water surfaces) through transfer processes such as absorption and gravitational sedimentation.

- **Wet deposition** is the removal of pollution plume components by the action of rain.

- **Surface roughness length parameter** is a measure for the ground surface roughness which determines the turbulence characteristics of the ambient boundary layer.

- **Inversion layers**: Normally, the air near the Earth's surface is warmer than the air above it However, under certain meteorological conditions, atmospheric layers may form in which the temperature increases with increasing altitude. Such layers are called inversion layers.

- **Mixing Layer Height**: The mixing layer height is the height above ground through which ground-based emissions will eventually be dispersed once thorough mixing occurs.

- **Atmospheric Stability Classes**: The most commonly used method of categorizing the amount of atmospheric turbulence present was the method developed by Pasquill in 1961. He categorized the atmospheric turbulence into six **stability classes** named A, B, C, D, E and F with class A being the most unstable or most turbulent class, and class F the most stable or least turbulent class. Table 2 lists the six classes. For air dispersion modeling exercises, the conditions of dual stability classes like A – B, B – C and C – D can be considered as B, C and D respectively.

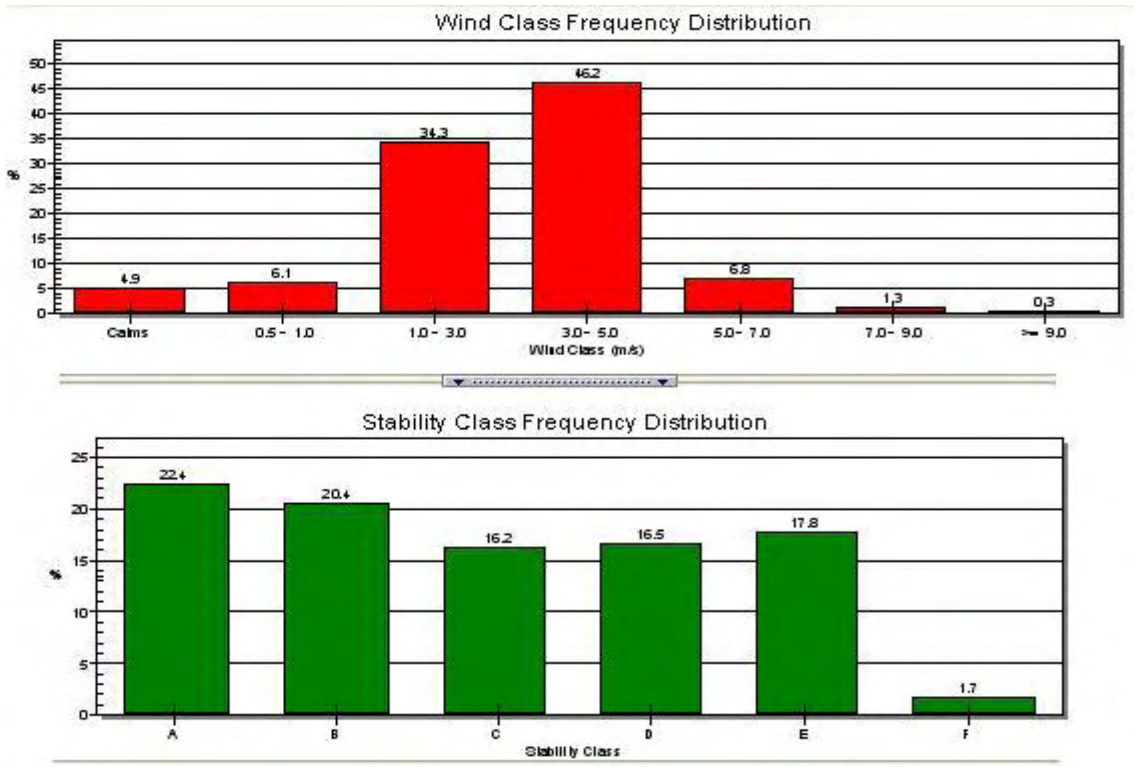
Table 2: The Pasquill stability classes

Stability class	Definition		Stability class	Definition
A	very unstable		D	neutral
B	unstable		E	slightly stable
C	slightly unstable		F	stable

The surface wind distributions for ASIZ extracted from MM5 outputs show that 24.8% of the time having winds less than 3m/s.

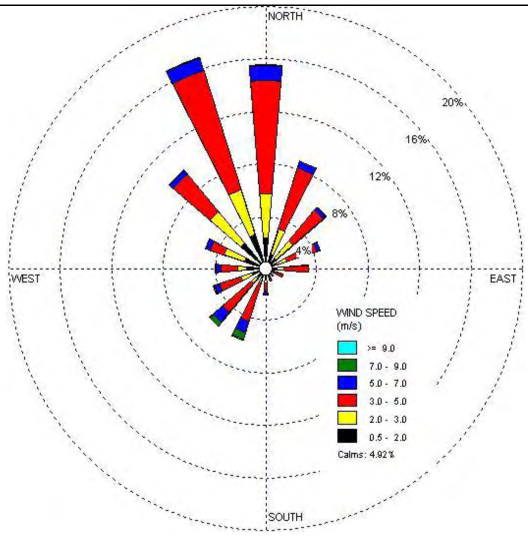
The calculated stability classes frequency from MM5 outputs show that 19.5% of the time is stable (category E and F).

Figure 3(a,b): wind(a) and stability(b) classes frequency distributions

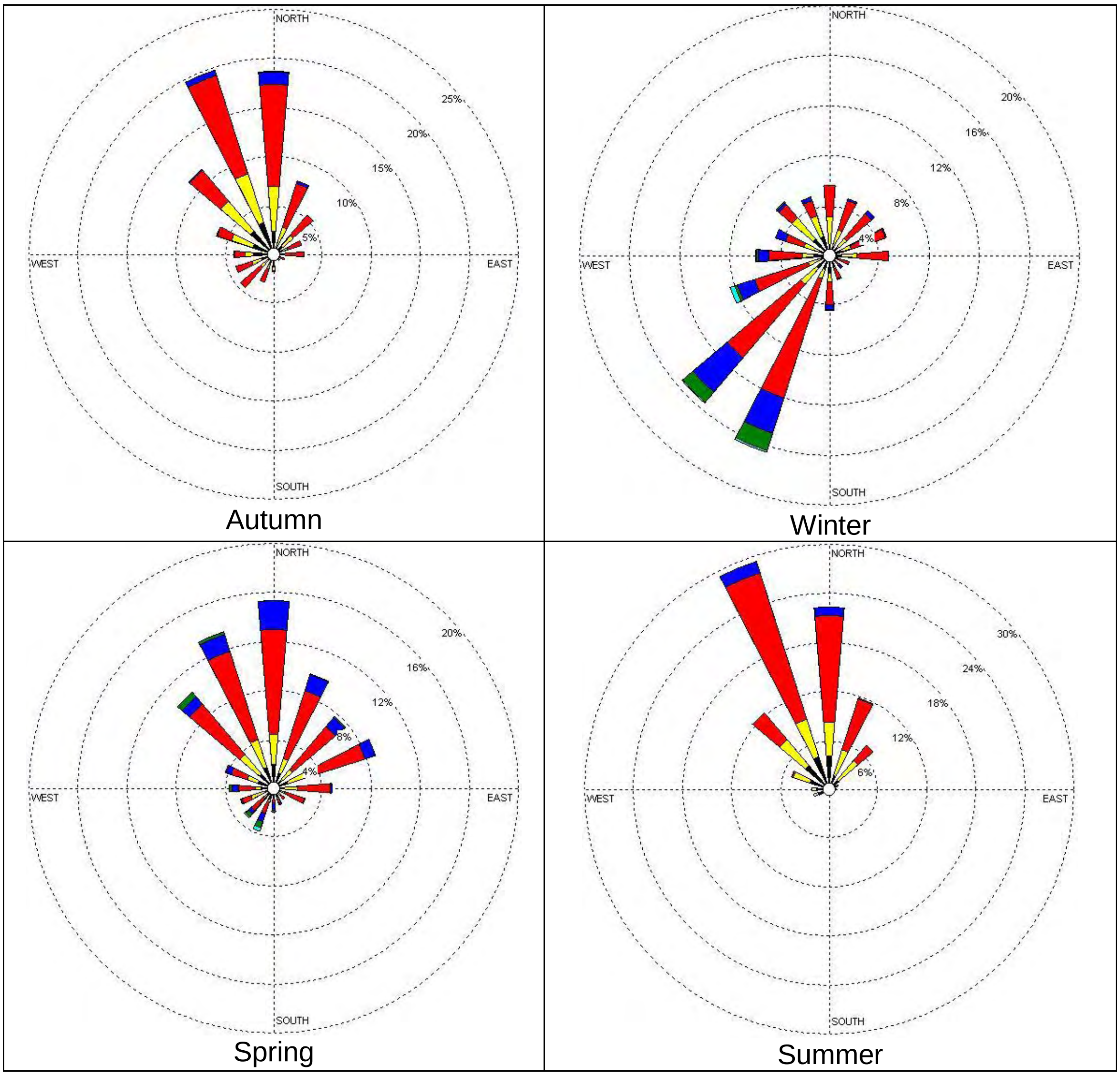


- **Wind rose:** Wind direction of the area show that predominant winds are from the north and north-east most of the year. Winter times show more South western winds because of the passage of the fast moving depressions affecting the area.

Figure 4: Wind rose for ASIZ area



Annual



The following climate summary data is obtained from the Egyptian Meteorological Authority bulletin based on 30 years observations at Cairo Airport station located 17 km to the south of ASIZ.

- **Temperature**: The warmest months of the year are June, July and August, which experience a mean daily maximum temperature of 34.0°C, 35.5°C and 35.4°C respectively and a mean daily minimum temperature of 20.5°C, 22.3°C and 22.6°C respectively. December, January and February are the coolest months experiencing daily maximum temperature of 22.1°C, 20.2°C and 21.6°C respectively and a mean daily minimum temperature of 10.8°C, 9.7°C and 9.8°C respectively.

- **Humidity**: Relative humidity peaks in November and decreases as the summer months approach. The 12 pm relative humidity readings are lower than the 06 am readings throughout the year. The 9 am relative humidity has an average annual range of approximately 68% with a minimum of 59% in May and a maximum of 80% in November. Similarly, a minimum 12pm relative humidity of 30% is achieved in May and a maximum relative humidity of 48% occurs in December.

- **Rainfall**: December and January are the wettest months of the year, receiving a mean monthly rainfall of 6.0mm and 5.9mm respectively. Summer Months are dry having zero rainfall amounts.

5. Air pollution dispersion models

5.1 Types of Air Dispersion Models

There are five types of air pollution dispersion models, as well as some hybrids of the five types:

- **Box model -** The box model assumes the air shed (i.e., a given volume of atmospheric air in a geographical region) is in the shape of a box. It also assumes that the air pollutants inside the box are homogeneously distributed and uses that assumption to estimate the average pollutant concentrations anywhere within the air shed. Although useful, this model is very limited in its ability to accurately predict dispersion of air pollutants over an air shed because the assumption of homogeneous pollutant distribution is much too simple.

- **Gaussian model -** The Gaussian model is perhaps the oldest (circa 1936) and perhaps the most commonly used model type. It assumes that the air pollutant dispersion has a Gaussian distribution, meaning that the pollutant distribution has a normal probability distribution. Gaussian models are most often used for predicting the dispersion of continuous, buoyant air pollution plumes originating from ground-level or elevated sources. Gaussian models may also be used for predicting the dispersion of non-continuous air pollution plumes (called puff models). The primary algorithm used in Gaussian modeling is the generalized dispersion equation for a continuous point-source plume.

- **Lagrangian model -** A Lagrangian dispersion model mathematically follows pollution plume parcels as the parcels move in the atmosphere and they model the motion of the parcels as a random walk process.

- **Eulerian model -** An Eulerian dispersions uses a fixed three-dimensional Cartesian grid as a frame of reference rather than a moving frame of reference. It is said that an observer of an Eulerian model watches the plume go by.

- **Dense gas model** - Dense gas models are models that simulate the dispersion of dense gas pollution plumes (i.e., pollution plumes that are heavier than air).

The Gaussian air dispersion model is used in this study.

5.3 Gaussian air pollution dispersion equation

The technical literature on air pollution dispersion models is quite extensive and dates back to the 1930's and earlier. The basis for most of those models was the complete equation for Gaussian dispersion modeling of continuous, buoyant air pollution plumes shown below:

$$C = \frac{Q}{u} \cdot \frac{f}{\sigma_y \sqrt{2\pi}} \cdot \frac{g_1 + g_2 + g_3}{\sigma_z \sqrt{2\pi}}$$

where:

f = crosswind dispersion parameter

$= \exp\left[-y^2/(2\,\sigma_y^2\,)\right]$

g = vertical dispersion parameter = $g_1 + g_2 + g_3$

g_1 = vertical dispersion with no reflections

$= \exp\left[-\,(z-H)^2/(2\,\sigma_z^2\,)\right]$

g_2 = vertical dispersion for reflection from the ground

$= \exp\left[-\,(z+H)^2/(2\,\sigma_z^2\,)\right]$

g_3 = vertical dispersion for reflection from an inversion aloft

$$= \sum_{m=1}^{\infty}\ \{\exp\left[-\,(z-H-2mL)^2/(2\,\sigma_z^2\,)\right]$$
$$+\exp\left[-\,(z+H+2mL)^2/(2\,\sigma_z^2\,)\right]$$
$$+\exp\left[-\,(z+H-2mL)^2/(2\,\sigma_z^2\,)\right]$$
$$+\exp\left[-\,(z-H+2mL)^2/(2\,\sigma_z^2\,)\right]$$

C = concentration of emissions, in g/m³, at any receptor located:
x meters downwind from the emission source point
y meters crosswind from the emission plume centerline
z meters above ground level

Q = source pollutant emission rate, in g/s

u = horizontal wind velocity along the plume centerline, m/s

H = height of emission plume centerline above ground level, in m

σ_z = vertical standard deviation of the emission distribution, in m

σ_y = horizontal standard deviation of the emission distribution, in m

L = height from ground level to bottom of the inversion aloft, in m

exp = the exponential function

It should be noted that σ_z and σ_y are functions of the atmospheric stability class (i.e., a measure of the turbulence in the ambient atmosphere) and of the downwind distance to the receptor.

5.4 Air Quality Model ISC3ST-Prime

The short-term industrial source complex model (ISC3ST-Prime) has been used in this study. The model is an advanced Gaussian dispersion model approved by the United States Environment Protection Agency (USEPA) for use in regulatory assessments undertaken within the United States. It is one of the most widely used regulatory models in the world. The ISC3ST-PRIME model uses the steady state Gaussian dispersion equation to simulate the dispersion of a plume from point, area or volume sources.
The model takes account of dry and wet deposition and includes mechanisms for determining the effect of terrain and buildings on plume dispersion

The two most important variables affecting the degree of pollutant emission dispersion obtained are the height of the emission source point and the degree of atmospheric turbulence. The more turbulence, the better the degree of dispersion.
The resulting calculations for air pollutant concentrations are often expressed as an air pollutant concentration contour map in order to show the spatial variation in contaminant levels over a wide area under study. In this way the contour lines can overlay sensitive receptor locations and reveal the spatial relationship of air pollutants to areas of interest.

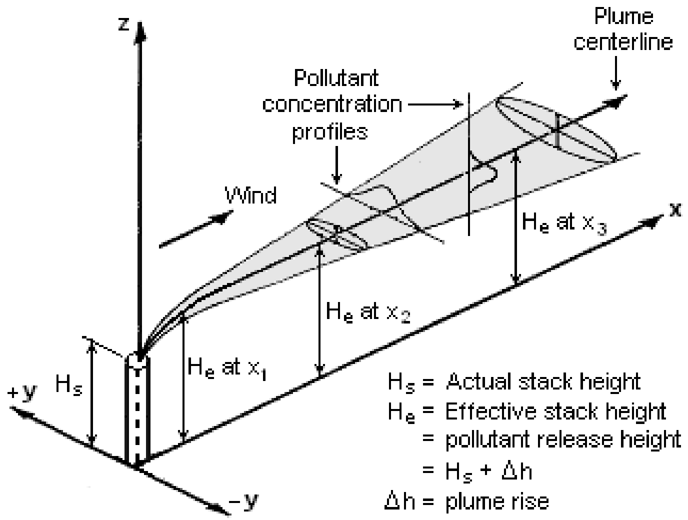
The **ISC3ST-Prime** model meteorological inputs are extracted from MM5 output in the format: yy, mm, dd, hh, wd, ws, st, pa, mdu, mdr, us, mo, zo, pc, pr where, yy:year, mm:month, dd:day, hh:hour, wd:wind direction(degrees from north), ws:wind speed(m/s), st:surface air temperature (K^o), pa:Pasquill stability class, mdu: urban mixing depth, mdr: rural mixing depth, us:friction velocity, mo:Monen Obokhove length, zo: roughness parameter, pc: precipitation code, pr: precipitation rate.

5.5 Final Plume rise

The effective stack height is taken to be the sum of the actual stack height and the final plume rise, defined as the height at which the plume becomes passive and subsequently follows the ambient air motion. Plume rise is caused by two factors: buoyancy and momentum of the stack gases. Momentum plume rise is a function of the momentum flux; that is, the product of vertical velocity and mass flow. Buoyancy plume rise is a function of the heat energy in the stack. This heat energy can be computed from the temperature differential between the stack and ambient air and the volumetric flow.

The Gaussian air pollutant dispersion equation (discussed above) requires the input of H which is the pollutant plume's centerline height above ground level and H is the sum of H_s (the actual physical height of the pollutant plume's emission source point) plus ΔH (the plume rise due the plume's buoyancy).

Figure 5: Visualization of a buoyant Gaussian air pollutant dispersion plume



To determine ΔH, the air dispersion models use what are known as "the Briggs equations."

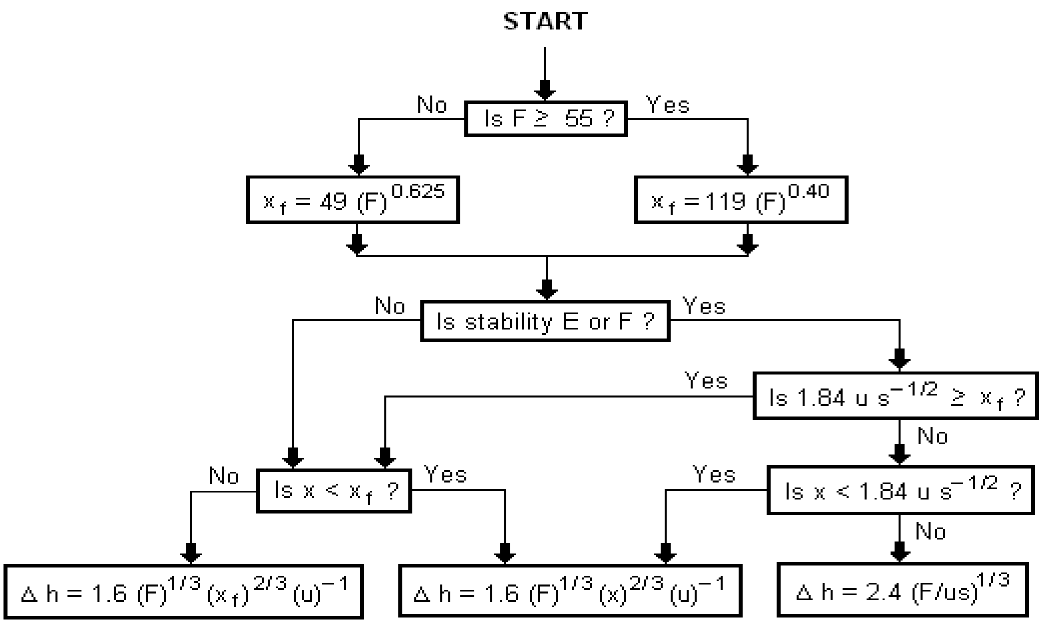
Briggs divided air pollution plumes into these four general categories:

- Cold jet plumes in calm ambient air conditions,

- Cold jet plumes in windy ambient air conditions,
- Hot, buoyant plumes in calm ambient air conditions,
- Hot, buoyant plumes in windy ambient air conditions.

A logic diagram for using the Briggs equations to obtain the plume rise trajectory of bent-over buoyant plumes is presented below:

Figure 6: Logical diagram for final plume rise calculation



where:

Δh	= plume rise, in m
F	= buoyancy factor, in m^4/s^3
x	= downwind distance from plume source, in m
x_f	= downwind distance from plume source to point of maximum plume rise, in m
u	= wind speed at actual stack height, in m/s
s	= stability parameter, in s^{-2}

Another factor can affect final plume rise **is building downwash**. When an air pollution plume flows over nearby buildings or other structures, turbulent eddies are formed in the downwind side of the building. Those eddies cause a plume from a stack source located within about five times the height of a nearby building or structure to be forced down to the ground much sooner than it would if a building or structure were not present. The effect can greatly increase the resulting near-by ground-level pollutant concentrations downstream of the building or structure. If the pollutants in the plume are subject to depletion by contact with the ground (particulates, for example), the concentration increase just downstream of the building or structure will decrease the concentrations further downstream.

Final plume rise, in our case, is calculated to determine whether there is sufficient momentum rise to allow a plume to escape the boundary layer ceiling 'determined by boundary layer height' then to determine the optimum stack dimensions to insure average plume rise higher than the average boundary layer height**.**

Certain conditions can reduce plume rise or produce conditions causing a plume to descend, rather than rise. Downwash, as well as building wake effects, can reduce the rise of a plume from what it would be in the absence of these effects. The emissions of gases denser than air can also cause a plume to descend. This density can be from gases with a higher molecular weight than air, from gases that are quite cold, or from the vaporization of water in a saturated plume.

5.6 Final plume rise and stack dimensions

Current practice is to determine plume rise from either the buoyancy rise formula or the momentum rise formula, whichever results in the higher rise.

The output of MM5 atmospheric model is used to calculation the final plume rise in the cases of stable conditions over the simulated year's hours. Unstable and neutral conditions cause considerable dispersion; hence more attention is paid for stable ones. Table (4) lists Effective Stack Height (m) for every stack category. The mean boundary layer height in stable conditions is found 176 meter for ASIZ area.

Table 4: The Effective Stack Height for every stack category

Stack diameter (m)	Stack exit Velocity (m/s)	Stack exit Temp. (K^o)	Initial Stack Height (m)	Effective Stack Height (m)
0.50	2.0	393.0	25	43
0.40	2.0	393.0	25	41
0.30	2.0	393.0	25	38
0.20	2.0	393.0	25	35
0.30	2.0	363.0	25	37
0.25	2.0	363.0	25	36
0.20	2.0	363.0	25	34

For ASIZ area MM5 outputs show that the frequency of the mixing layer depth less than 40m is about 5.0% of the time, other frequencies are depicted in table (5).

Table 5: The frequency of the mixing layer depth categories occurrence.

Mixing height	< 40m	< 80m	< 120m	<160m	<200m	<240m	<280m
Percentage frequency	5.0%	8.1%	11.6%	15.5%	19.6%	23.6%	27.4%

It is also notable that according to MM5 outputs for ASIZ the average mixing height during stable conditions is 127 meter.

From table 4 and 5, we conclude that the final plume rise is far from penetrating the mixing layer. That is because of the fact that ASIZ is a collection of small workshops. So that if the accumulated ambient air concentrations exceeded the objectives we should think about reducing the emission rate instead of adopting the stack dimensions.

6. Model Inputs

- **Distribution of Foundries**

The distribution of foundries in the ASIZ takes into consideration the already allocated foundries. As shown in figure, the distribution of foundries is undertaken as follows:

- Iron foundries using induction furnaces in the two strips parallel and adjacent to the residential area, to the east of the ASIZ.
- The copper and aluminium foundries are allocated in the small land plots to the west, farthest from the residential area.
- The iron foundries using cupola furnace are distributed in the remaining area.

Figure 7: Distribution of Foundries within the ASIZ

1 Iron foundry, cupola/induction
2 Iron foundry, induction
3 Copper foundry, crucible
Numbers without a circle indicate foundries that have been already allocated.

- **Emission Loads**

It was planned to calculate the pollution load from each foundry using emission factors. It was found that there was no Egyptian emission factors for the foundries. The international emission factors were not representative of the Egyptian foundries and thus could not be used in the process. Accordingly, it was decided to use the maximum allowable limits for pollutants in law 4/1994 and its executive regulations to calculate the emissions from each foundry. This is because all facilities are required by law to abide by these allowable limits. Emission loads were calculated in tons/yr for each of CO, SO_2 and PM10.

Table 3: Maximum Allowable Limits for Stack Emissions (Law 4/1994 and its Executive Regulations)

Type of Fuel	Maximum Allowable Limits, mg/m^3			
	PM10	SO_2	CO	HM
Solar	125	1600	300	25
Coke	250	2500	2500	25

- **Assessment Criteria**

There are a number of air quality standards and objectives relevant to the proposed facility. An air quality objective refers to ambient objectives set for the receiving environment. Egyptian Environmental Protection Law (4/94) (EEPL) is referenced to determine the assessment criteria. The objectives relevant to the ASIZ for ambient air quality are listed in the following Table.

Table 4: Air quality objectives relevant to the proposal (EEPL)

Emission	Averaging Period	Maximum ground level concentration ($\mu g\ m^{-3}$)
Particulate matter (as PM10)	24 hours	150
	one year	70
Sulfur dioxide SO2	one hour	350
	24 hours	150
	one year	60
Carbon monoxide CO	one hour	30000
	24 hours	10000

- **Production Capacity**

The production capacity of any foundry is related to its area. The daily production of a foundry shall not exceed 7.5kg/m^2 of the foundry area.

- **Operation Timing**

Owing to the fact that not all the factories operate at full capacity at the same time, it was assumed that foundries operate at 66.6% of their capacity all the time, 24hours per day. This percentage was found to be reasonable and provides a high level of stringency.

- **Background Pollution**

Modeling results did not take the background concentrations into account. Possible pollution sources are the Fertilizer Company south east of the site. Emissions from the Fertilizer Company may reach the residential area, east of the site, when the wind direction is south. There is no current information regarding the ambient air quality in the area. The model results provide the ASIZ contribution only.

7. Alternatives and Model Results

7.1 Alternative I

In this alternative, pollution loads are calculated assuming that foundries will comply with the maximum allowable limits of emissions which are:

The modeling results has shown that:

- The contour lines of the CO show that the CO in both maximum annual 8-hours average (figure 8) and maximum annual one hour average (figure 9) are well below the ambient maximum allowable limits of law 4/1994 (30,000 µg/m^3 and 10,000 µg/m^{3}respectively). The concentrations reached a maximum of 3% of the maximum allowable ambient concentration. Concentrations reaching the residential area east of the site are 200µg/m^3 and 500 µg/m^3 respectively, which are well below the allowable limits for ambient quality.
- The contour lines of the PM10 show that the PM10 in both annual average (figure 10) and maximum annual 24-hours average (figure 11) are well below the ambient maximum allowable limits of law 4/1994 (150 µg/m^{3}and 70 µg/m^3 respectively). The concentrations reached a maximum of 25% of the maximum allowable ambient concentration. Concentrations reaching the residential area east of the site are 5µg/m^3 and 10µg/m^3 respectively, which are well below the allowable limits for ambient quality.
- The contour lines of the SO_2 show that the SO_2 in annual average (figure 12), maximum annual 24-hours average (figure 13) and maximum annual one hour average (figure 14) exceed the ambient maximum allowable limits of law 4/1994 (350 µg/m^3, 150 µg/m^3 and 60 µg/m^3 respectively). The concentrations reached a maximum of about 7 times of the maximum allowable ambient concentration. Concentrations reaching the residential area east of the site are 50µg/m^3 and 300µg/m^3 and 900µg/m^3 respectively, which are much higher that the allowable limits for ambient quality.

Table 5: Comparison of the Alternative Results with Ambient Allowable Limits

	Legal Allowable Limits, µg/m^3	**Maximum Ambient Concentrations, µg/m^3 as per Model**	**Remarks**
CO			
8 hour	10,000	600	Within limits
1 hour	30,000	1100	Within limits
PM10			
Annual	150	15	Within limits
24 hour	70	40	Within limits
SO2			
Annual	60	200	Exceeding limits
24hr	150	500	Exceeding limits
1 hour	350	2100	Exceeding limits

Figure 8: Ambient CO Contours- Maximum Annual 8-hr Average

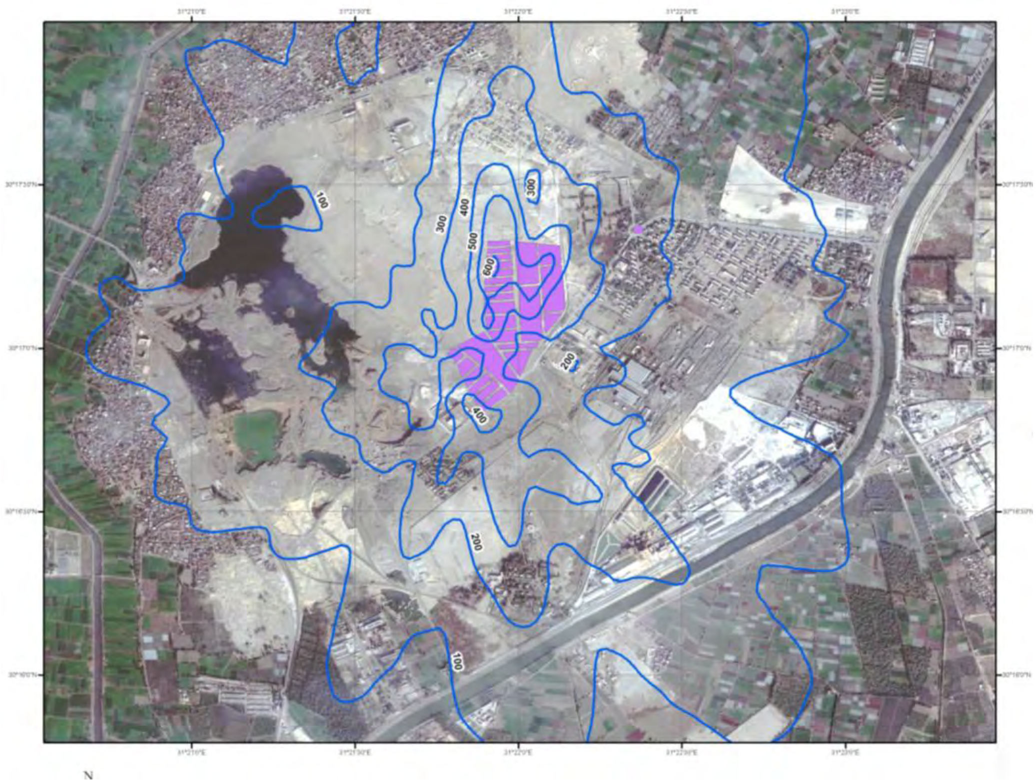


Figure 9: Ambient CO Contours- Maximum Annual 1-hr Average

Figure 10: Ambient PM10 Contours - Annual Average

Figure 11: Ambient PM10 Contours- Maximum Annual 24-hr Average

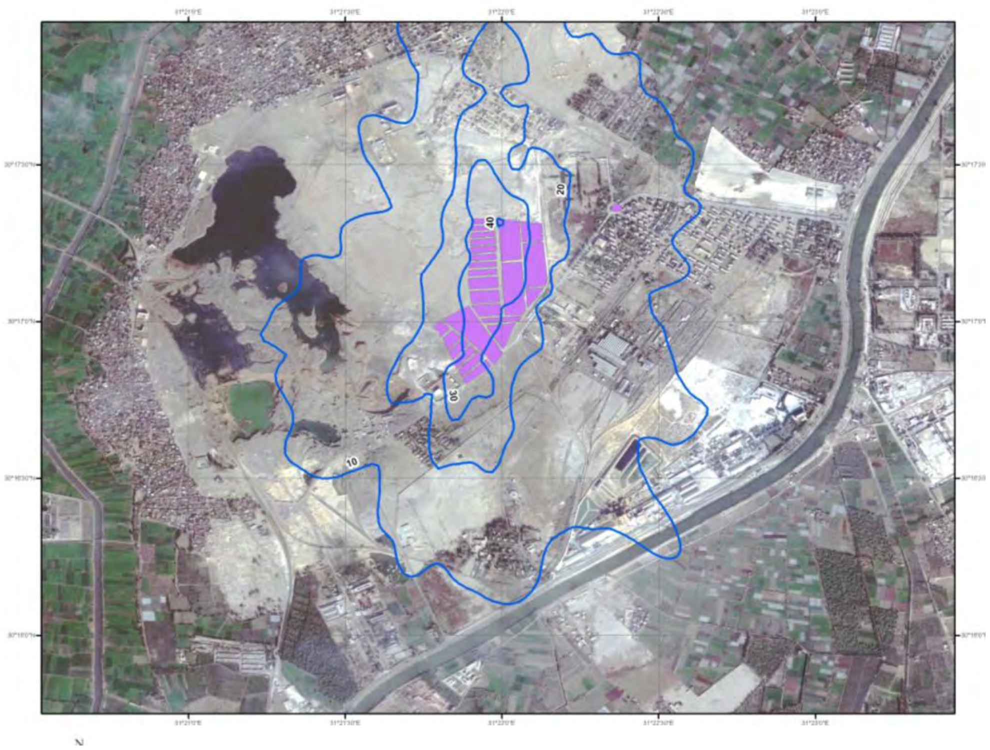


Figure 12: Ambient SO2 Contours- Annual Average

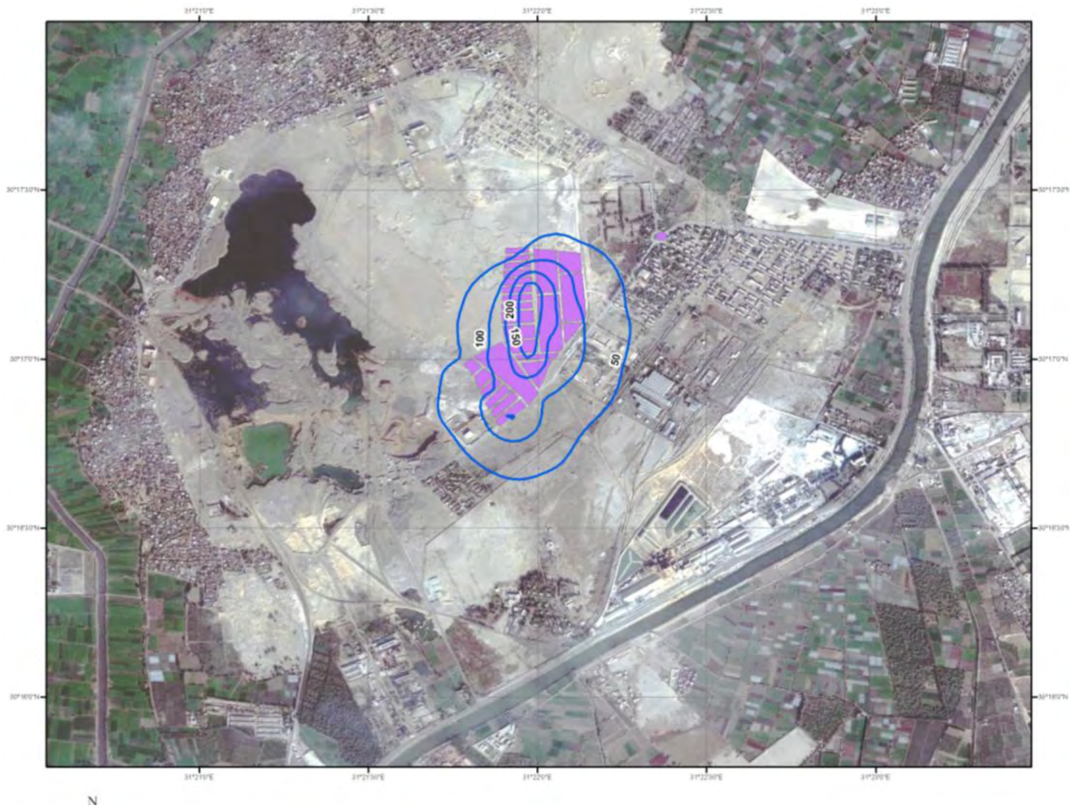


Figure 13: Ambient SO2 Contours- Maximum Annual 24-hr Average

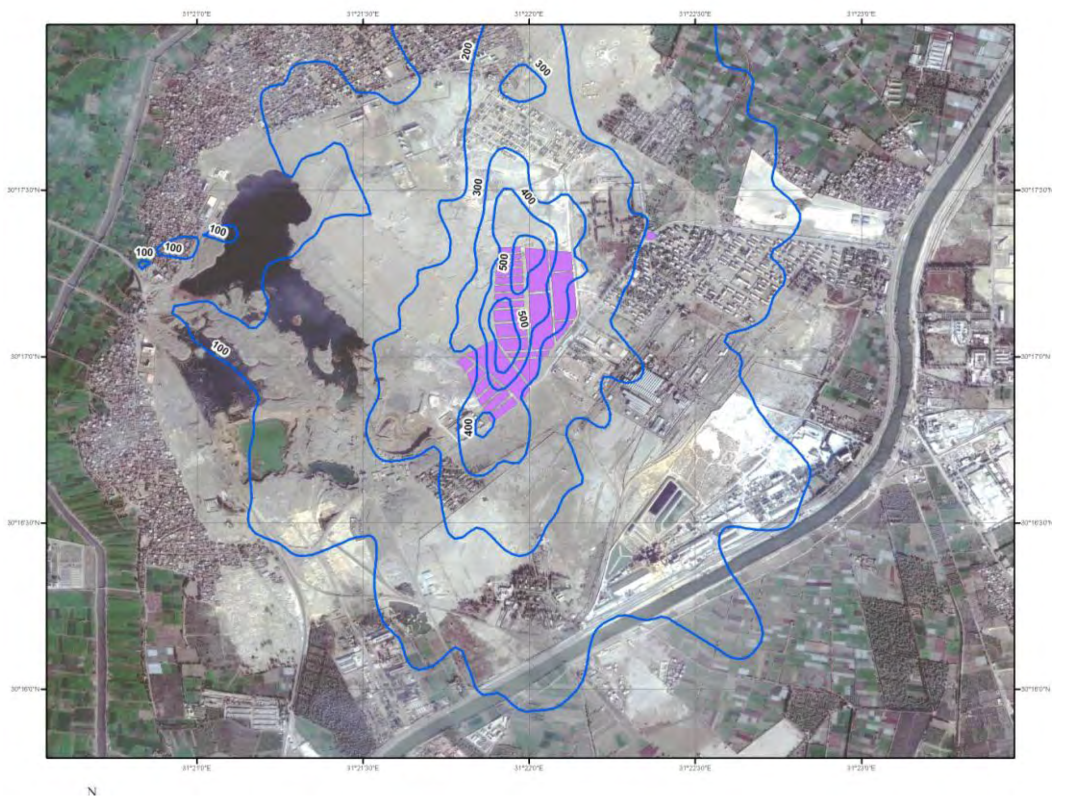


Figure 14: Ambient SO2 Contours- Maximum Annual 1-hr Average

The results of this alternative have indicated the compliance of foundries with maximum allowable limits for stack emissions are sufficient in cases of carbon monoxide and PM10 since this ensures that the ambient concentrations are well below the allowable ambient limit, even if other external emission sources are contributing to the emissions. However, this is insufficient in the case of sulfur dioxide, which ambient concentrations are much higher than its ambient allowable limit. It is thus imperative that foundries abide by a much lower stack emissions of sulfur dioxide.

The model results in relation to sulfur dioxide have indicated that actions should be taken to address one or more of the three factors leading to this situation; number of foundries, type of fuel and point source emissions. The following alternatives were considered:

- Reduce the number of foundries, which is not investigated because GOQ relies on the ASIZ to relive Shoubra El Kheima from foundries;
- Connect natural gas to the ASIZ, investigated in alternative II, and
- Lowering the allowable concentration for sulfur dioxide from the stack, investigated in alternative III

7.2 Alternative II

This alternative takes into consideration the potential future plans for connecting the ASIZ to the natural gas network. In this alternative, it is assumed that natural gas is used in ASIZ in all foundries except the iron foundries with cupola furnaces using coke. The ambient concentrations for both sulfur dioxide and nitrogen dioxide are calculated based on the assumption that the stack emissions of both gases are within the allowable limits indicated in the law.

The contour lines of the SO_2 show that the SO_2 in annual average (figure 15), maximum annual 24-hours average (figure 16) and maximum annual one hour average (figure 17) exceed the ambient maximum allowable limits of law 4/1994 (350 µg/m^3, 150 µg/m^3 and 60 µg/m^3 respectively). The concentrations reached a maximum of around 1.5, 2 and 3 times of the maximum allowable ambient concentration for annual, 24hr and 1hr respectively. Concentrations reaching the residential area east of the site are 40µg/m^3 and 100µg/m^3 and 500µg/m^3 respectively, which are still higher than the one-hour allowable limits for ambient quality, especially seen with the fact that no background concentrations are taken into account.

The nitrogen dioxide ambient concentrations were found to be within the allowable limits as shown in figures (18) and (19).

The results of this alternative show that even if natural gas is connected to the ASIZ, the resulting ambient concentration of sulfur dioxide will still be above limits when the stack emissions of the cupola furnaces using coke are only constrained by the regulatory allowable limits.

Table 6: Comparison of the Alternative Results with Ambient Allowable Limits

	Legal Allowable Limits, µg/m^3	**Maximum Ambient Concentrations, µg/m^3 as per Model**	**Remarks**
SO2			
Annual	60	90	Exceeding limits
24hr	150	300	Exceeding limits
1 hour	350	1100	Exceeding limits
NO2			
24hr	150	70	Within limits
1 hour	400	250	Within limits

Figure 15: Ambient SO_2 Contours- Annual Average

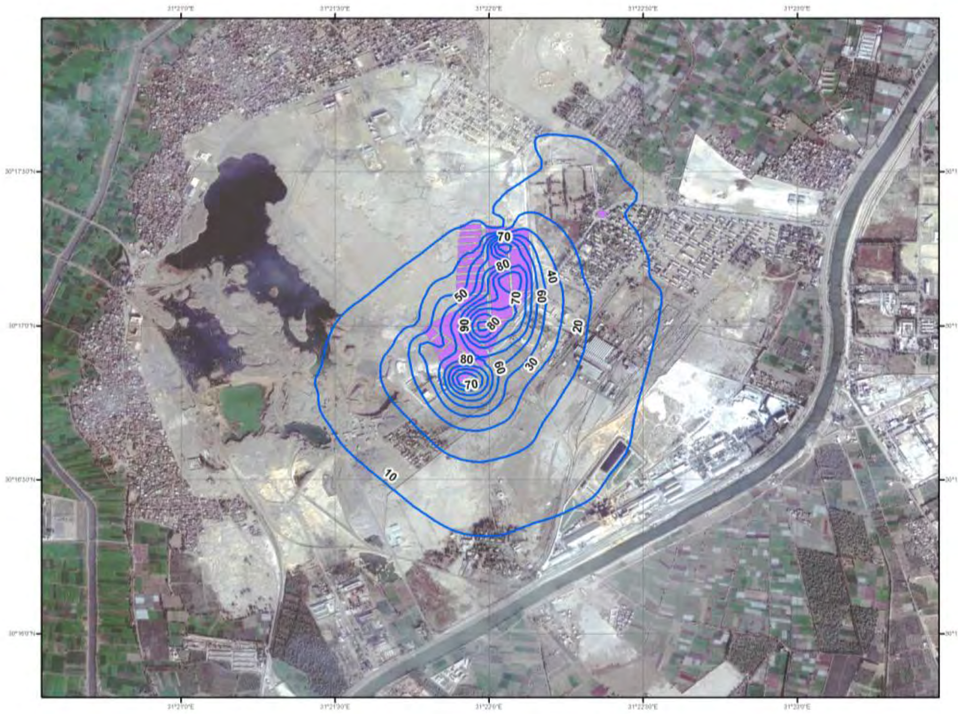


Figure 16: Ambient SO_2 Contours- Maximum Annual 24-hr Average

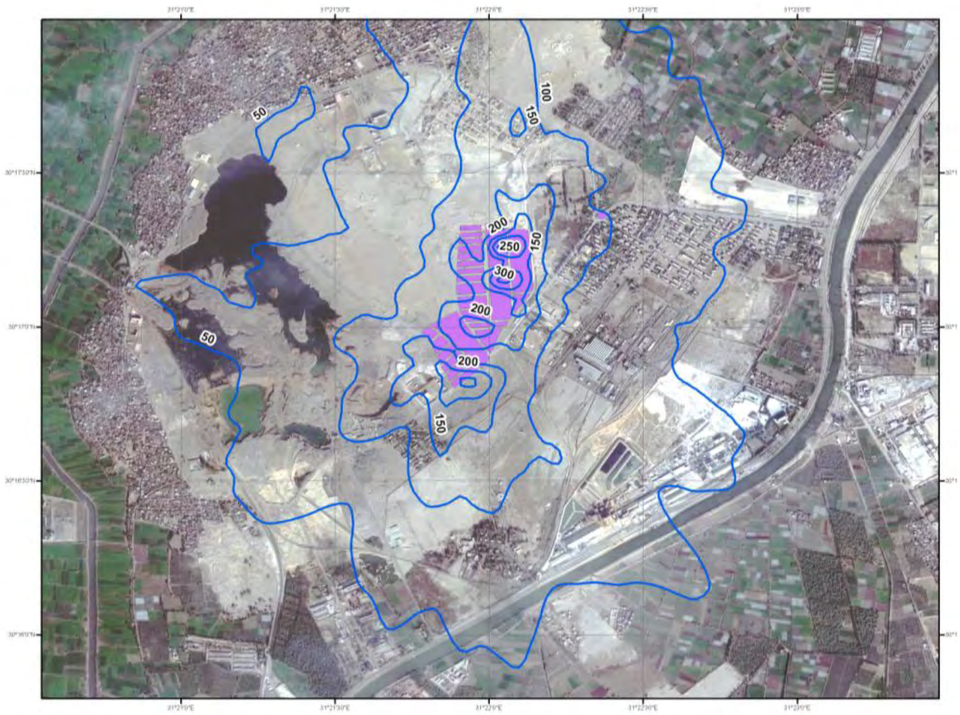


Figure 17: Ambient SO_2 Contours- Maximum Annual 1-hr Average

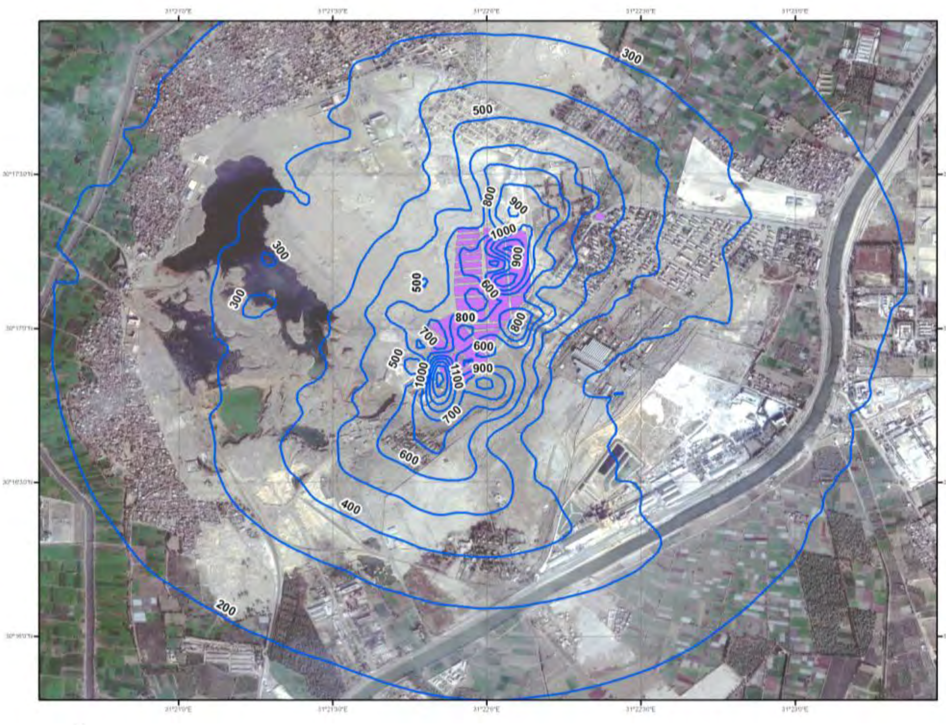


Figure 18: Ambient NO_2 Contours- Maximum Annual 24-hr Average

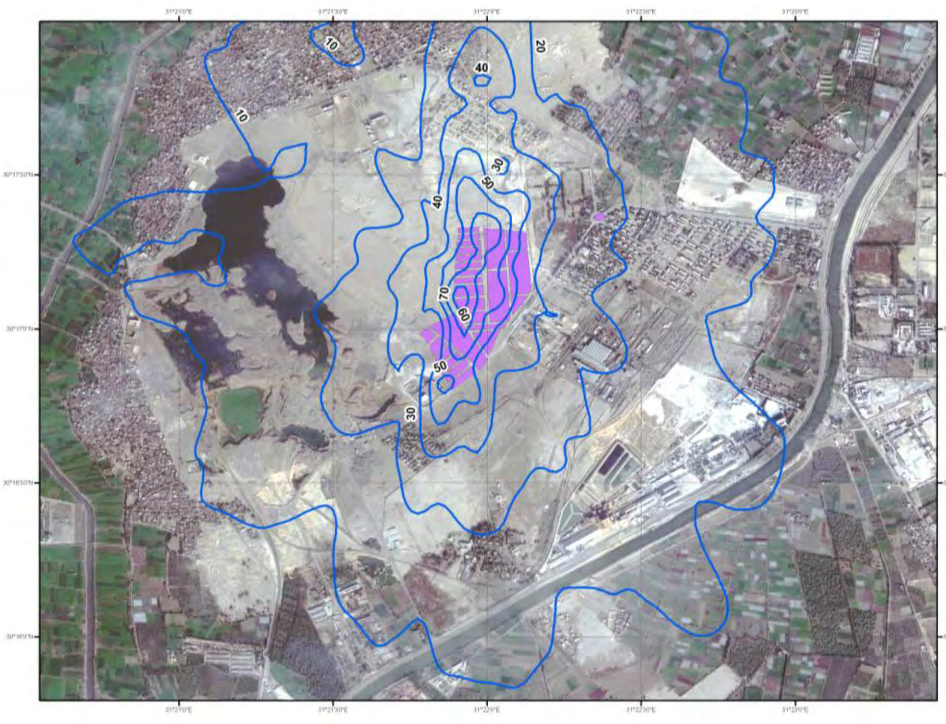


Figure 19: Ambient NO_2 Contours- Maximum Annual 1-hr Average

7.3 Alternative III

The difference between this alternative and alternative I is that SO_2 stack emissions of the foundries were reduced to 250 µg/m^3 of the allowable limits for SO_2 in case of coke burning. This concentration is feasible using a wet scrubber of at least 80% efficiency. The model was run again with this SO_2 stack concentration. The results of the model has shown that in all cases, the concentration of ambient sulfur dioxide is much lower than the allowable limits reaching a maximum of about 50% of the annual allowable limit (figure 20), 47% of the daily allowable limit (figure 21) and 70% of the hourly allowable limit (figure 22). Concentrations reaching the residential area east of the site are 5µg/m^3 and 20µg/m^3 and 100µg/m^3 respectively, which are well below the allowable limits for ambient quality and allow for the necessary precaution given that no background concentrations are taken into account.

Table 7: Comparison of the Alternative Results with Ambient Allowable Limits

	Legal Allowable Limits, µg/m^3	Maximum Ambient Concentrations, µg/m^3 as per Model	Remarks
9.1 SO2			
Annual	60	30	Within limits
24hr	150	70	Within limits
1 hour	350	250	Within limits

Figure 20: Ambient SO_2 Contours- Annual Average

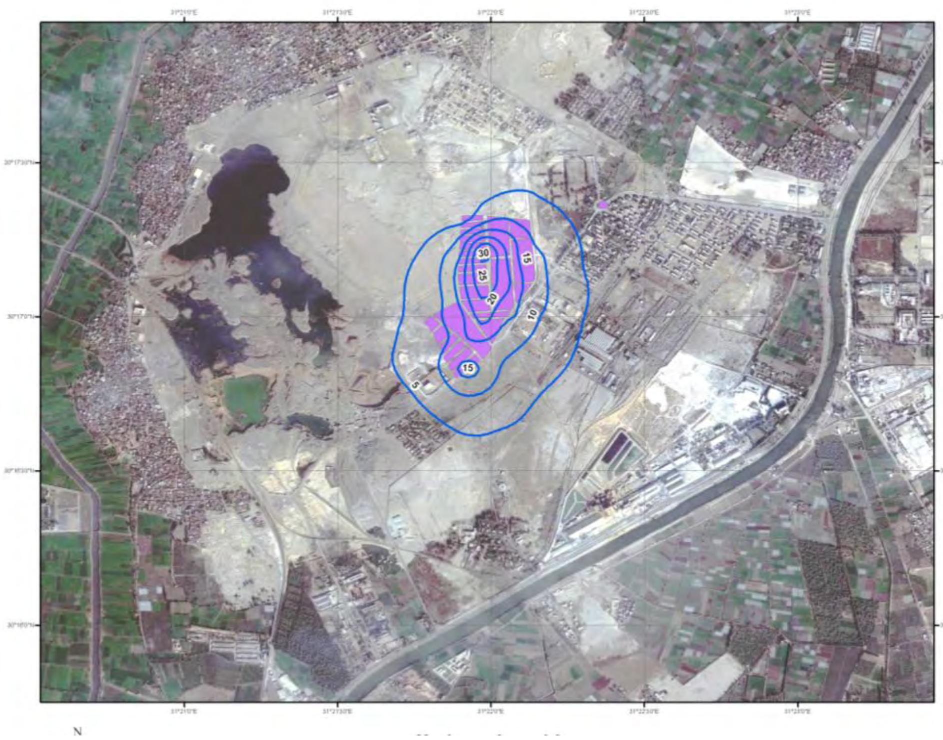


Figure 21: Ambient SO_2 Contours- Maximum Annual 24-hr Average

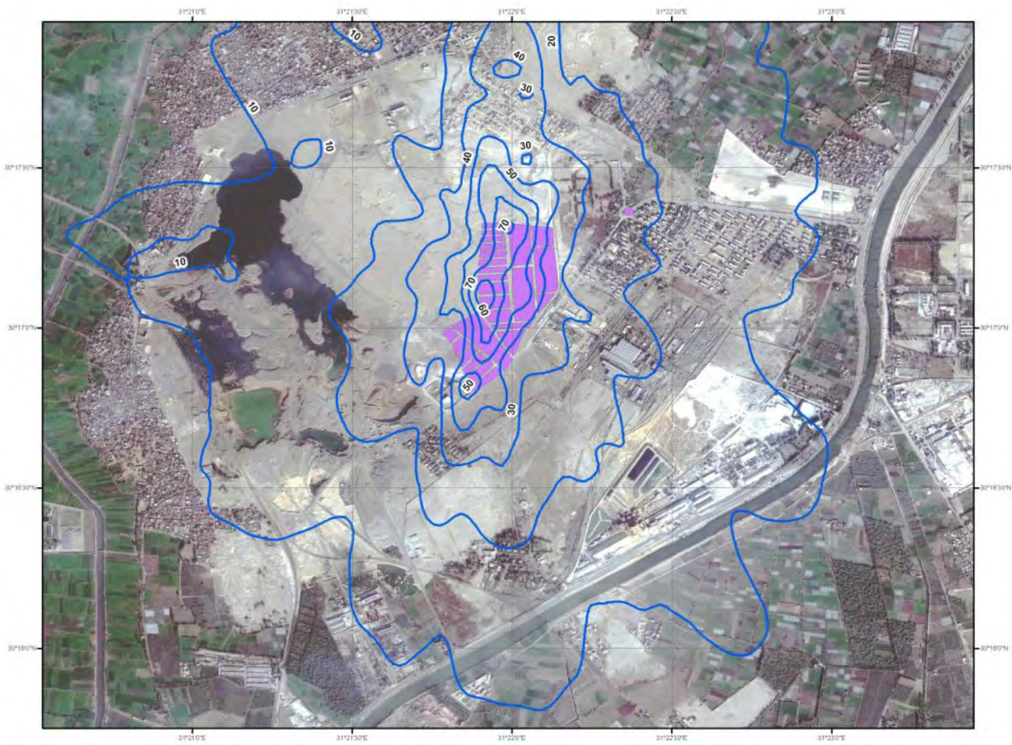


Figure 22: Ambient SO_2 Contours- Maximum Annual 1-hr Average

7.3 Alternative IV

In this alternative, the foundries distribution is slightly changed to allow for more foundries using cupola furnaces versus induction furnaces (figure 23). The same conditions of alternative II applies (i.e. SO_2 stack concentration is 250µg/m^3).

The results of this alternative have shown that even with the increase in the number of cupola furnaces, the ambient sulfur dioxide concentrations are still within the maximum allowable limits (Figures 24, 25 and 26). Accordingly, it is possible to allow more cupola furnaces without negatively affecting the ambient conditions of the area. Concentrations reaching the residential area east of the site are 5µg/m^3 and 30µg/m^3 and 150µg/m^3 respectively, which are below the allowable limits for ambient quality, and allow for the necessary precautions given that no background concentrations are taken into account.

Table 8: Comparison of the Alternative Results with Ambient Allowable Limits

	Legal Allowable Limits, µg/m^3	**Maximum Ambient Concentrations, µg/m^3 as per Model**	**Remarks**
SO2			
Annual	60	30	Within limits
24hr	150	80	Within limits
1 hour	350	250	Within limits

Figure 23: Foundries Distribution for Alternative IV

1 Iron foundry, cupola/induction
2 Iron foundry, induction
3 Copper foundry, crucible
Numbers without a circle indicate foundries that have been already allocated.

Figure 24: Ambient SO_2 Contours- Annual Average

N

Figure 25: Ambient SO_2 Contours- Maximum Annual 24-hr Average

Figure 26 : Ambient SO_2 Contours- Maximum Annual 1-hr Average

Arab Republic of Egypt
The Cabinet of Ministers
Ministry of State for Environmental Affairs
Egyptian Environmental Affairs Agency

The information required in this form should be filled in an accurate and legible way.
The administrative authority should review and stamp the form, then send it to EEAA for review and give opinion. Site visit report or any additional attachment might be submitted

Environmental Screening FORM (A)

1. General Information

1.1. Project title:--

1.2. Type and number of project (refer to the attached list) -----------------------------------
----

1.3. Name of the owner (individual, company, etc) ---

1.4. Name of the person in charge (the responsible person): -------------------------------
Address:---
Telephone: --

1.5. Competent Administrative Authority:---

2. Project data

2.1 Location of the project (please attach a map that clearly shows the location of the project in relation to residential areas and neighboring activities. The map should have a suitable and clear scale and should be approved by the competent administrative authority).

Address of the project: ---

A. City ,أvillage (yficeps esaelp) أ srehto ,أ enoz lairtsudni detidercca ,أ-------

B. In a residential area أ aera laitnediser a edistuO ,أ

C. Individual building أ A multiple story building with a residence above أ

Total area of the project (Square meter): ---

2.2. Type of project:

New أ noisnetxE أ

Type of extension: ---

- *If the type of project is an extension, has an EIA study been submitted for the original project?*

  Yes No

- Date of obtaining the previous approval from the EEAA: ------------------------

2.3 Production capacity: [ ] and/or storage capacity: [ ]

Please mention units used: ---

2.4 Final product: --

2.5 By-product: ---

2.6 Stages of the project and expected starting dates:

Construction: --------------------------, Operation: -------------------------------------

2.7. Brief description of the project:

2.7.1 Project components such as machinery, equipment and complementary services

----

2.7.2 Industrial processes (demonstrated as possible by catalogues and *figures*)

2.7.3 Power supply used: ---------------------------- source: ----------------------------

2.7.4 Type of fuel: ------------------------------- rate of consumption:----------------------

2.7.5 Raw materials:

Main:---

Auxiliary:--

2.7.6. Source of water (public, groundwater, surface water, others):--------------------------------

----

Water usage (cooling, industrial uses, *human use*):---

Rate of consumption: --

3. Wastes resulting from the activity during the operation stage and treatment methods:

3.1.Liquid wastes:--

Type of liquid wastes:---

Volume:---

Methods of disposal: --

3.2 Solid wastes: --

Type:---

Amount: ---

Methods of disposal: ---

3.3 Gaseous emissions , dust, Temperature condition and methods of control (stacks, filters, others):---

3.4. Methods of protection and control of noise: --

3.5. Description of any other mitigation measures: --

DECLARATION

Hereby I, the signer, declare that the information submitted above is accurate and true and that in case there is any modification of the information stated above, the EEAA shall be informed through the Competent Administrative Authority. Hereby I declare:

Name: ---

Identity Card number and address: --

Position (in the capacity of): --

Date: ---

Form filled in with the knowledge of the competent administrative authority

Name: --
Professional title:--
Signature: ---

1. Official Stamp