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Research Paper

Assessment of pollution resulting from petroleum refining activities in (CORC), Mostord, Egypt using comprehensive environmental pollution index for industrial areas

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ABSTRACT: *The Comprehensive Pollution Index (CEPI), which takes into account many environmental elements that indicate environmental quality such as air quality, water quality and soil pollution, is a method used to evaluate the level of pollution in industrial centers and urban areas. Policy makers can take action to reduce pollution levels and improve environmental conditions by determining whether a research area is severely polluted and determining the degree of contamination. Investors interested in launching new industries in a particular area can also benefit from indicator information to establish economically favorable and environmentally efficient conditions.*

The study attempts to evaluate the pollution resulting from oil refineries in the Mostorod region of Egypt, determine the extent of the risk of benefiting from the impact of comprehensive environmental pollution, determine whether it poses a danger to people, take the necessary steps to mitigate it and conclude the harmful consequences of pollution resulting from oil refining on people's health

KEYWORDS: *Comprehensive Environmental Pollution; Environmental Pollution Index; Air pollution; CORC; Industrial Areas*

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I. INTRODUCTION

The problem of environmental degradation in the Greater Cairo neighborhoods has become one of the most important problems facing human health at the present time, represented by environmental risks that in turn lead to a threat to the population's wellbeing in these areas.

Industrial activity is considered the most important urban activity affecting the environment, and there are 10 industrial zones in Cairo. Major cities lead to many environmental problems and the deterioration of public health, and studies have indicated that Greater Cairo is at the top of the list of cities that topped the air quality factor in the year 2020. [1]

Mostorod is one of the most important affected areas in Greater Cairo, and it is one of the most important industrial areas in Cairo. Al-Kubra, which contains oil refineries, and it is the largest refinery in the Middle East, but considered one of the initial sources of pollution additionally to the occurrence o.f many diseases and the A growth in population numbers with respiratory illnesses, as respiratory diseases constituted a large percentage of the population of the region with diseases, followed by some diseases that are attributed As a result of this environmental deterioration, and because of this deterioration, the solution was environmental Planning in the region and identify methods to reduce pollution and maintain environmental health.

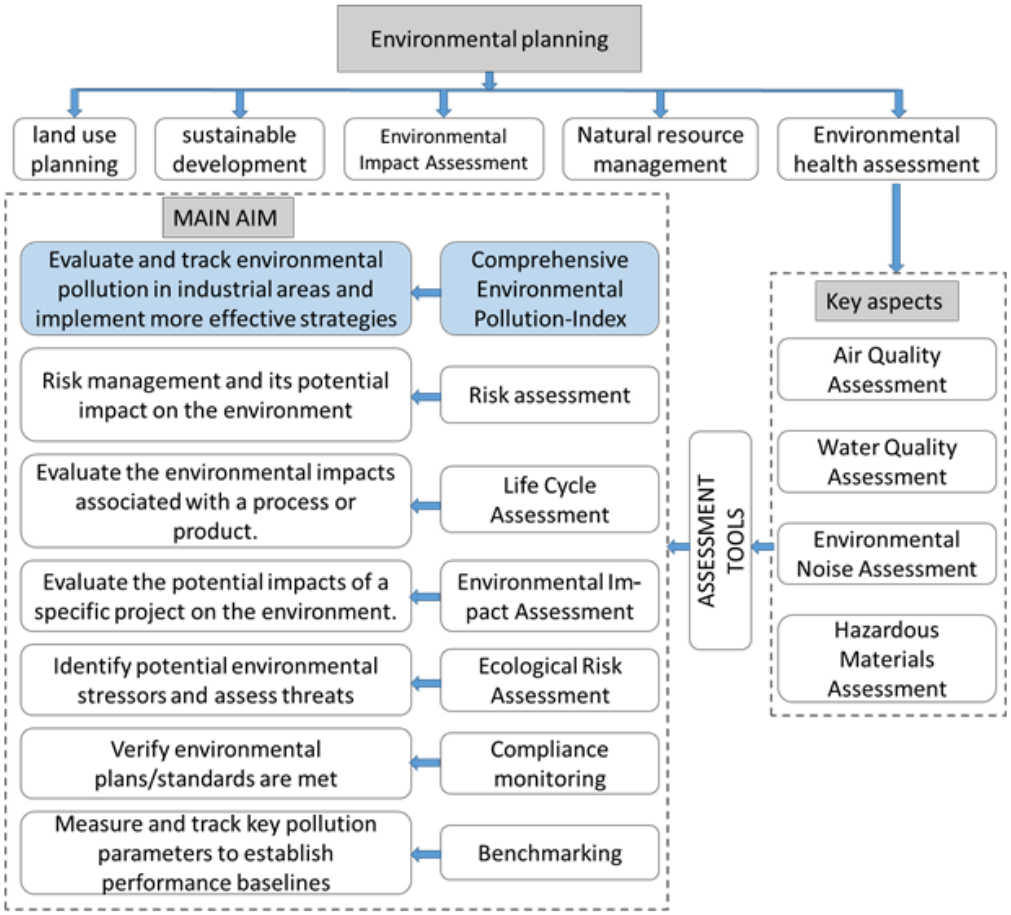
Environmental Planning: The process of facilitating the organized and sustainable use, Environmental planning is the development and management of resources from nature and the environment, it entails taking into account a variety of elements such as land use, infrastructure development, biodiversity conservation, and socio-economic considerations in order to balance human demands with environmental protection. [2] Environmental planning includes several basic aspects, namely (land use planning: this includes analyzing and determining the most appropriate use of land, taking into account factors such as environmental sensitivity,

infrastructure requirements, and community needs - sustainable development: environmental planning aims to promote sustainable development through Incorporating environmental considerations into decision-making processes and seeking to meet current needs without compromising the ability of future generations to meet their own needs Environmental Impact Assessment: Environmental impact assessment is a critical component of environmental planning. It involves assessing potential environmental impacts of proposed projects or developments and assists in assessment Identifying and mitigating harmful impacts and promoting sustainable practices – Natural resource management: Environmental planning addresses the natural resource management that is sustainable, such as water, forests, minerals, and wildlife and aims to balance resource use with efforts to maintain environmental integrity, environmental health assessment: Environmental health assessment focuses on the assessment and management of environmental factors environmental health that can affect human health. It includes identifying and evaluating potential hazards in the environment and implementing measures to mitigate risks), and key aspects of environmental health assessment also [3] include:

- Air quality assessment
- Water quality evaluation
- Environmental Noise Assessment
- Hazardous Materials Assessment

Environmental planning serves a significant and useful role in assessing the pollution of industrial areas by evaluating several factors[3] (selection and division of points - environmental impact assessment - pollution control and mitigation of its goods - occupational health and safety - community participation) and through the integration of environmental planning and environmental health assessment by taking these Factors considered, industrial estates can be developed and operated in a dynamic manner that minimizes health commodities hazardous to human health and terrain and promotes openness to sustainable industrial practices. and there are many assessment tools aimed at sustainable environmental planning and directing it to industrial areas to conduct a comprehensive assessment, reduce harmful health effects on the environment and society, and move towards sustainable industrial practices, there are various evaluation tools used in the comprehensive assessment of pollution, depending on the specific goals and objectives of the assessment. Some common evaluation tools include:

Figure1: Assessment tools for environmental health, Source: author



Comprehensive. Environmental. Pollution-Index: it's is a comprehensive indicator used to estimate Environmental circumstances of an area or region. It takes into account multiple environmental parameters similar as air, water, soil pollution, and waste operation,CEPI provides a single value that represents the overall pollution position of an area or region. [4-29]

Risk.Assessment: This is a process of evaluating the likelihood and severity of harmful effects on human health or the environment due to exposure to pollutants. It involves detecting probable origins of pollution, assessing the exposure pathways, and characterizing the risks associated with each pollutant. [5]

Life.Cycle_Assessment (LCA): This is a tool used to assess how an operation or From the extraction of raw materials until the disposal of the product, the surroundings may be harmed. LCA takes into account every phase of a function life cycle. and evaluates the environmental impacts associated with each stage [5-6]

Environmental .Impact-Assessment (EIA): This is a proceeding applied to valuate the possible environmental impacts of propounded growth systems. EIA considers the possible impacts on the air, water, soil, and biodiversity, as well as the impacts on mortal health and socio- profitable conditions [7-8]

Ecological.Risk_Assessment: This is a process used to estimate the implicit pitfalls to the terrain and ecosystems due to exposure to adulterants. Ecological threat assessment considers the implicit impacts on greenery and fauna, as fluently as the possible impingements on ecosystem functions [9-10-11]

Compliance monitoring: It is considered an evaluation process to see if the pollution measures that have been taken are effectively implemented and implemented, and if they achieve the results for which they were taken, and to ensure follow-up and control of good representation of regular follow-up operations, sampling and verification of environmental media to ensure good compliance with the measures taken[12]

Benchmarking: This is a process of comparing the environmental performance of a company or facility contrary to the standards of the industry or ideal procedures. Benchmarking can be used to find chances and domains for development, for pollution prevention or reduction. [13]

After identifying the various environmental assessment tools and their objectives to assess the current situation of the study area ,the comprehensive Environmental Pollution Index was chosen for the study sector assessment because it is a highly appropriate indicator of the state of the area and is a more general and broad approach to assessing the environmental quality of an area.

The Coalition for Preparedness Innovations (CEPI) is typically used to assess the overall environmental quality of an area, while the Environmental Impact.Assessment is used to assess the potential impacts of a particular project on the environment. CEPI also gives a clear number showing the degree of contamination of the study area through specific criteria. Therefore, it was chosen as a comprehensive evaluation tool for the study area, through which the region is comprehensively evaluated by researching all causes of pollution and evaluating the region through comprehensive environmental pollution index criteria to determine the most common cause of environmental pollution in the region, which directly and indirectly affects health. people and the environment in this region. Through this study, strategies can be developed to reduce pollution and mitigate the negative effects resulting from the oil refining industry

COMPREHENSIVE _ENVIRONMENTAL _POLLUTION _INDEX _ (C.E.P.I):

The. Comprehensive. Environmental. Pollution-Index (CEPI) is an instrument for evaluating and quantifying contamination of the environment in manufacturing facilities., It is a composite index that integrates the data on various environmental parameters [1] such as The pollution of the air, the state of the water, the condition of the soil, levels of noise, solid garbage, and dangerous materials are all factors to consider., The CEPI provides a single number that reflects the overall pollution load of industrial zone, That tool helps policymakers and Organizations of regulation to identify the environmental hotspots and prioritize the mitigation measures [14] [15].

The CEPI was developed by the Central. Pollution. Control-Board (C.P.C.B) in India in collaboration in collaboration with the UN. [1] Industrial .Development . Organization (UNIDO) in 2009. That tool was designed to evaluate pollutant level of India's clusters of industries and to prioritize the implementation of mitigation measures [16].

The CEPI is grounded on a set of 37 parameters, which are grouped into six orders air, water, land, dangerous waste, solid waste, and noise. These parameters include colorful pointers, similar as the attention of adulterants in air and water, the quantum of dangerous and non-hazardous waste generated, and the noise situations in the artificial area.

The CEPI provides a score between 0 and 100, with advanced scores indicating advanced pollution situations. The tool also ranks the artificial areas grounded on their pollution situations, furnishing a base for prioritizing pollution control measures.

The CEPI has been extensively used in India and has been espoused by other countries as well. For illustration, Bangladesh has developed its own interpretation of CEPI To determine the polluting location of its artificial areas.

The CEPI is a useful tool for policymakers, regulators, and industries to analyze industrial activity' environmental impact to prioritize mitigation measures to reduce pollution levels. The tool also ranks the industrial areas based on their pollution levels, providing a basis for prioritizing pollution control measures. The CEPI has been widely used in India and has been adopted by other countries as well, such as Bangladesh which has developed its own version of C.E.P.I to determine the level of pollution in its industrial regions [4-14].

The CEPI has been integrated into the regulatory framework in .India, with the .Ministry .of Environment, .Forest and Climate .Change (MoEFCC) requiring all new and existing industrial units to disclose their CEPI score. The disclosure of the CEPI score is intended to increase transparency and accountability in the industrial sector and to encourage the adoption of cleaner production technologies and practices [17].

Overall, the CEPI is a useful tool for policymakers, regulators, and industries to evaluate the impact on the environment industrial activities to prioritize mitigation measures to reduce pollution levelsan important tool for assessing the environmental impact of industrial activities and for promoting sustainable industrial development. Through the use of the CEPI, policymakers, regulators, and industries can work collaboratively to reduce pollution levels and to promote environmental sustainability [18].

The CEPI is used to classify industries based on their pollution levels into three categories:

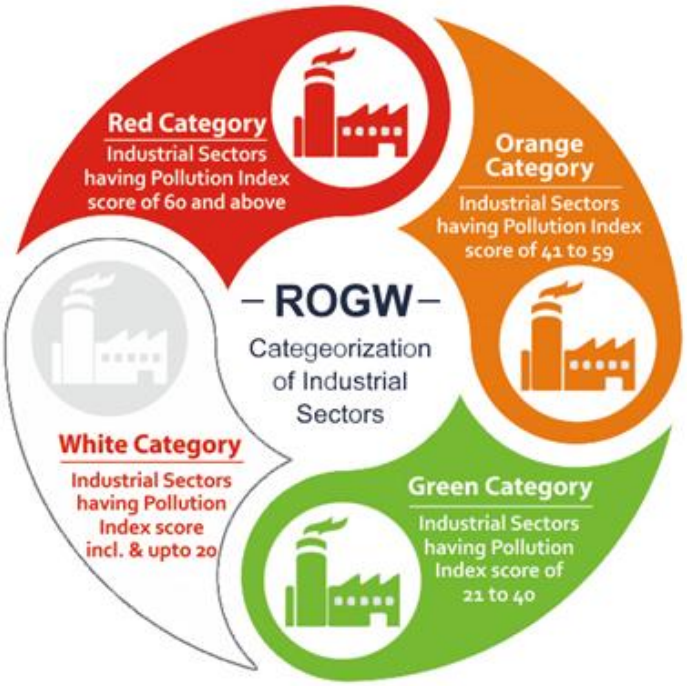


Figure1: Categorization of Industrial Sectors, Source: [4]

The Red Category these industries are considered highly polluting and are subject to strict pollution control measures and regulatory oversight chemical industries, cement plants, and thermal power plants

The Orange Category these industries are moderately polluting and are subject to pollution control measures and regulatory oversight textile industries, sugar factories, and paper mills,

The Green Category these industries are considered low polluting and are subject to minimal regulatory oversight examples for Green Category IT parks, food processing industries, and handicrafts

The classification of industries into the Red, Orange, and Green categories is an important tool for policymakers and regulators to prioritize Controls for pollution are put in place, Industries in the Red Category are subject to the most stringent pollution control measures, while industries in the Green Category are subject to minimal regulatory oversight, Overall, the use of the CEPI to classify industries based on their pollution levels provides a basis for prioritizing pollution control measures and promoting sustainable industrial development [19].

The measurement of the CEPI score involves collecting data on a range of environmental parameters and using a standardized formula to calculate the score. The CEPI score offers a useful instrument for assessing industrial pollution's environmental impact activities and promoting sustainable industrial development [17-19].

Calculating all 37 parameters may not be necessary for every artificial area. The choice of parameters to be measured and covered may depend on the nature of the artificial exertion, the position of the artificial area, and the environmental enterprises specific to the area.

For illustration, if an artificial area is located near a body of water, it may be important to cover water quality parameters similar as pH, duck, COD, and total coliform to assess the impact of artificial exertion on the water body. Likewise, if the artificial area is located in an environmentally sensitive area, it may be important to cover soil corrosion, soil parcels, and fungicide remainders to assess the impact of artificial exertion on soil quality.

In some cases, it may be necessary to cover all 37 criteria to gain a comprehensive understanding of the environmental impact of artificial exertion. still, in other cases, a subset of parameters may be sufficient for EIA and CEPI score computation.

Based on a thorough evaluation of the environmental issues unique to the industrial location and the potential effects of the industrial activity in terms of the environment and public health, the criteria to be evaluated and monitored should be chosen. [20].

II. MATERIALS .AND .METHODS

The double pendulum is illustrated in Diagram1. It is convenient to define the coordinates in terms of the angles between each rod and the vertical. In this diagram m_1,L_1 and θ_1 represent the mass, length and the angle from the normal of the inner bob and m_2, L_2 and θ_2 stand for the mass, length, and the angle from the normal of the outer bob. The simple kinematics equations represent in next section to derive equations of motion by using Lagrange equations

Study_area

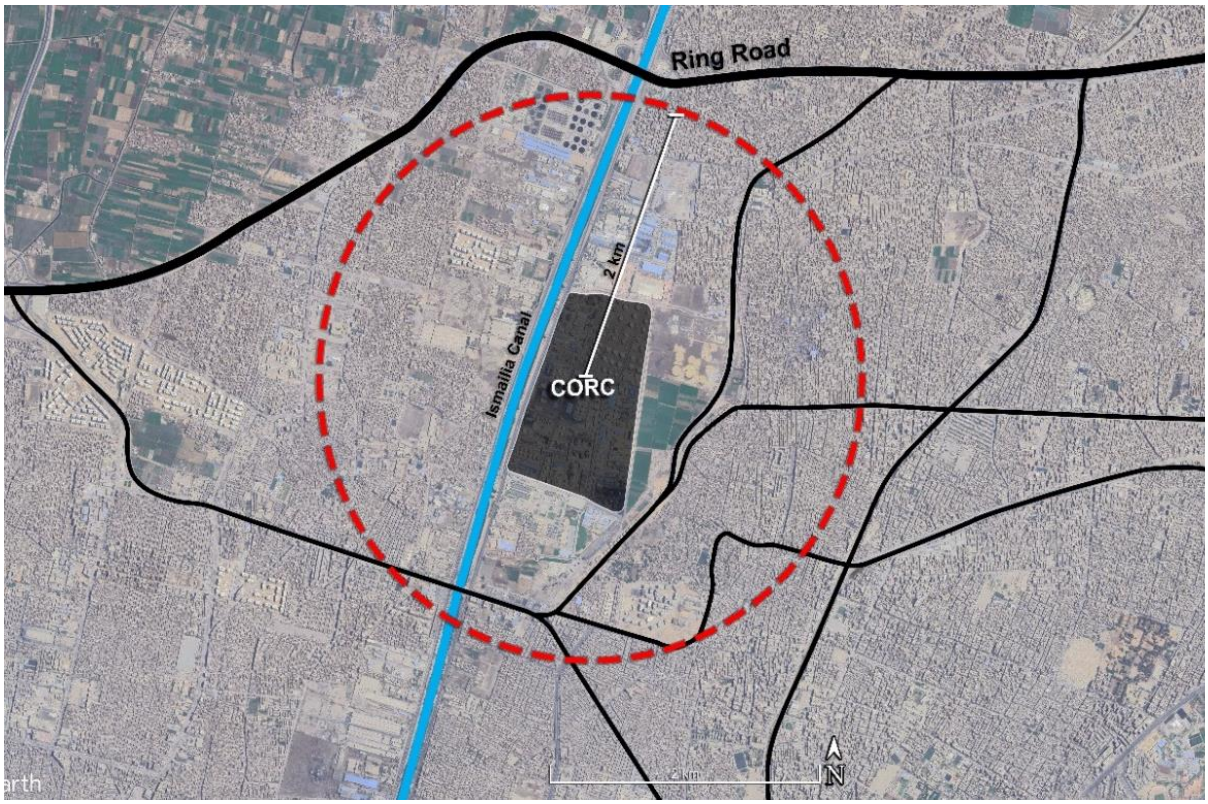


Figure3: the area of study area 2Km range, Source: Author

Mostorod is located in the city of Shubra Al-Khaima, which is affiliated to Al-Qalyubia Governorate, one of the governorates of Egypt. Shubra El Kheima is located in the northern suburbs of Cairo, the capital of Egypt. It is one of the largest and most densely populated cities in Qalyubia Governorate. At the level, the city is thought to be an industrial fortification. At the governorate level, in particular, and at the Arab Republic of Egypt level in general. The city's manufacturing operations contribute to enhancing Egyptian exports and outperform other countries in many outputs derived from manufacturing operations. Transformational industries

in the petroleum sector Mostorod Refinery (Qalyubia), which is the oldest refinery in the Arab Republic of Egypt and is owned by the Cairo Company [21].

The refinery has a significant impact in meeting the Egyptian demand for refined petroleum products, as it processes crude oil and converts it into various products, including gasoline, diesel, jet fuel, liquefied petroleum gas, and other petroleum derivatives, CORC is a subsidiary of the Egyptian General Petroleum Corporation (EGPC) [22]., the national oil company of Egypt. The refinery has a large processing capacity and contributes to Egypt's energy security by reducing the country's dependence on imported petroleum products., The refining capacity of the Cairo Petroleum Refining Company is about 142,000 barrels per day. It uses various refining processes, including distillation, catalytic cracking, and hydrocracking, to convert crude oil into valuable petroleum products [23]

The refinery produces a range of products, including but not limited to gasoline, diesel, heating oil, jet fuel, butane and propane. These products meet the local demand and contribute to meeting the country's energy needs and support various sectors such as transport, industry and local consumption. The operations of the Cairo Oil Refining Company contribute to supporting the petroleum sector in Egypt and play a role in meeting the local demand for energy in the country.

While it is important to acknowledge that the Cairo Petroleum Refining Company (CORC) plays a critical role in meeting Egypt's energy needs, oil refineries, including CORC, can have negative impacts on environmental health. Some of the potential environmental impacts associated with oil refineries are [24-25]

Air Quality and Respiratory Health: Refineries emit Sulphur dioxide (SO2), nitrogen oxides (NOx), volatile organic compounds (VOCs), and particulate matter are examples of pollutants. into the air. Prolonged exposure to these pollutants can lead to respiratory problems, including asthma, bronchitis, and other respiratory illnesses. It can also exacerbate existing respiratory conditions in neighboring communities [24].

Chemical exposure: Oil refineries handle and process a range of hazardous chemicals, including petroleum products and by-products. Accidents, leaks, or improper handling of these chemicals can release them into the environment, posing risks to human health. Exposure to these chemicals can cause adverse effects, such as skin irritation, respiratory problems, organ damage, and even long-term health complications. [25-26].

Water pollution and drinking water quality: Refining processes generate wastewater that contains various pollutants, including heavy metals, hydrocarbons, and chemicals. If not properly treated and managed, these pollutants can enter water bodies, resulting in water pollution. This contamination can affect the quality of drinking water sources, posing health risks to neighboring communities [26].

Worker Health Hazards: Refinery workers may face occupational health risks due to proximity to potentially toxic materials, exposure to high noise levels, and the risk of accidents or chemical spills. Safety protocols, training and appropriate protective measures are critical to protecting the health and welfare of refinery workers [27]

Community health and environmental justice: Oil refineries are often located near communities, and negative environmental impacts can vulnerable populations, such as low-income communities and marginalized groups, are disproportionately affected. This raises concerns about environmental justice, as these communities may face greater exposure to pollutants and bear the brunt of the associated health risks [28].The current situation of the study area has numerous openings and rudiments, despite the presence of the most important problem caused by it. The following is the SWOT analysis of the most important points in the study area

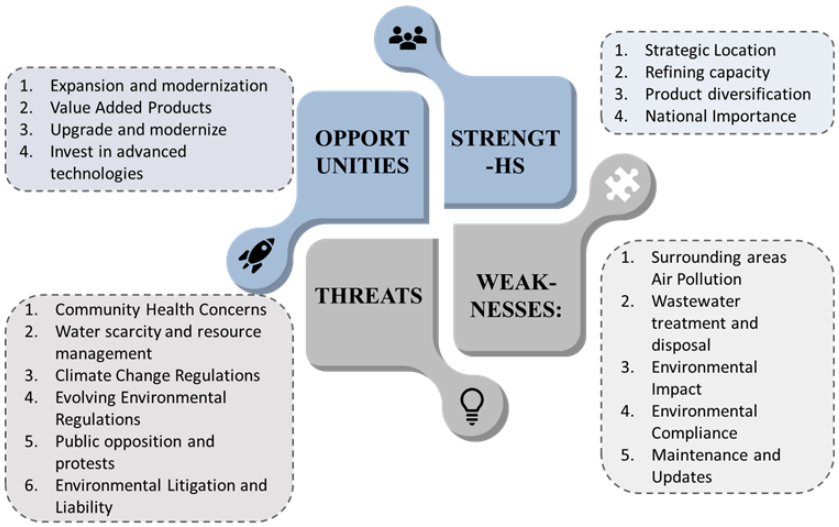


Figure 4: SWOT analysis for current situation, Source: Author

Strength point.

1. Strategic Location: The study area enjoys a strategic location in Mostord, and this provides proximity to transportation routes and major markets, which facilitates efficient distribution of petroleum products.
2. Refining capacity: CORC has a refining capacity of about 142 thousand barrels per day, which allows it to process a large amount of crude oil and convert it into various petroleum products to meet the local demand.
3. Product diversification: CORC's refinery has the ability to produce a variety of petroleum products, allowing the company to meet different market demands and maximize revenue streams
4. National Importance: As a subsidiary of the Egyptian General Petroleum Corporation, CORC plays a critical role in Egypt's energy sector, contributing to energy security in the country and decreasing reliance on imported petroleum products.

Weaknesses point

1. Surrounding areas: The area surrounding CORC is located in the Mostorod area, near the company's site, and the population density increases within a range of 2:5 km around CORC.
2. Air Pollution: CORC's refining processes have the potential to release air Sulphur dioxide, nitrogen oxides, and volatile organic compounds are examples of pollutants, these pollutants contribute to air pollution and pose risks to the surrounding environment and neighboring communities.
3. Wastewater treatment and disposal: The refinery's refining processes produce large amounts of wastewater that contain pollutants and chemicals. If not properly treated and managed, the discharge of untreated or improperly treated wastewater leads to surface water pollution. and groundwater and negatively affect environmental health.
4. Environmental Impact: The study area faces challenges related to the surroundings, such as air and water pollution, greenhouse gas emissions, and waste management, these issues can require significant investments in pollution control and environmental management.

Opportunities:

1. Expansion and modernization: CORC can explore opportunities to expand and modernize its refining capacity, and adopt more efficient technologies and processes to improve productivity and reduce environmental impact as compatible with the country's directions in expanding and increasing CORC's capacity.
2. Value Added Products: CORC can explore the production of value added petroleum products, such as petrochemicals or specialty chemicals, to diversify its product offering and capture additional market segments.
3. Upgrade and modernize: CORC can explore opportunities to upgrade its refineries with advanced technologies and processes, such as adopting cleaner and more efficient refining techniques. This can enhance operational efficiency, reduce environmental impact, and potentially improve competitiveness.
4. Invest in advanced technologies: CORC can explore investment opportunities in advanced technologies and equipment that improve refining efficiency, reduce emissions, and reduce environmental impacts.

Threats:

1. Community Health Concerns: CORC's proximity to the Mostorod area raises concerns about health risks to nearby residents. Increased awareness and scientific studies linking refinery emissions to adverse health effects could lead to legal action, community demands for stricter regulations, and potential liabilities for CORC.
2. Water scarcity and resource management: Refining operations require large amounts of water for cooling, processing and other operations. Egypt suffers from water scarcity and water availability can become a constraint and CORC may face challenges in managing and securing water resources sustainably.
3. Climate Change Regulations: Increasing global focus on mitigating climate change may lead to stricter regulations and policies aimed at reducing greenhouse gas emissions. CORC may face challenges complying with these regulations and transitioning to cleaner, lower-carbon technologies.
4. Evolving Environmental Regulations: Environmental regulations are subject to change and may become more stringent over time. CORC needs to stay abreast of evolving regulations and invest in measures to ensure compliance. Failure to meet new requirements can result in penalties, operational disruptions, or reputational damage.

METHODOLOGY

A. Determining the artificial areas to be estimated Determining the artificial areas to be estimated grounded on their environmental impact and the extent of pollution in these areas..
B. Select Environmental Criteria: Select the appropriate indicators for the region from the 37 environmental parameters grouped into four categories: air, water, land and waste related to petroleum refining activities in this region. The selection should be based on their relevance to the environmental impact of industrial activities and the availability of data.
C. Assign weights to parameters Assign weights to each parameter grounded on its relative significance in causing environmental pollution., Weights should be assigned grounded on expert opinions and available scientific substantiation.
D. Data collecting: gathering information on specific requirements for the industrial sectors under consideration. Data can be gathered from any number of different sources, such as governmental departments, business, and independent surveillance organizations.
E. Parameter logging: For each parameter, calculate the result by dividing the actual value by the standard value and multiplying by the weight assigned to that parameter. Standard values are derived from national or international standards and guidelines.
F. Calculate the CEPI Score: Add the weighted scores for all parameters to calculate the CEPI score for each industrial area being assessed.
G. CEPI Score Interpretation: Interpret your CEPI score to identify areas for improvement and to prioritize environmental management initiatives.

In the Comprehensive Environmental Pollution Index (CEPI) methodology, pathways and receptors are important considerations in the selection and weighting of environmental parameters pathways refer to the routes or mechanisms by which pollutants are released towards the surroundings and can endanger the well-being of people or the environment. For example, pollutants can be released into the air through industrial emissions, into water bodies through wastewater discharge, or into soil and groundwater through landfills or spills. [20]

The receptors are living or dead organisms that are exposed to and can be impacted by environmental toxins. Humans, animals, plants, and ecosystems can all be sensors.

The CEPI technique considers environmental contaminants' pathways and receptors by selecting environmental characteristics relevant to the specific industrial activities and their related pathways and receptors. For example, air quality measures may be given larger weights for industries that emit pollutants into the air, whereas water quality parameters may be given higher weights for industries that discharge wastewater into bodies of water. [29]

By considering the pathways and receptors of environmental adulterants, the CEPI methodology can give a further comprehensive assessment of The ecological consequences of artificial conditioning and can help to determine areas that need enhancement and to prioritize environmental operation enterprise.

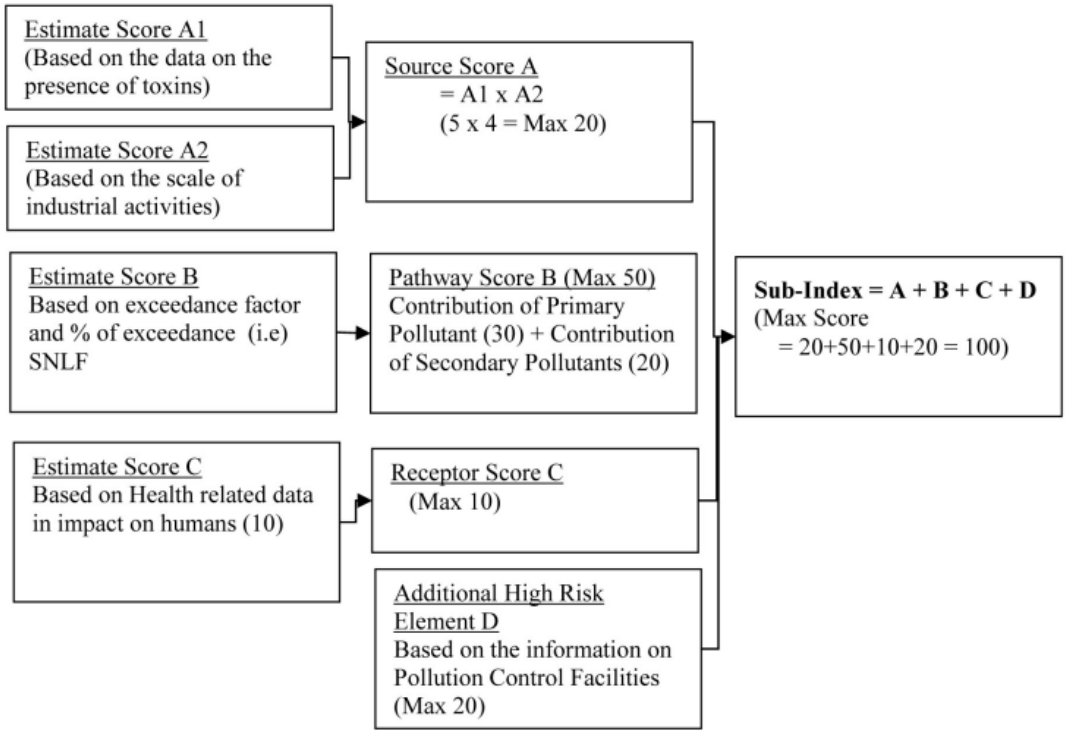


Figure 5: CEPI score calculation methodology, Source: [15]

The CEPI scoring can be calculated using the CEPI approach based on the evaluations of three components: score A, score B, and score C.

Score A is calculated grounded on the environmental parameters related to air, water, land, and waste, Estimated A1 refers to the estimated factual value of the parameter grounded on available data or expert opinions. This estimation is generally grounded on the available data from analogous artificial areas or on the anticipated trends in the environmental parameter grounded on the nature of the artificial exertion, estimated A2 refers to the estimated standard value of the parameter grounded on public or transnational norms and guidelines. This estimation is generally grounded on the being regulations and guidelines for the specific environmental parameter. [29]

Score B is calculated grounded on the propinquity of the artificial area to environmentally areas of concern, similar as public premises, wildlife reserves, and ecologically important territories.

Score C is calculated based on the population density in the surrounding areas of the industrial site, the scores for components B and C may be estimated, rather than directly measured, due to a lack of available data or other reasons. These estimated scores can be derived from available data on similar industrial areas or from expert opinions [29-30].

ASSESSMENT OF CEPI FOR MOSTORD

Factor (A1) Depending on concentration and exceedance, up to three of the most critical contaminants may be present. The principal pollutant's maximum contribution is three.

Group A: A.1 = (1)

Group B: A.1 = (2)

Group C: A.1 = (4)

The punishment for the specified a mixture of important chemicals is added to the highest possible amount A1 for them to arrive at the final value of A1. [29]

critical pollutants PM10 =132 µg/m3 (C), PM2.5 = 70 µg/m3 (C), NO2 = 65 µg/m3 (A).

so, maximum value of A.1 is for PM10 = (4) and from the table: this lies in 'any other combination' and, hence, the penalty = 0.0. Hence, (A1 = 4 + 0 = 4.0)

Factor (A2) the magnitude of industrial activity

Large = 5 (if there are > 10 (R17)* per ten km2 area or fraction OR > 2 R17 + 10 (R54) per ten km2 area or fraction OR > 100 (R54) per ten km2 area or fractions

*(R17) refers to (17) extremely polluting sectors in addition those classified as red by C.P.C.B (a list of industries can be found in Appendix).

*R54 are the Central Pollution Control Board's red category industries (a list of which can be found in Appendix).

Moderate = 2.5 (if there are 2 to 10 (R17) per 10 km2 area or fraction OR 10-100 (R54) ten km2 area or fraction

Limited = 1 (else there is any industry within ten km2 area or fraction) Because these two elements are multiplicative, the overall rating for this component appears as following. [29]

There are a number of other industries besides the oil refineries and hydrocracking plants and factories that follow R17 so, A2 = 2.5

SCORE A = A1 × A2 (A= 4 × 3 = 12)

Pathway factor calculation B:

(Factor .B1) That is determined using the exceedance factor (.F).

- Critical: B1. = 6 (F > .1.5)
- High: B1. = 3 (F = 1.0 to .1.5)
- Moderate: B1 = 2 (F = .0.5–1.0)
- Low: B1. = 1 (F < .0.5)

Critical pollutants PM10 = 132 μg/m3 (50), PM2.5 = 70 μg/m3 (50), NO2 = 65 μg/m3 (60), so F(PM10) = 2.64 hence it is critical (6).

F (PM2.5) = 1.4 so it is high (.3)

F (NO2) = 1.08 hence it is high (.3)

hence B1 = 6

(Factor B2) Collecting trustworthy proof of detrimental effects on people or fatalities caused by exposure. Media reporting, records from hospitals, general interest legislation (PIL), and non-governmental organizations (N.G.O.s) reporting, academic research reports, and literature that has been republished are all examples of reliable evidence.

No: B2 = 0

Manifestation of indicators: B2 =0. 3

Proof of a mortality: B2 =0. 6

A large proportion of the population, estimated at 12%, was damaged due to the presence of oil refineries, and some cases were doomed to death there is evidence of death according to the data of the Egyptian Ministry of Health, there are percentages of the population exposed to various diseases due to their proximity to the source, and therefore B2 = 6

(Factor B3) It is gathered trustworthy evidence of negative effects on ecological aspects. According to the state of the environment reports for 2019, there are high levels of arsenic concentration in the waters of the Ismailia Canal, and as shown on the map of the region's location, the Ismailia Canal borders the refinery, and the element of arsenic is one of the most important elements resulting from the waste products of refinery plants, and the element zinc It's one of among the most necessary Compounds that cause pollute to a high degree.

hence: B3 = 6

Now, using B, compute the route factor B= B1 + B2 + B3

SCORE B = .B1+ .B2 + .B3 = (6 +6+6 = 18)

Factor Receptor Calculation C

(Factor C.1) The count of individuals affected by air pollution within a 2-kilometer radius of The polluting source is expected to include workers in factories and their families as well. [29]

<1000 = 1

1000 to 10 000 = 1.5

10 000 to 100 000 = 3

> 100 000 = 5

The population of the city of Shubra al-Khaimah is estimated at about 3,881,399 people, most of whom are located within 2 km of the pollution source. Most of the population is exposed to emissions resulting from pollution as a result of the random distribution of factories and oil refineries, and a greater number of those in the Shubra al-Khaimah neighborhood are exposed to the cumulative effects of the resulting pollution. So factor C1 =5.0

Factor (C2) To compute C2, SNLF is computed where, SNLF = (number. of samples. exceeded the standards/total number of samples) × (mean excess component).

Low: C2 = 1 (SNLF = 0)
Moderate: C2 = 1.5 (SNLF < 0.5)
High: C2 = 2 (SNLF 0.5–1)
Critical: C2 = 3 (SNLF > 1)

The conclusive sum of C2 is computed by calculating the repercussions for each significant pollutant mixture and multiplying it by the highest amount C2 for each of them.

worthwhile polluters PM10 greater than for 36 out of 37 monitoring days, PM2.5 36 out of 37 days, NO2 36 out of 37 days.

Making use of the exceeding parameter (F) calculated in B1;

SNLF (PM10) = 2.64*36/37 = 2.6 => Critical (3)
SNLF (PM2.5) = 2.64*36/37 = 2.6 => Critical (3)
SNLF (NO2) = 2.64*36/37 = 2.6 => Critical (3)

So, the table for Factor C2 = 3

Factor (C.3) Additionally, vulnerable people/sensitive_historical/arch.aeological/religious/national parks/sanctuaries/ecological the environment are all likely to be within two kilometres of the origin.

No: C.3 = .0
Yes: C.3 = .5

Right now, applying the formula, compute receptors factor C. C = (C1 × C2) + C3

SCORE C = (C1 × C2) + C3 =(5 × 3)+0 = 15)

Calculating additional high-risk element factor D

- If all industries have functioned adequately and maintained pollution = 0.
- If the marine industries are viable for conservation. = 5.
- If all industries work appropriately and maintain pollution without insufficient capacity in maintenance = 10.
- If it is adequately designed, it has pollution control facilities but the industries in research are in default = 15.
- (Insufficient pollution prevention efforts for major, medium, and small industries, as well as the informal economy) [29] Maximum score = 20

Accordingly, the D = 20

Calculate the air pollution after calculating the sub-index A, B, C and D; Sub-indicator score is determined as follows: Score = (A + B + C + D)

SCORE = 12 + 18 + 15 + 20 = 65

The water quality and land contamination sub-index was calculated using the same mathematical process, and the results are as follows:

Table 1 calculated the sub-index Source: author

Pollution	A.1	A.2	A.	B.1	B.2	B.3	B.	C.1	C.2	C..	D	Sub.index
Air. pollution	4	3	12	6	6	6	18	5	3	15	20	65
water pollution	3.75	2.5	9.375	6	3	6	15	5	2	10	15	49.375
Land pollution	2.5	2.5	6.25	3	3	0	6	5	1.5	7.5	15	34.75

THE AGGREGATED C.E.P.I SCORE COULD BE OBTAINED BY:

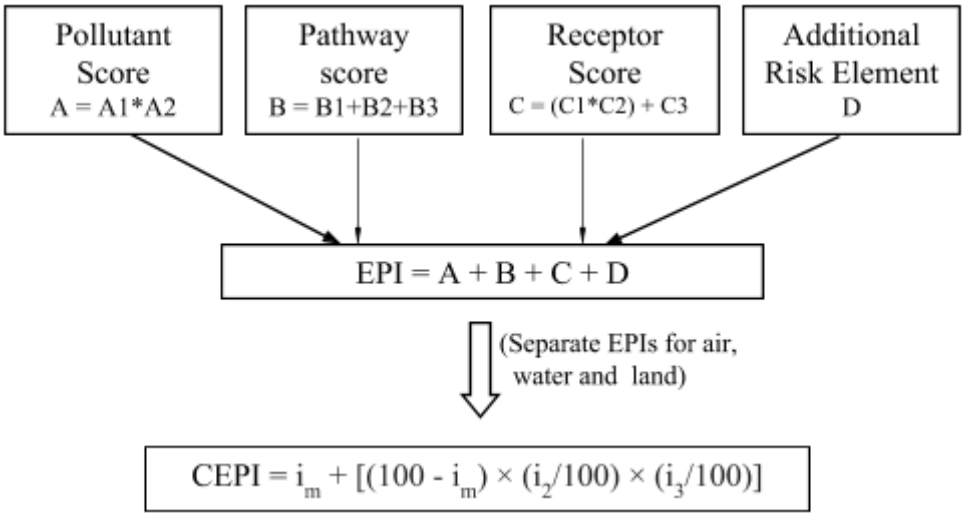


Figure 6. C.E.P.I Calculation chart, Source: [15]

C.E.P.I = i.m + {(100 – i.m) × (i.2/100) × (i.3/100)}
where, i.m - the maximum sub-index; And i.2 and i.3 are sub-indicators of other parameters

Table 2 calculated the CEPI index Source: author

Air pollution sub.index(i)	water pollution sub_in.dex(i2)	Land pollution sub_in.dex(i3)	Max sub.index score (i.max)	Score of C.E.P.I
65	49.375	34.75	65	71.00523

CEPI=65+ {(100 - 65) × (49.375/100) × (34.75/100)} = 71.00523

The total CEPI score +60 this is the Red Category considered highly polluting and are subject to strict pollution control measures and regulatory oversight

INFERRING THE FUTURE CONDITIONS OF THE CITY IN THE LIGHT OF PREVIOUS SIMILAR CASE STUDIES

Gujarat, one of India's most industrialized states, was represented by identical study experiences that effectively produced outcomes there. Petrochemicals, chemicals, textiles, cement, paints, pulp and paper, pharmaceuticals, and ceramics are Gujarat's primary industrial sectors, additionally, there are thermal power plants using coal that produce considerable pollutants and ash emissions. Additionally, urban development and demolition projects as well as old solid waste contribute to poor air quality. Additionally, Gujarat's urban areas have a relatively high average annual vehicle growth rate, which makes a substantial contribution to the state of the air. In addition, air pollution is also a result of mining operations, important ports, railroads, and infrastructure projects that create a lot of traffic on the roads , the Comprehensive Environmental Pollution Index (CEPI), a measurement tool, can be used to assess the level of air pollution in Gujarat., six of Gujarat's largest industrial sites have been deemed critical areas by the Ministry of Environment, Forests, and Climate Change, along with 12 other places that are moderately polluted and pose a threat to the local people [31]

The development of new industries and the expansion of current ones in certain regions have been put on hold. The National Clean Air Programme (NCAP), a time-bound strategy at the national level to comprehensively address air pollution, was finalized and launched (January 2019) by the Ministry, according to the most recent CEPI results submitted (July 2019) by the Central Pollution Control Board (CPCB) to the National Green Court (NGT). [32]

As a result of these measures taken and the national program that was followed in the aforementioned experiment, its results were achieved by reducing pollution rates in terms of all the elements that cause air, water and soil pollution until this was achieved in the last assessment (CEPI) This was done so that the 6 critical areas reached the orange category and the 12 areas Medium pollution reached the green category, and the number of patients with Asthma and bronchitis are examples of airborne diseases, cancer, and acute respiratory infections decreased from 9.6% to 4.3% of the total population of the experimental areas[31].

Predicting the future results of the CORC study area according to a similar study and following the proposed policies CEPI is expected to be as follows:

Table 3 An expected sub-indicator of future conditions Source: author

Air pollution sub.index(i)	water pollution sub_in.dex(i2)	Land pollution sub_in.dex(i3)	Max sub.index score (i.max)	Score of C.E.P.I
48.25	35.25	28.25	48.25	53.4033

Table 4 An expected CEPI index of future conditions Source: author

Pollution	A.1	A.2	A.	B.1	B.2	B.3	B.	C.1	C.2	C..	D	Sub.index
Air. pollution	2.5	2.5	6.25	4	4	4	12	5	3	15	15	48.25
water pollution	2.5	2.5	6.25	3	3	3	9	5	2	10	10	35.25
Land pollution	1.5	2.5	3.75	1	3	3	7	5	1.5	7.5	10	28.25

CEPI=48.25+ {(100 - 48.25) × (35.25/100) × (28.25/100)} = 53.4033

The total CEPI score is 53.4, and this is expected for the CEPI evaluation of the study area in the near future if the proposed policies are followed, where the orange category is considered medium pollution are moderately polluting and are subject to pollution control measures and oversight regulatory

III. CONCLUSION

The study area is considered one of the areas in the red category, whose total Comprehensive Environmental Pollution Index more than 60 degrees.

As a result, several policy measures and control scenarios are required to reduce the severity of these pollutants, improve the removal of pollutants from the air, and eliminate wastewater leakage on peripheral water sources through general mitigation and adaptation strategies that help decision-makers and relevant parties to reduce the impact. healthy environmental. on the surrounding population and achieve environmental management.

The CEPI evaluation must ensure a continuous inflow of new data and information to prove that the region is affected by environmental pollution caused by petroleum and refining assiduity after the evaluation process is completed. Evaluation should be a continuous and dynamic process.

Therefore, continuous assessment is required in parallel with the implementation of mitigation scenarios until a comprehensive assessment following the green category is reached

Among the most important recommendations that must be followed are the following: Monitoring pollutants that exceed the maximum allowable limit, accessing pollution sources and studying them in detail so that you can find a solution for each pollutant separately or together. It is permitted, and therefore a comprehensive evaluation of it will reach the green category for its emissions and mitigate its impact on human health and damage to the environment.

FUTURE FRAMEWORK FOR THE ENVIRONMENTAL DEVELOPMENT OF THE CITY AND INTERVENTION POLICIES TO IMPROVE THIS SITUATION:

Emission Standards and Monitoring: Enforce rigorous emission restrictions for air contaminants CORC emits, and monitor emissions. To make sure that these guidelines are being met, regular air quality monitoring should be done. To efficiently detect and manage emissions, put continuous emissions monitoring systems (CEMS Flue gas measurement systems for stationary sources in a wide range of regulated industrial facilities, including power plants, oil refineries, petrochemical plants, waste incinerators, the pulp and paper sector, and many more. [33][39].

Pollution Prevention and Control Measures: Requires implementation of the latest pollution control technologies, such as scrubbers, catalytic converters, and particulate filters, to reduce pollutant emissions from CORC. Commission routine maintenance and inspections of pollution control equipment to ensure its optimal performance. [34]

Environmental Impact Assessments (EIAs): Conduct comprehensive Environmental Impact Assessments (CEPI) for CORC to assess potential environmental impacts of its operations on a regular basis These assessments should assess risks of air, water and soil pollution and identify mitigation measures to address any negative impacts Ensure that EIAs are conducted by Qualified and independent experts. [32-34]

Wastewater treatment: Implementation of strict CORC wastewater regulations. Requiring the company to treat wastewater to remove pollutants before discharging it. Establish effluent standards for various pollutants and regularly monitor the quality of discharged wastewater to ensure compliance. [35]

Community Engagement and Transparency: Encourage open dialogue and participation between CORC and the neighborhood. Create channels via which the business can communicate data from environmental monitoring, pollution control, and operations. Encourage public involvement in CORC's environmental performance and in decision-making processes. [35-36-37]

Green Infrastructure and Land Use Planning: Promote the development of green infrastructure, such as parks and green spaces, tree planting initiatives in areas surrounding the pollution source and implement land use planning strategies that prioritize buffer zones and limit residential or sensitive land uses in close proximity to the refinery. [37-38]

Compliance and Enforcement: Strengthening regulatory agencies responsible for monitoring and enforcing environmental regulations. Ensure that appropriate penalties and sanctions are applied in case of non-compliance. Conduct regular inspections and audits to verify compliance with pollution control measures and impose penalties for non-compliance and for exceeding permissible limits for pollution [36-37]

RECOMMENDATIONS FOR FUTURE STUDIES:

The results of the evaluation showed that the highest percentage of the sub-indicator is air pollution, and the largest reason for this percentage is particulate air pollution (PM10), which was shown through the evaluation to be the most pollutant that exceeds the permissible limits, so there is a recommendation through this study to conduct a detailed study of this pollutant and trace its sources and Adopting policies that limit the high percentage of this pollutant and reach the safe limit, which in turn could lead to the comprehensive assessment reaching the orange category.

REFERENCES

[1] IQAIR (2013) Air quality in Cairo Retrieved from: https://www.iqair.com/egypt/cairo/cairo-c

[2] Elisa Conticelli and Simona Tondelli (2014) Eco-Industrial Parks and Sustainable Spatial Planning: A Possible Contradiction? Administrative sciences Series: ISSN 2076-3387

[3] Kustysheva (2017) Consideration of Environmental Factors in Planning and Development of Urban Areas IOP Conf. Series: Materials Science and Engineering Series: ISSN 262 012166

[4] Central Pollution Control Board (CPCB), India. (2011). Comprehensive Environmental Pollution Index (CEPI). Retrieved from: http://www.cpcb.nic.in/Comprehensive_Environmental_Pollution_Index.php

[5] United States Environmental Protection Agency (EPA) (2020) Introduction to Risk Assessment Retrieved from: https://www.epa.gov/risk/introduction-risk-assessment

[6] World Health Organization (WHO). (2021) Principles of Characterizing and Applying Human Exposure Models Retrieved from: http://www.who.int/ipcs/methods/harmonization/areas/human_exposure/en/

[7] International Organization for Standardization (ISO) (2022) ISO 14040:2006 Environmental management Life cycle assessment -- Principles and framework Retrieved from: https://www.iso.org/standard/37456.html

[8] United States Environmental Protection Agency (EPA). (2020) Life Cycle Assessment -- Retrieved from: https://www.iso.org/standard/37456.html

[9] United States Environmental Protection Agency (EPA) (2023) National Primary Drinking Water Regulations. Retrieved from: https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations

[10] United Nations Environment Program (UNEP (2018) Environmental Impact Assessment Training Resource Manual Retrieved from: https://wedocs.unep.org/bitstream/handle/20.500.11822/30796/UNEP_EIA_Training_Resource_Manual.pdf?sequence=1&isAllowed=y

[11] United States environmental protection Agency (EPA) (2023) Ecological Risk Assessment Retrieved from: https://www.epa.gov/risk/ecological-risk-assessment

[12] United States environmental protection Agency (EPA) (2023) How We Monitor Compliance Retrieved from: https://www.epa.gov/risk/ecological-risk-assessment

[13] P. Thunis, E. Georgieva, S. Galmarini (2011) A procedure for air quality models benchmarking Joint Research Centre, Ispra

[14] Kansal, A., & Sharma, A. (2017). Comprehensive Environmental Pollution Index (CEPI) and Human Development Index (HDI) for Sustainable Development in India. In Environmental Sustainability in Asia. Springer, Singapore., p pp. 1-16.

[15] United Nations Industrial Development Organization (UNIDO). (2002). Methodology for Comprehensive Environmental Pollution Index (CEPI) for Industries. Retrieved from: https://www.unido.org/sites/default/files/200910/[Methodology

[16] United Nations Industrial Development Organization (UNIDO). (2010) The Comprehensive Environmental Pollution Index (CEPI) for Industrial Clusters. Retrieved from: https://www.unido.org/sites/default/files/2010-03/CEPI_Brochure.pdf

[17] Singh, S. (2021) Classification of Industries Based on CEPI Score, Central Pollution Control Board (CPCB), India. Retrieved from: http://cpcb.nic.in/classification-of-industries-based-on-cepi-score/

[18] Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India. (2018) Notification on the Environmentally Sensitive Industrial Sectors and Red, Orange and Green Categories of Industries Retrieved from: http://moef.gov.in/wp-content/uploads/2018/03/Notification-dt-14.03.2018-regarding-ESI-sectors.pdf
[19] United States Environmental Protection Agency (EPA) (2023) National Primary Drinking Water Regulations. Retrieved from: https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations
[20] Harshavardhini Varagunan (2018) Comprehensive Environmental Pollution Index (CEPI), citizen consumer and civic action group Retrieved from: https://www.cag.org.in/blogs/comprehensive-environmental-pollution-index-cepi
[21] Doaa hegazy, Mohamed el-bastaweesy, Hassan garamoon, Ahmed melegy and Mohamed ali elsaid (December 2018) the impacts of human and agricultural activities on the groundwater quality in mostorod abu zabal area, east nile delta, egypt Al Azhar Bulletin of Science Series: Vol. 29, No. 2, pp. 59-71
[22] Egyptian Environmental Affairs Agency, within theMinistry of State for Environmental Affairs (2010), Egypt State of the Environment Report: 2009.
[23] Egyptian Refining Company (2011). "Project Overview. Website accessed on April 2, 2014. Available at: http://www.ercegypt.com/index.html
[24] Kevin Haynes (April, 2023) Hazards of Living Near an Oil Refinery Available at https://kherkhergarcia.com/hazards-living-near-oil-refinery/
[25] Zane Gustafson and Eric de Place (October 2021) DIRECT IMPACTS OF NORTHWEST REFINERY POLLUTION, Egypt sightline institute Available at https://www.sightline.org/2021/10/20/direct-impacts-of-northwest-refinery-pollution/
[26] Khatatbeh, M., Alzoubi, K., Khabour, O., & Al-Delaimy, W. (2020) Adverse Health Impacts of Living Near an Oil Refinery in Jordan Environmental health insights: Available at https://doi.org/10.1177/1178630220985794
[27] Javier Blas (2020) Adverse Health Impacts of Living Near an Oil Refinery in Jordan Environmental health insights: Available at https://doi.org/10.1177/1178630220985794
[28] DAPHNEY SAVIOTTI OROZCO(2021) Refinery Pollutants and their Effect on Public Health the public health advocate: Available at https://pha.berkeley.edu/2021/04/11/refinery-pollutants-and-their-effect-on-public-health/
[29] Central Pollution Control Board (2009) Criteria for Comprehensive Environmental Assessment of Industrial Clusters Ecological Impact Assessment Series: EIAS/4/2009–2010
[30] Lars Emmelin (2012) Effective Environmental Assessment Tools- critical reflections on concepts and practice Blekinge Institute of Technology Series: ISSN 1103-1581; 3
[31] Medha Sharma, Dr. Geeta Singh (Oct 2019) Critically Polluted Area Analysis using Comprehensive Environmental Pollution Index International Research Journal of Engineering and Technology (IRJET) Series: Vol. 06 Issue: 10

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[32] Government of Gujarat (2022) Report of the Comptroller and Auditor General of India on Performance Audit of Air Pollution Control, Indian audit and accounts department Series: Report No. 02 chapter 9
[33] Festus M. Adebiyi (2022) Air quality and management in petroleum refining industry: A review, Environmental Chemistry and Ecotoxicology Series: Vol 4, Pages 89-969 Available at https://www.sciencedirect.com/science/article/pii/S2590182622000030
[34] EPA (2023) Controlling Air Pollution from the Oil and Natural Gas Industry, UNITED STATE ENVIROMENTAL PROTECTION AGENCY ,Available at https://www.epa.gov/controlling-air-pollution-oil-and-natural-gas-industry/epa-issues-supplemental-proposal-reduce
[35] Ivan Radelyuk , Kamshat Tussupova , Jaromír Kleme, Kenneth M. Persson (2021) Oil refinery and water pollution in the context of sustainable development: Developing and developed countries, Journal of Cleaner Production Series: Vol 302, 126987Available at https://www.sciencedirect.com/science/article/pii/S0959652621012063
[36] Ruqayah Ali Grmasha , Csilla Stenger-Kovács , Baydaa Abdul Hussein Bedewy , Osamah J. Al-sareji , Raed A. Al-Juboori , Mónika Meiczinger , Khalid S. Hashim (2023) Ecological and human health risk assessment of polycyclic aromatic hydrocarbons (PAH) in Tigris river near the oil refineries in Iraq, Environmental Research Series: Vol 227, 115791Available at https://www.sciencedirect.com/science/article/pii/S0013935123005832
[37] Yuanyuan Cui, Lan Yang, Lei Shi, Guangxin Liu, Yutao Wang (2023) Cleaner production indicator system of petroleum refining industry: From life cycle perspective, Journal of Cleaner Production Series: Vol 355, 131392 Available at https://www.sciencedirect.com/science/article/abs/pii/S0959652622010162
[38] Mathiyazhagan Manickam, Bupesh Giridharan and Meenakshi Sundaram Kishore Kumar (2022) Biotechnological Strategies for Effective Remediation of Polluted Soils chapter Soil Pollution: Causes and Consequences , Water Science and Technology Library Series: Vol 104, Page 253Available at https://link.springer.com/chapter/10.1007/978-981-13-2420-8_1
[39] envea (2023) EMISSIONS CEMS (Continuous Emissions Monitoring Solutions),Available at https://www.envea.global/solutions/emissions-monitoring-solutions/