ARAB REPUBLIC OF EGYPT
MINISTRY OF STATE FOR ENVIRONMENTAL AFFAIRS
EGYPTIAN ENVIRONMENTAL AFFAIRS AGENCY

Assessment Report

Development of national action plans and assessment of the priority locations for BAT/BEP implementation

Prepared for the project:

Promotion of Strategies to Reduce Unintentional Production of Pops in the Red Sea and Gulf of Aden (PERSGA) Coastal Zone

UNIDO PERSGA Project Number: GH / RAB / 08 /

Regional Organization for the Conservation of Environment of the Red Sea and Gulf of Aden (PERSGA)

1 - TECHNOLOGY ASSESSMENT

1.1 Summary

1.1.1 General:

Persistent Organic Pollutants (POPs) consist of chemicals – pesticides (such as DDT), industrial chemicals (such as polychlorinated biphenyls [PCBs]), and unwanted by-products of industrial processes or combustion / waste incineration / open burning of wastes (such as polychlorinated dibenzo-dioxins and furans) – that are dangerously resistant to environmental degradation. With no or little alterations of their original composition, POPs are transported to oceans and coastal areas by air, water and soil, via direct industrial effluents, sewages and solid source releases, as well as irrational dumping and dredging of waste.

The Stockholm Convention (SC) deals mainly with 12 POPs, sometimes referred to as "the dirty dozen" (now 9 new substances are added to the convention), which are of major concern due to their toxicity, long term persistence and their ability to move to far off places by moving from one matrix to the other from their original places of production / use / disposal and accumulate in the fatty tissues of humans and animals.

What makes POPs so dangerous is that they are easily transportable and globally pervasive, and that they pose serious health risks to all living organisms.

POPs bio-accumulate in the fatty deposits of animals and plants and get passed on down the food-chain. They have been linked to alterations in the functioning of hormone systems in fish, wildlife and have been linked to a range of health concerns in humans as well, including cancer, immune-toxicity, thyroid and liver malfunction, nervous system damage, reproductive complications, hormonal disruptions, behavioral problems, allergies, birth defects, and developmental disorders. Fish, predatory birds, mammals and humans are high up in the food chain and absorb the greatest concentrations levels. These chemicals can interfere at three levels of biodiversity via:

- The generic level
- The population species level
- Community / ecosystem level

Due to the great concern in protecting the human health and environment from POPs, Egypt signed the Stockholm Convention on 17/5/2002 and ratified it on 2 / 5 / 2003, so Egypt has approved and issued its NIP on 31/8/2005.

One of the Countries' obligations to Stockholm Convention is actions to be taken in relation to compliance with Article 5 concerning chemicals of Annex C of the Convention. Reductions of releases of Dioxins and Furans have been identified as priority actions for the Red Sea and Gulf of Aden Coastal zone.

Coastal areas have always been a major focus of development of human civilizations. Many coastal cities and towns worldwide have cultures and ways of life that go back over many centuries. More than half of the world's population currently lives within 60 km of the shoreline – a statistic that could rise to three quarters by 2020. Moreover, 16 of the 20 mega cities of the world are located in coastal areas. Among the numerous threats caused by rapid population growth, development and industrialization in or near coastal areas, is the introduction of Persistent Organic Pollutants.

1.1.2 POPs in PERSGA Region:

The coastal zone of the Red Sea and Gulf of Aden has been witnessing a rapid economic and tourism growth in the last three decades. This is expected to continue in the future. Several

coastal investment projects are still in planning in Egypt, Jordan, Saudi Arabia, Sudan and Yemen, mainly in the petroleum, cement, fertilizers and petrochemical industries. This is not to mention the change in the style of life of the new generations by planning new modern cities at the coastal zone. Rapid industrialization will create high pollution rate and hotspots. As a result the use of raw materials, chemicals and energy will increase as well.

The proposed project (Promotion of Strategies to reduce unintentional production of POPs in the Red Sea and Gulf of Aden [PERSGA] coastal zone) will build on the existing cooperation and collaboration experiences of the participating countries (and their effort on sustainable coastal zone management) and the integration of the industrial sector with the Stockholm Convention (SC) requirements in the Red Sea coastal zone to reduce and/or eliminate unintentionally produced persistent organic pollutants (UP-POPs).

Four PERSGA countries (Egypt, Jordan, Sudan and Yemen) have become Parties of the SC and during regular consultation meetings of PERSGA, they have also agreed that close cooperation is needed to collectively implement the SC's measures concerning introduction of best available techniques (BAT) and best environmental practices (BEP) for the coastal zone industries.

The countries have further agreed that it could be possible that a larger impact on the environment and the coastal zone economy be attained if the cooperation is made at regional level rather than each country intervenes alone at the industries of its own coastal zone.

Consequently, PERSGA has approached UNIDO for assistance through developing and implementing a Medium-Sized Project (MSP) to enable the introduction of BAT and BEP to the industrial sector of the coastal zone.

PERSGA has approached UNIDO seeking assistance in developing a GEF MSP to develop an action plan and strategy for the elimination of the UP-POPs in the PERSGA region, in particular the reduction and elimination of the unintentional production of POPs as per Article 5 of the Stockholm Convention and to promote the use of BAT and BEP.

In this respect, Egypt has prepared the report of the stage (1) of this project to explain the current situation of unintentional releases of POPs in the Red Sea coastal areas within the borders of Egypt, specifically the governorates of the Red Sea, South Sinai and Suez.

Implementation of the project has given an overview of the Red Sea Coastal Zone, its present capacity and future requirements to comply with the SC including applying of the BEP/BAT in the different activities inside this region.

The main objective of BAT/BEP implementation would be to achieve meaningful release reductions of the Annex C POPs releases.

1.1.3 General Country Baseline:

The country over decades has gone through a major economic development while the population increased from 48 million in 1986 to 60 million in 1996 and in 2006 according to census final results of CAPMAS it becomes 76,699,427 million (inside and outside Egypt). While the total area is more than one million km2, only 35,000 km2 (%7.83) of the total area are habitable and most of it lies along both sides of Nile River.

Egypt over the years, has initiated a number of laws/decrees related to air emission control, banning highly toxic and persistent pesticides, introducing strict regulations for importing /producing/using/exporting toxic and hazardous chemicals. The country possesses good quality laboratories to carry out residue analysis for crops, food, contaminated land, and chemical residues in many environment /human/animal matrices. The country faced major obstacles when it came to the unintentional POPs; Public awareness on chemical safety, data collection/assessment and management/dissemination of data, carrying out regular monitoring of toxic chemicals and interpretation of their economic/social/health impact, understanding and introduction of Best Available Techniques and Best Environmental Practices (BAT/BEP) in relevant industry sectors and above all land remediation and right technology adoption for disposal of toxic/hazardous wastes. Under this context, the enabling activities of GEF project on POPs gave an excellent opportunity to assess the country's

capacity/capability and help in drawing out strategies/action plan for sound management of chemicals especially the industrial and unintentional POPs.

1.1.4 The Red Sea Coastal Zone Base Line

The Red Sea Coastal Zone is blessed with a variety of regional merits such as climate, coastal beaches that are famous for water and marine treasures, including coral reef and different kinds of fish and snails, as well as marine islands …etc.

Such merits directed developmental activities towards the touristic sector as a pioneer project of integrated development that could be invested in the marine environment that in turn could be a base for touristic attraction in the Red Sea Region. Hence, environmental Law number 4/1994 which was amended by Law number 9/2009 and its executive regulations was issued as a developmental means for regulating human interference, through investment, with the marine environment and protecting it as a national value in the economics of local, national investment in the Red Sea Coastal Zone.

In general, the Governors of this zone believe that the stability of the environmental law perceptions is an important factor for pushing touristic development forward. There are also other aspects of development in the Governorates related to minerals and fish in addition to valleys cultivation whether by underground water or by water flows. There is also the transportation sector that connects the governorates vertically or horizontally to other governorates and marine ports.

1.1.5 Inventory Results of Unintentional POPs and Priority Sectors for BAT/BEP Introduction:

These mainly refer to polychlorinated dibenzo-p-dioxins and dibenzofurans, capacity has been built through understanding of the UNEP toolkit (Standardized Toolkit for Identification and Quantification of Dioxin/Furan Releases) and its limitations, also through field visits. By virtue of ratification of SC, the law 4/94 which was amended by Law number 9/2009 automatically covers release of unintentional POPs. The survey studies revealed that the current situation of unintentional POPs in Red Sea Coast is not compatible with the obligations of Annex C of the Stockholm Convention.

The survey covered all categories, and total default emissions in the Egyptian Red Sea coastal zone are shown in the figure below [the high emission was to air (595.4485 gTEQ/a which represents 62.249 % of total emission), followed by the emission to land (350.6 gTEQ/a which represents 36.772 % of total emission) and after them the emission to residue (8.8317 gTEQ/a which represents 0.926 % of total emission) then the emission to water (0.512 gTEQ/a which represents 0.052 % of total emission)].

The high emission to air was from landfill fires which represent 98.108 % of total emission to air; also the high emission to land was from landfill fires which represent 99.966 % of total emission to land.

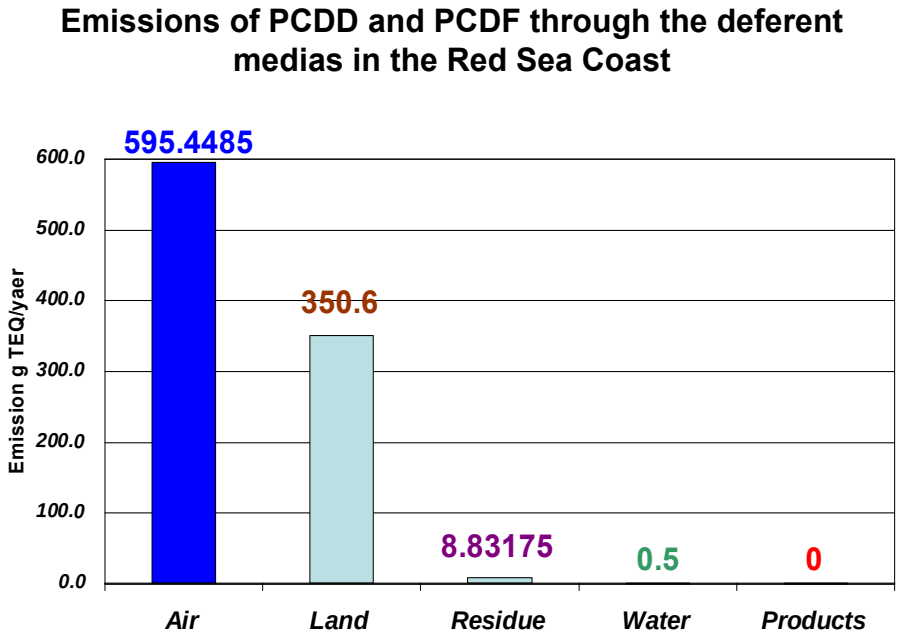


Chart (1) Emission of PCDD and PCDF through deferent Medias in the Egyptian Red Sea Coastal Zone.

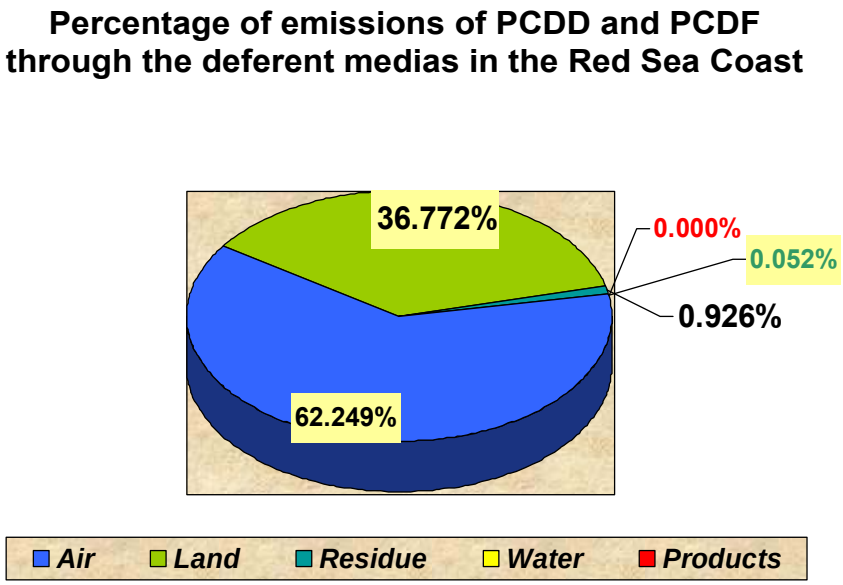


Chart (2) Percentage of Emission of PCDD and PCDF through deferent Medias in the Egyptian Red Sea Coastal Zone.

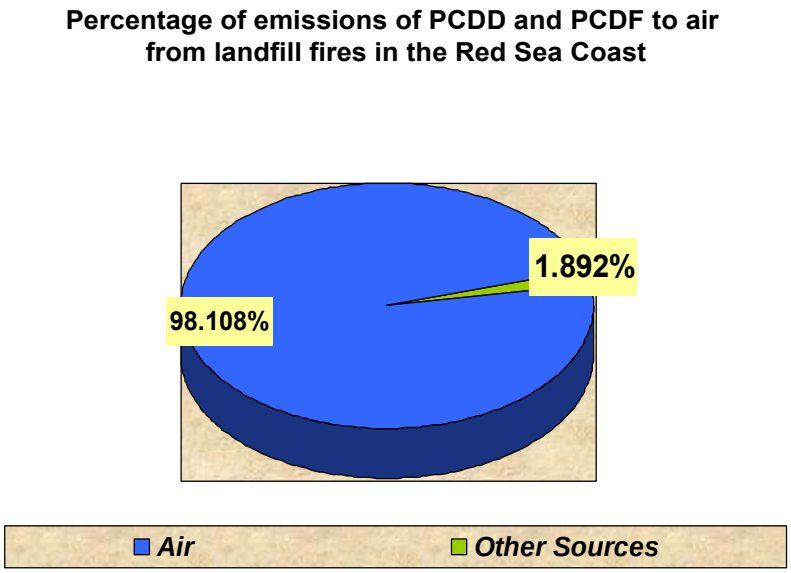


Chart (3) Percentage of Emissions of PCDD and PCDF to Air from Landfill Fires in the Egyptian Red Sea Coastal Zone.

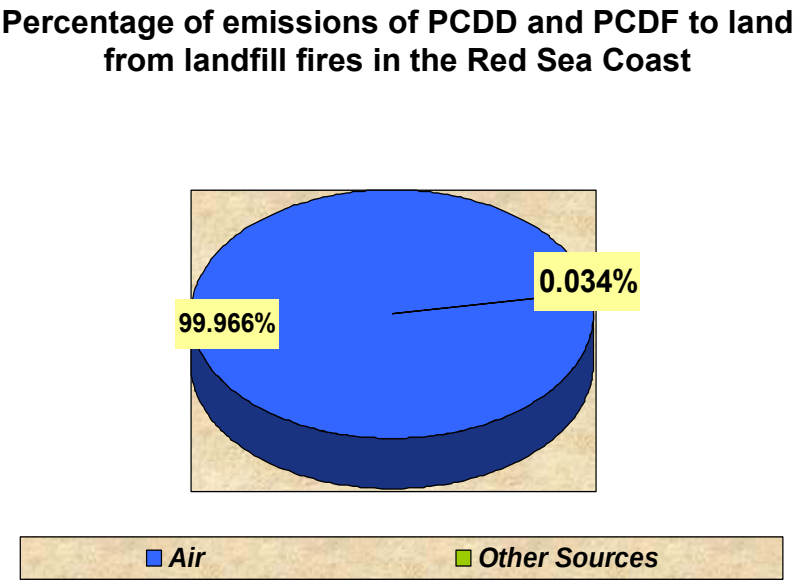


Chart (4) Percentage of Emissions of PCDD and PCDF to Land from Landfill Fires in the Egyptian Red Sea Coastal Zone.

The criteria for selecting the priority locations for BAT/BEP implementation take account of health, environmental and socio-economic impact, also child and women.

The main objective of BAT/BEP implementation would be to achieve meaningful release reductions of the Annex C POPs releases. According to the criteria for selecting the priority

locations for BAT/BEP implementation, Egypt has selected one specific source (petroleum refineries at Suez Oil Processing Company – Suez Governorate {SOPC}, and the 3rd Project Management Committee has selected a common source for the whole region(landfills) {Hurghada landfill – Red Sea Governorate- Egypt}.

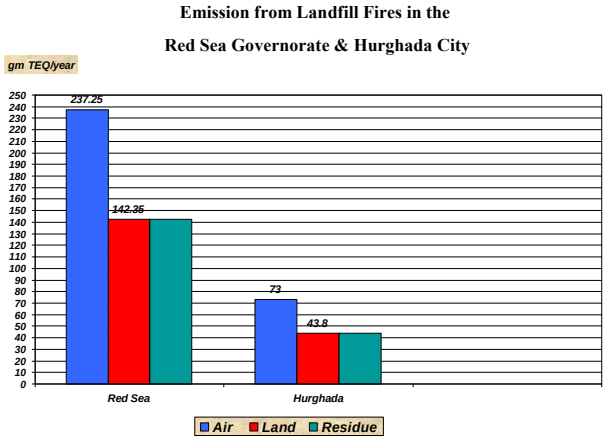


Chart (5) Emissions of PCDD and PCDF from Landfill Fires in the Red Sea Governorate and Hurghada.

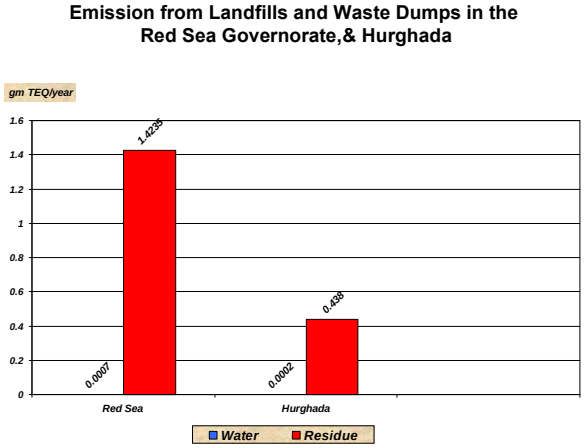


Chart (6) Emissions of PCDD and PCDF from Landfill Fires and Waste Dumps in the Red Sea Governorate and Hurghada.

Emission from Petroleum Industry in Suez Governorate and SOPC

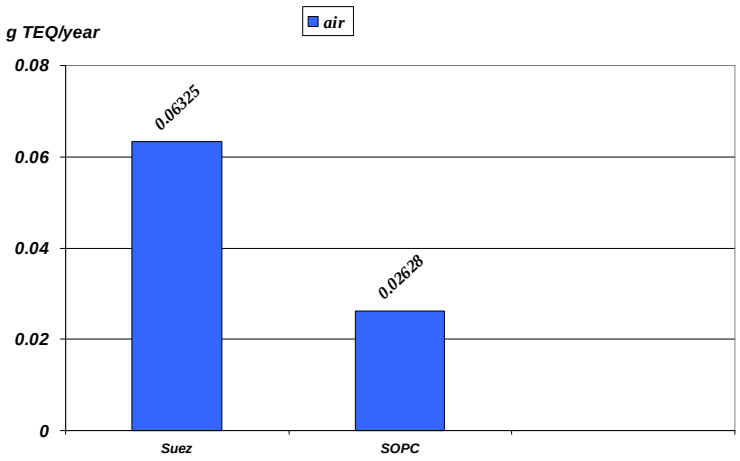


Chart (7) Emissions of PCDD and PCDF from Petroleum Industry in Suez Governorate and SOPC.

1.1.6 Suez Oil Processing Company – Suez Governorate {SOPC}

Suez Oil Processing Company (SOPC) is the first national oil refining company in Egypt since 1921. It is located on the coast of Gulf of Suez just downstream the international water way, Suez Canal.

It is a wholly owned subsidiary of the Egyptian General Petroleum Corporation (EGPC) and has been operating a refinery that repeatedly upgraded in order to cope with overgrowing local market demand for oil products.

Off gases produced from the different processing units are directed to the fuel gas network to be utilized as fuel gas for process fired heaters requirements and the excess is routed to the existing two separate flares headers (dist. & lube oil flare and Coker & reformer flare).

The points of the technology where Annex C POPs might be generated and released are from the two flares.

The waste management principles are intended to assist SOPC in preparing specific policies and procedures to manage effectively the wastes generated by their own activities or by contractors acting on their behalf. Local, legal and environmental requirements, available treatment and disposal options, and the specific waste streams involved all need to be taken into account.

SOPC in cooperation with this regional project is planning to purchase a complete gas recovery system to minimize the flared gas routed to the flare headers and utilize it as a fuel gas for process fired heaters that simultaneously resulted in reduction of COX, NOX and UP-POPs emissions and extend flare tips lifetime.

Flare gas recovery can result in near 100 percent reduction of normal flaring, limiting flare operation to emergency releases and scheduled maintenance. Captured flare gas can then be reused as valuable fuel or feedstock. Near-zero flaring reduces costly emissions, giving you environmental control with an immediate return on investment.

In addition to the above, the project activity also results in significant reduction of plant emissions. The project is expected to reduce 120,000 tons/year CO2.

1.1.7 Hurghada Landfill – Red Sea Governorate

Hurghada landfill is located in the desert away from Hurghada by about 17 kms towards the south of the city as shown in the figure, it is away from the nearest residential area by 7 kms..

The owner of the landfill is Hyrghada City Council- Red Sea Governorate.
The size of landfill is about 250,000 m2 (500 meter length x 500 meters width).

Hebca Company is the contractor with Hyrghada City Council, for transportation of wastes to the landfill, and there is a factory for recycling of organic wastes but it is not working due to the large consumption of energy.

The landfill includes 4 municipal cells; the cell is suitable to receive 120,000 tons of solid wastes per year. The total capacity of the landfill = 4x120, 000 = 480,000 ton/year.

The landfill has designed to include the following four steps:

1- Collection of domestic and agriculture wastes,
2- Separation of the different waste according to its type; the recyclable wastes are sent to recycle plants and the dangerous wastes are segregated and sent to other suitable places.
3- The inert solid waste is compacted through loaders into a thin layer, and
4- This thin layer is covered over with sand at the end of the day. This prevents much of the nuisances and hazards associated with rubbish dumps like litter, odours and vermin.

Nowadays, it receives 400 tons/year solid wastes and 80 to 100 tons/year agricultural wastes divided into 30% organic compounds, 10% plastic containers, 10% glass, 25% paper, 15% Tin and aluminum cans and 10% other components.

Dioxins and furans (PCDD/Fs) are formed during incomplete combustion of organic materials into the four municipal cells which the landfill includes where chlorine is available in the feedstock or in the air supply during the combustion process

There is a lack in the needed criteria for the landfill understudy to fulfill the criteria of sanitary landfills; also the landfill has no pollution control system.

A sanitary landfill must be carefully designed structure built into or on top of the ground in which waste is isolated from the surrounding environment (groundwater, air, soil). The modern landfill offers much more protection for the environment and for local people than traditional dumps did. Problems with odors, litter, vermin, etc., are greatly reduced by the careful management of the site. Most landfills are made up of:

- Bottom liner system.
- Cells (old and new) - where the waste is stored within the landfill
- Storm water drainage system.
- Leachate collection system - the leachate should be treated and disposed of in a safe way.
- Gas collection system -where possible, these gases are used for the production of electricity.
- Covering or cap .

Only 22 kilometers of the Hurghada international airport, El Gouna perfectly situated along the exquisite red sea coastline.

Recycling unit consists of three factories and one small bio gas unit beside two stores and galleries.
About 50 tons of garbage enters daily with 20 different kinds of solid wastes.

The procedure for manual separation consists of:

- The types which re- sell
- The types which recycle
- The types which are reused

1.2 Background

1.2.1 Introduction

Persistent organic pollutants (POPs) are organic compounds of anthropogenic origin that resist photolytic, biological or chemical degradation, leading to their bioaccumulation in the food chain. They can be also transported over long distances in the atmosphere, resulting in widespread distribution across the earth including regions where they have never been used. Owing to their toxic characteristics, they can pose a threat to humans and the environment. In recent years, therefore, the international community has called for urgent global action to reduce and eliminate the release of POPs and to identify their possible risk to human health and the environment.

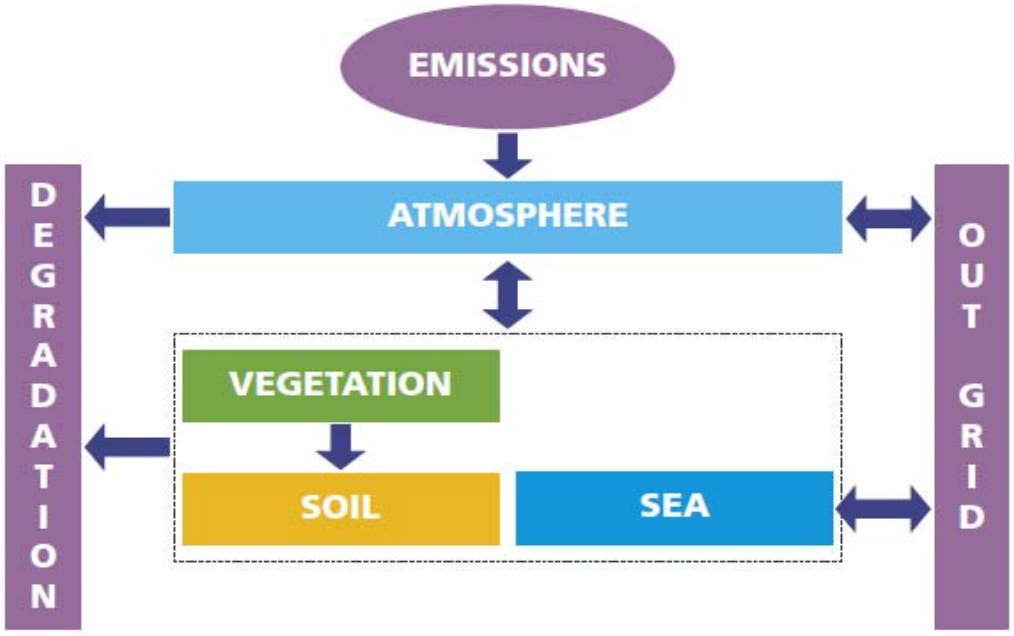


Figure (1): A simplified scheme of the POPs distribution

The PERSGA contain some of the world's most important coastal and marine environment and resources. The high rate of population and economic growth in the coastal areas in the region has resulted in an increasing pressure on the environment. There is a growing risk of marine pollution and environmental degradation due to several human economic activities where one of them is the industrial pollution.

By becoming Party to the Stockholm Convention, the countries have demonstrated that the reduction or elimination of POPs is a respective national priority and that they are committed

to take appropriate actions. Due to the transboundary movement of POPs and the special nature of the coastal zone, it is of importance to take preventive measures to reduce the negative impact of industrial activities, human settlements and particularly in areas of uniqueness to the ecological integrity of the coastal zone. These preventive measures can be more effective if undertaken in a coordinated manner at the regional level and coupled with the regular collection and interpretation of high quality scientific data to provide corrective feedback and enable effective decisions. The participating countries have therefore decided to integrate their collective efforts under the regional umbrella of PERSGA and take united actions in reducing UP-POPs releases from the industrial sources.

Promotion of strategies to reduce unintentional production of POPs (specially Dioxins and Furans) have been identified as a respective national priority for the Red Sea and Gulf of Aden Coastal Zone Countries of PERSGA, and that they are committed to take appropriate actions towards the reduction of the releases of unintentionally produced persistent organic pollutants (UP-POPs).

According to the inventory results of Dioxin/Furan emissions the high emission to air was from landfill fires which represent 98.108 % of total emission to air; also the high emission to land was from landfill fires which represent 99.966 % of total emission to land.

In this respect, Egypt has prepared the report of the stage (1) of this project to explain the current situation of unintentional releases of POPs in the Red Sea coastal areas within the borders of Egypt, specifically the governorates of the Red Sea, South Sinai and Suez.

1.2.2 Project Objectives:

The objective of the proposed project is to reduce and/or eliminate the unintentional production of POPs (UP-POPs) in the key sectors of industry (cement, incineration, metallurgy, pulp and paper) recognized as important source categories in Annex C of Article 5 of the Stockholm Convention through the introduction of BAT/BEP strategies in the industrial sector of the coast in the PERSGA eligible member countries. By achieving this goal, the project will permit PERSGA member countries attain compliance with their obligations under the Stockholm Convention on POPs, particularly those related to the industrial sector releases of UP-POPs. The project will further contribute to the improvement of human health and environmental conditions in the coastal zone as the project is linked to national sustainable development plans of the participating countries.

Based on the Annex C POPs inventories developed specifically for the coastal zones of the participating countries priority locations for BAT/BEP implementation have been identified.

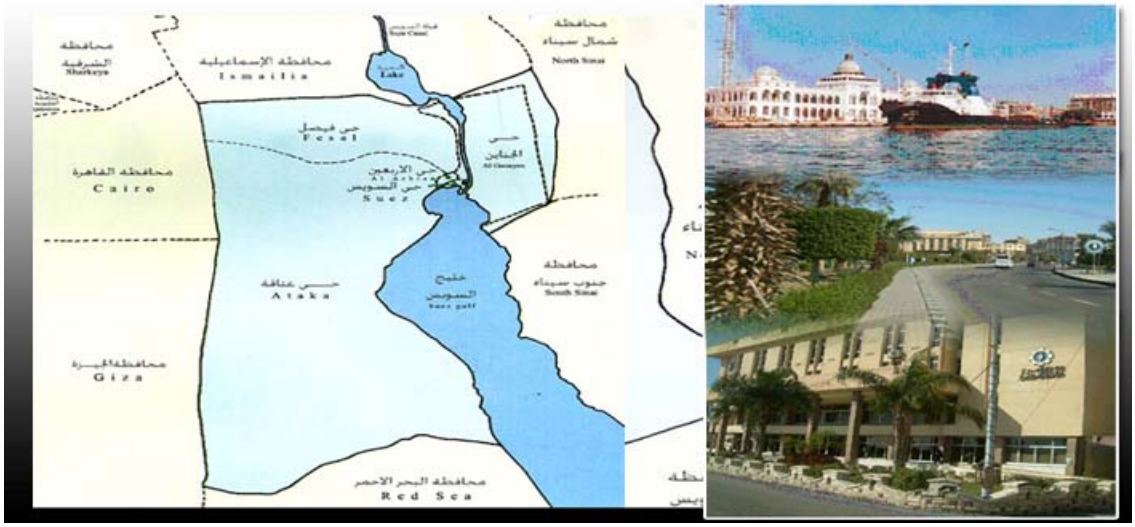
According to the inventory results we suggest the priority sectors for BAT/BEP introduction in the Red Sea Coastal Zone in Egypt to be as following:

- Uncontrolled burning processes (public dumpsites) in the Red Sea Governorates, they need at least 3 secured sanitary landfills, and 3 centers for waste recycling and establishing fertilizer plants with budget of about 15 million dollars for each (for the 1st stage short term action plan.
- Medical waste incineration in Suez Governorate, (they need two units working as central system including the collection, transportation, storage, treatment, and safe disposal from the residues with budget of about 10.0 million dollars).
- Power generation in Suez Governorate (2 stations).
- Ferro Manganese company in South Sinai Governorate (public sector)
- Petroleum refineries in the three governorates.
- Production of mineral products (like cement production).
- Sewage and sewage treatment.

The main objective of BAT/BEP implementation would be to achieve meaningful release reductions of the Annex C POPs releases. Egypt has selected one specific source (petroleum refineries at Suez Oil Processing Company – Suez Governorate {SOPC}, and the 3rd Project Management Committee has selected a common source for the whole region(landfills) {Hurghada landfill – Red Sea Governorate- Egypt}.

1.3 General information on the location:

1.3.1 Suez Oil Processing Company – Suez Governorate {SOPC}



Map (1): Suez Governorate

Suez Oil Processing Company (SOPC) is the first national oil refining company in Egypt since 1921. SOPC is uniquely located in an area with specific geographical criteria; It is located in Suez, Egypt, on the on the coast of Gulf of Suez just downstream the international water way, at the entrance of Suez Canal. It is also situated 4-km from Suez city-center

It is a wholly owned subsidiary of the Egyptian General Petroleum Corporation (EGPC) and has been operating a refinery that repeatedly upgraded in order to cope with overgrowing local market demand for oil products.

This region includes a coastal area on the red sea with a nearby harbor called Zaitia. It also includes both residential area of the Suez city and industrial area for petroleum refining; the local environment is also influenced by the presence of some roads.

SOPC refining capacity is 3 MM ton/year of crude oils to produce the main petroleum products required for the local market demand.

SOPC is the first company in the Egyptian oil sector that has the sole resid. upgrading complex (Coker complex) and is also the first to have a lube oil complex as well as a naphtha Platforming complex. The refinery processes various kinds of crude oils to produce the following finished oil products:

Fuel gas / propane / butane / gasoline / jet fuel / kerosene / gas oil / fuel / fuel oil / asphalt / lube oils / wax / coke / sulfur and other specialty products.

As an affiliate of the Egyptian General Petroleum Corporation , our company has been playing and integrating a complementary role with the rest of the national oil refining sister companies of the oil sector.

Always (SOPC) is focusing on the production with continuous short and long term plant maintenance and replacement activities as well as on loss prevention while being environmentally friendly.

Figure (2): Picture for Suez Oil Processing Company

Contact details of the plant:
Addressee: Suez Governorate- Elzaytiyat- Salah Neseam Street .
Telephone: 2062 3360362, 21, 20.

The total number of workers = 4349 which can be divided according to the level of education as following:

- Higher education : 842 employees represent 19.36%.
- Over medium education : 289 employees represent 6.65%.
- Medium education : 2645 employees represent 60.82%.
- Less than medium education (preparatory) :293 employees represent 6.74%.
- Read and write only : 280 employees represent 60.82%.

Figure (3): Suez Oil Processing Company (over view)

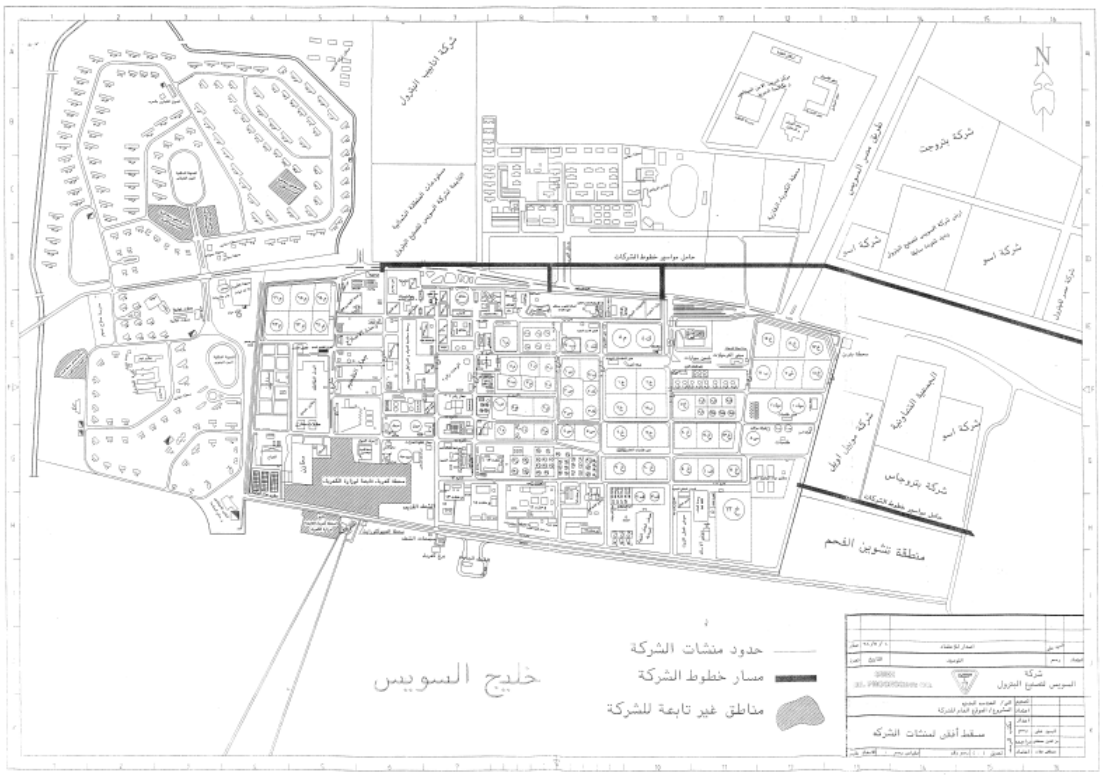
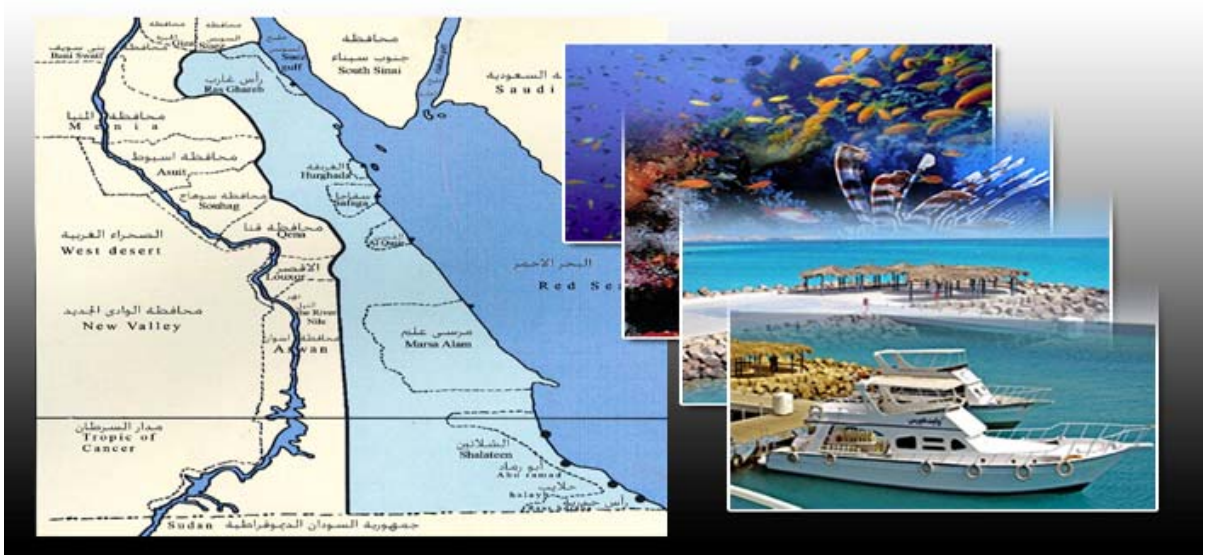


Figure (4): Suez Oil Processing Company (projection)

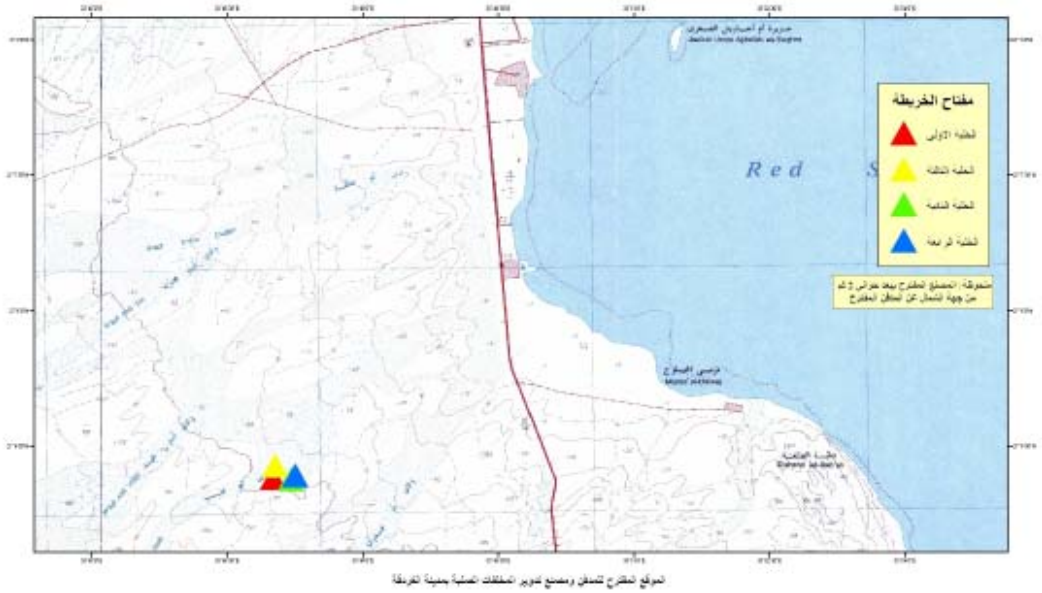
Figure (5): Satellite Image for Suez Oil Processing Company

1.3.2 Hurghada Landfill – Red Sea Governorate



Map (2): Red Sea Governorate

Map (3): Red Sea Governorate



Map (4): Red Sea Governorate (Position of Hurghada Landfill Cells).

The total population of Hurghada is estimated to be 95,000 (Census2006).

Hurghada landfill is located in the desert away from Hurghada by about 17 kms towards the south of the city as shown in the figure, it is away from the nearest residential area by 7 kms..

The owner of the landfill is Hyrghada City Council- Red Sea Governorate.
The size of landfill is about 250,000 m2 (500 meter length x 500 meters width).
No. of employees in the landfill = 136 (125 worker, 5 security persons, 5 supervisors and 1 responsible person from the contractor).

The landfill includes 4 municipal cells; the cell is suitable to receive 120,000 tons of solid wastes per year. The total capacity of the landfill = 4x120, 000 = 480,000 ton/year.

Hebca Company is the contractor with Hyrghada City Council, for transportation of wastes to the landfill, and there is a compost factory for recycling of organic wastes but it is not working due to the large consumption of energy

1.4 Description of applied technology:

1.4.1 Suez Oil Processing Company – Suez Governorate {SOPC}

SOPC refining capacity is 3 MM ton/year of crude oils to produce the main petroleum products required for the local market demand through the following processing plants:

- Atm. & Vac. Distillation Units:

  Design capacity: 3,000,000 T/Y (65000 BBL/D), first unit was constructed in1964.

  - Atmospheric unit:

Raw materials: Mixed or Land Balayim crude for atmospheric unit 1 and Shukeir blend, Marine Balayim crude or others for atmospheric unit 2.

.

Products and side products: Gases, L. naphtha, H. naphtha, Kerosene, Gas Oil and Fuel Oil for atmospheric unit 1 and Gases, naphtha, kerosene, jet fuel, gas Oil and fuel Oil for atmospheric unit 2.

- Vacuum unit:

Raw materials: Atmospheric residue of Marine Balayim crude.
Products and side products: Vacuum gas oil, light wax distillate, mid. wax distillate, heavy wax distillate and vacuum residue.

- Catalytic Reforming Complex:

Design capacity: 656,000 T/Y (19100 BBL/D), constructed in 1983.

- Hydrogenating unit :

Raw materials: Straight run naphtha.
Products and side products: Heavy hydrotreated S.R.N. LPG and light naphtha.

- Catalytic reforming unit :

Raw materials: Heavy hydrotreated S.R.N.
Products and side products: L.P.G., high octane gasoline and H2 rich gas.

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- Vapor recovery unit :

Raw materials: L.P.G. & light naphtha from naphtha hydrotreating unit and L.P.G. from platforming unit.
Products and side products: Gases, Propane, butane and light naphtha.

- Coker Complex:

Design capacity: 1,500,000 T/Y (33100 BBL/D), constructed in 1965.

- Skimmed crude two stage distillation unit:

Raw materials: (ATM. Long Residue) fuel oil.
Products and side products: Coker gas, coker gasoline, coker distillate and minimized coke production

.

- Delayed coking unit:

Raw materials: Short residue from A.V.D. unit (U-10) and Asphalt from lube oil complex.
. Products and side products: Straight run distillate (S.R.D) feed to HDS.
Short residue feed to Coker unit).

- Coker distillate unifining unit:

Raw materials: Coker distillate from Coker unit (high sulfur).
Products and side products: Gases, naphtha, kerosene, gas oil, diesel oil (low sulfur).

- Sulfur recovery unit:

Raw materials: Acid gases.
Products and side products: Sulfur (purity 99.9% wt min.)

- Hydrogen Plant:

Raw materials: Natural gas or light naphtha.
Products and side products: Hydrogen (purity 99.99 % vol. min.).

- Lube Oil Complex:

Design capacity: 69,000 T/Y (1645 BBL/D), was constructed in 1966

- Deasphalting unit:

Raw materials: Short residue from vacuum unit.
Products and side products: De-asphalted oil to be fed to the Phenol extraction unit
Asphalt to the market.

- Phenol extraction unit:

Raw materials: Distillates from vacuum unit.
De-asphalted oil
Products and side products: Raffinate to Dewaxing unit & extract.

- Dewaxing unit:

Raw materials: Raffinate from phenol extraction unit.
Products and side products: Dewaxed oil to be fed to the hydro finishing unit.
Slack was to be fed to deoiling section

- Hydro finishing unit:

Raw materials: Dewaxed oil produced from the Dewaxing unit
Products and side products: Treated base Oils.

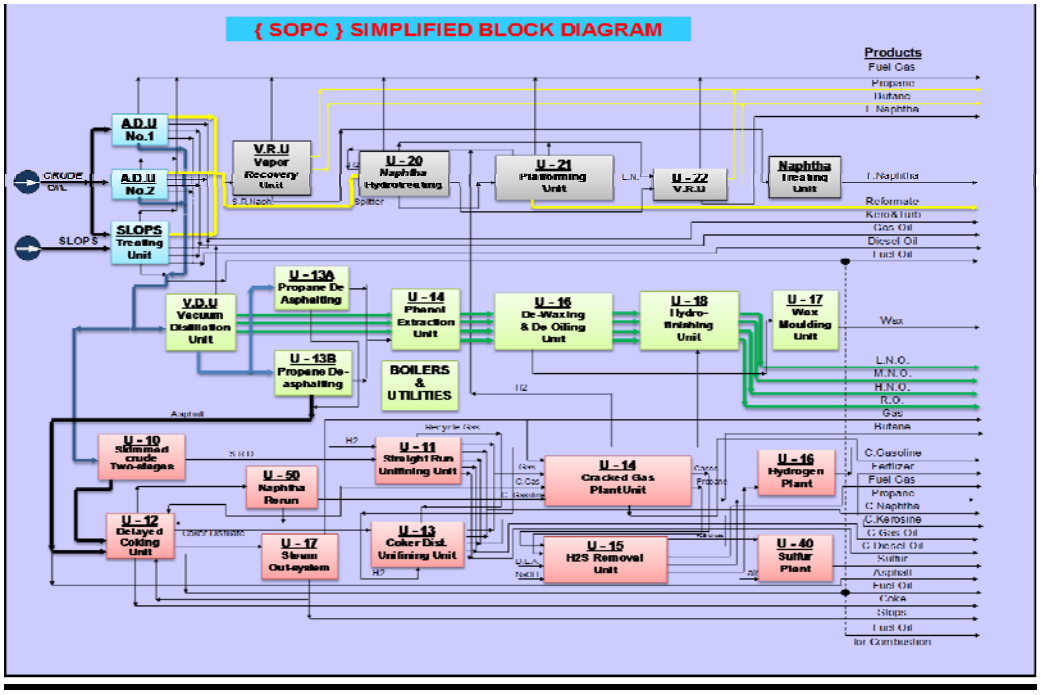

Figure (6): Suez Oil Processing Company (Simplified Block Diagram).

1.4.2 Hurghada landfill – Red Sea Governorate

The studied landfill was designed to receive solid waste in form of agricultural, commercial and residential wastes generated in municipal or notified areas in either solid or semi-solid with excluding the industrial hazardous wastes. The present landfill has designed to include the following four steps:

5- Collection of domestic and agriculture wastes,
6- Separation of the different waste according to its type; the recyclable wastes are sent to recycle plants and the dangerous wastes are segregated and sent to other suitable places.
7- The inert solid waste is compacted through loaders into a thin layer, and
8- This thin layer is covered over with sand at the end of the day. This prevents much of the nuisances and hazards associated with rubbish dumps like litter, odours and vermin.

Nowadays, it receives 400 tons/year solid waste and 80 to 100 tons/year agricultural wastes divided into the following table:

Type	%
Organic compounds	30
Plastic containers	10
Glass	10
Papers	25
Tin and aluminum cans	15
Others	10

Table (1): Types of wastes in Hurghada landfill

1.5 Detailed technology description:

1.5.1 Suez Oil Processing Company – Suez Governorate {SOPC}

SOPC refining capacity is 3 MM ton/year of crude oils to produce the main petroleum products required for the local market demand through the following processing plants:

- Atm. & Vac. Distillation Units:

  - Atmospheric unit No.1:

    Description: Feed is preheated, desalted and flashed in the preflash tower (C-1).The topped crude is heated in (F-1) to a temperature of 260oC. Heater effluent is fractionated in (C-2), and then the products are pumped to storage.

  - Atmospheric unit No.2:

    Description: Feed is pumped to a desalter through heat exchangers, flashed in flash drum. The topped crude is heated and fed to the main tower (2 C-1) to separate the products which are cooled and pumped to storage.

  - Vacuum distillation unit:

    Description: Feed is pumped and exchanged with hot products then heated through (F-2) and separated into products in the vacuum tower (C-4). Products are stripped and cooled then pumped to the lube oil complex.

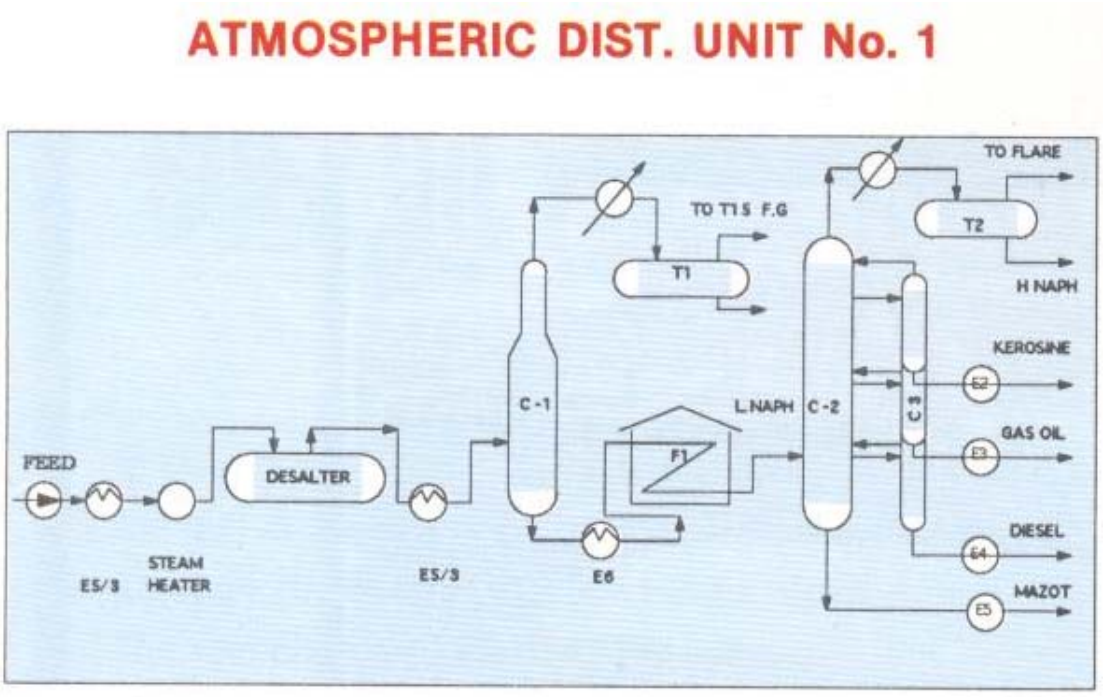

Figure (7): Atmospheric Distillation Unit No.1

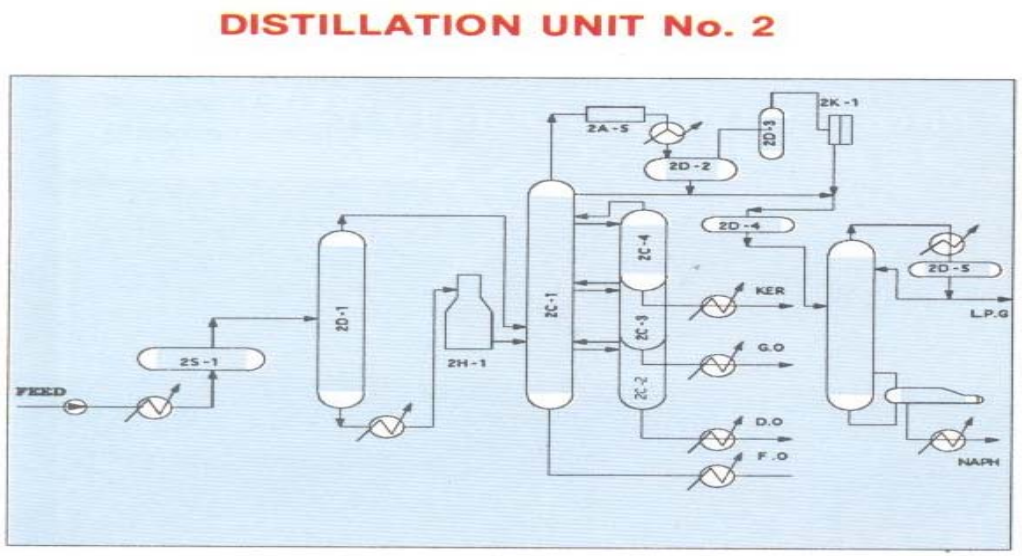

Figure (8): Distillation Unit No.2

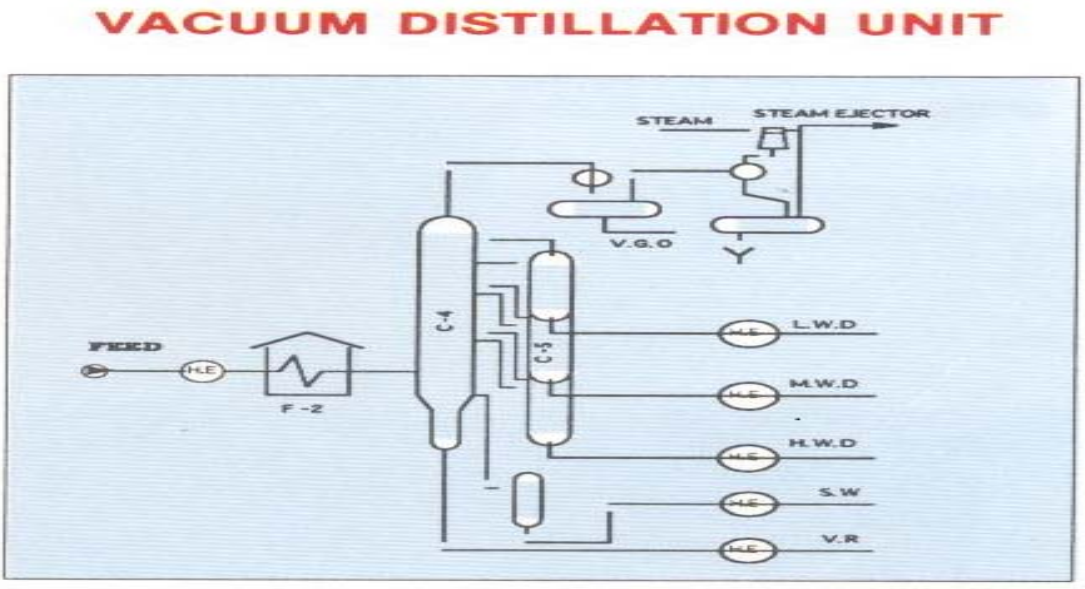

Figure (9): Vacuum Distillation Unit.

- Catalytic Reforming Complex:

  - Hydrogenating unit :

    Description: The main target of this unit is to remove all contaminants to produce suitable feed stock for the catalytic reforming unit. The combined H2 rich gas and raw oil charge streams are heated to the reaction temp. and enter the reactor loaded with (CoMo) or (NiMo) catalyst, in which hydrotreating reactions take place. The effluent from the reactor is cooled down and separated. Hydrotreated naphtha is pumped to the catalytic reforming unit.

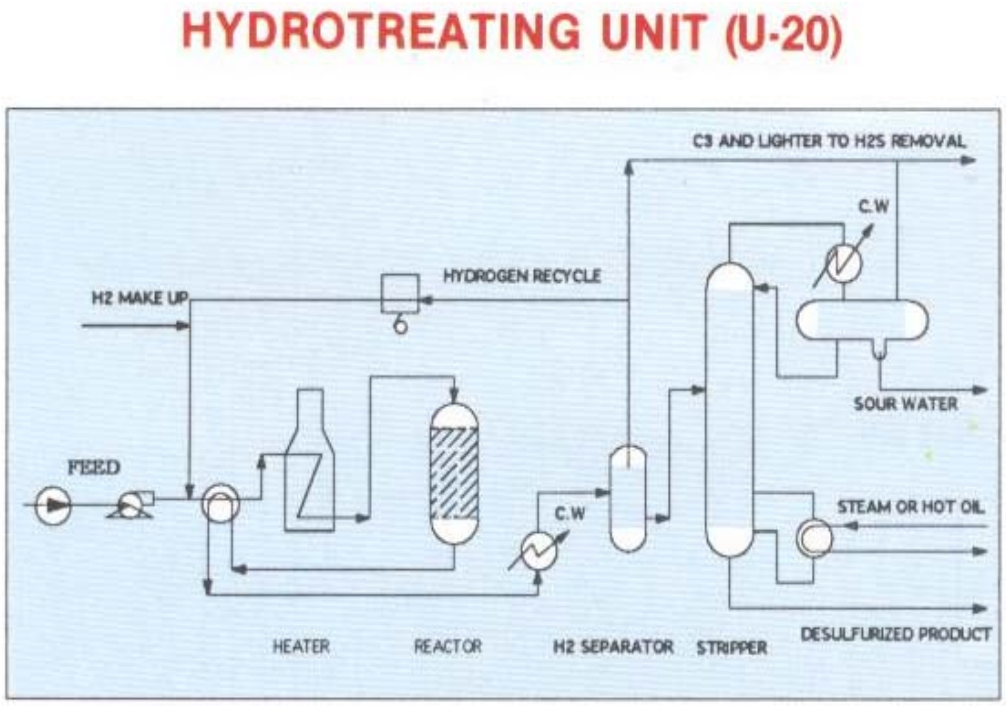

Figure (10): Hydroginated Unit.

- Catalytic reforming unit :

Description: Catalytic reforming process is used for converting low quality hydrotreated naphtha into high quality gasoline (RON 98). Feed is pumped from NHT unit and mixed with H2 rich gas recycled by the steam turbine driven compressor to the reactors (Pt/Re catalyst) then heated in CFE and heaters where reforming reactions take place to produce high octane gasoline.
The effluent from the third reactor is cooled and separated to obtain reformate.

- Vapor recovery unit :

Description: L.P.G. stream from NHT unit is washed by amine solution first, then by caustic solution. The sweetened L.P.G. stream together with L.N joins the deethanizer. The propane is recovered from the mixture in the recovery section which includes also a debutanizer column to remove butane from rich naphtha. Operating conditions are controlled to produce on spec. products.
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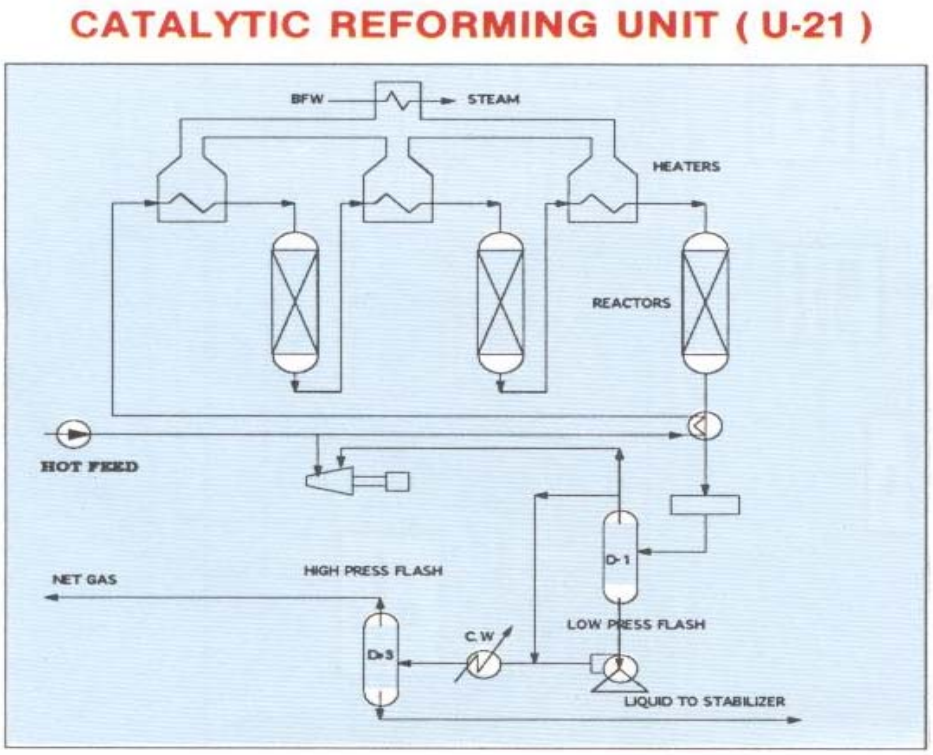

Figure (11): Catalytic Reforming Unit.

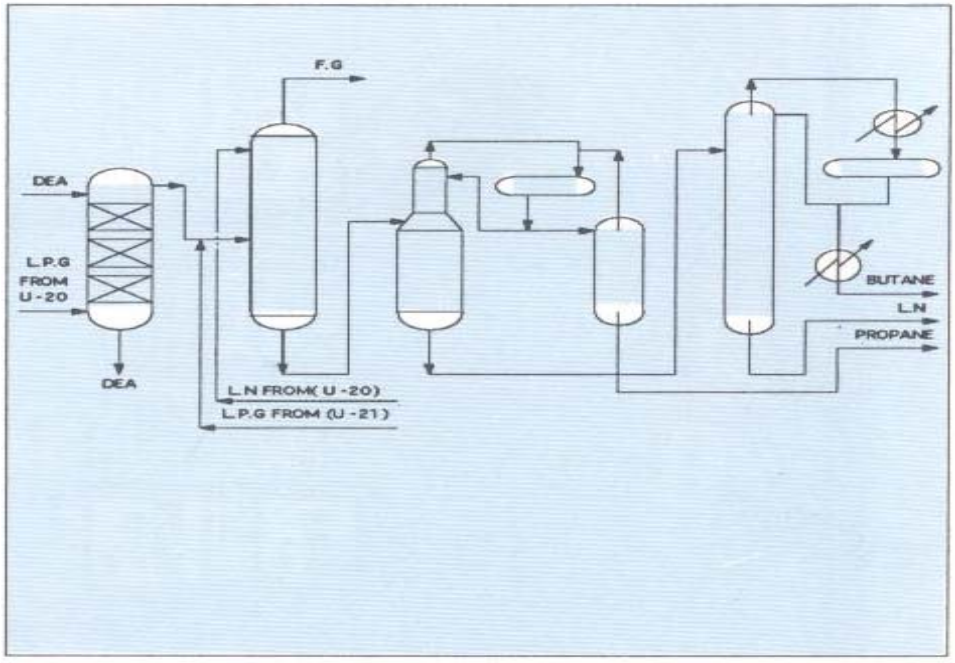

Figure (12): Vapor Recovery Unit.

- Coker Complex:

  - Skimmed crude two stage distillation unit:

Description: Feed from storage tank is pumped to a main heater H-1 and enters distillation tower at 359 oC. Bottom product is pumped to vacuum tower C-2 via heater H-2 at a temp. of 362 oC. The vacuum tower bottom stream is sent to Coker unit (U-12) whereas middle & top streams are sent to HDS unit (U-11).

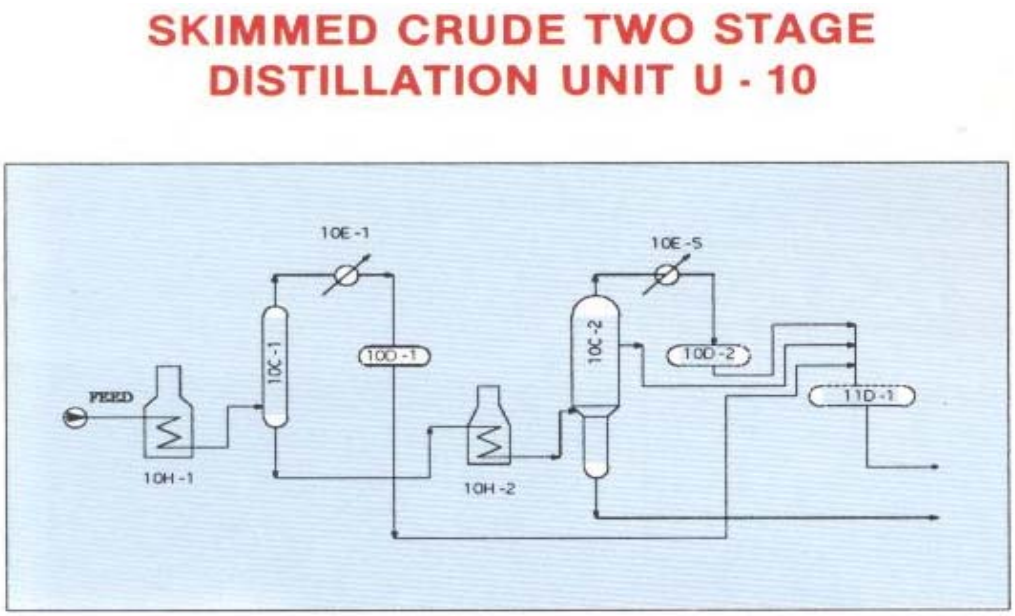

Figure (13): Skimmed Crude Two Stages Distillation Unit.

- Delayed coking unit:

Description: Short residue combined with recycle and asphalt is pumped and heated to a coking temp. of 4930C through the coker heaters where cracking takes place to produce the above products. Steam is injected to delay coke formation in the coker heaters and permits coke formation in the large coke drums. All liquids & gases leave the coke drum to coker fractionator where products are separated.

- Coker distillate unifining unit:

Description: Coker distillate is fed to fixed bed reactor with hydrogen at a pressure of 50 Kg/Cm2 and a high temp. of 3250C. HDS & HDN and saturation reactions take place at the previous conditions. In fractionation section, the reactor effluents are separated to the above products.
DEA solution keeps the level of H2S in recycle gas at the design level via absorber tower at high pressure.

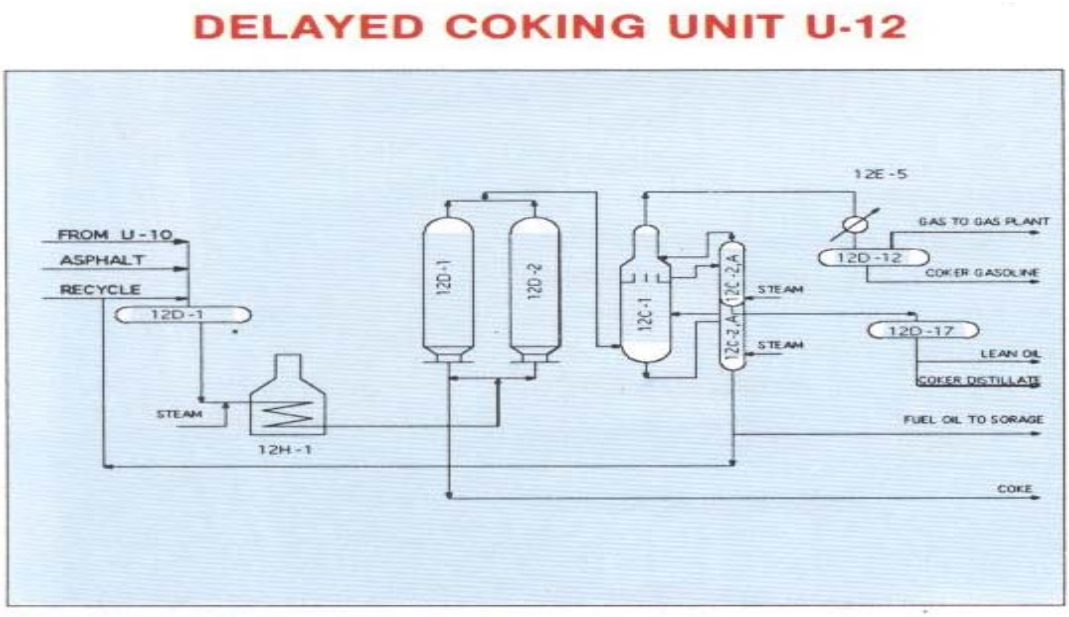

Figure (14): Delayed Coking Unit.

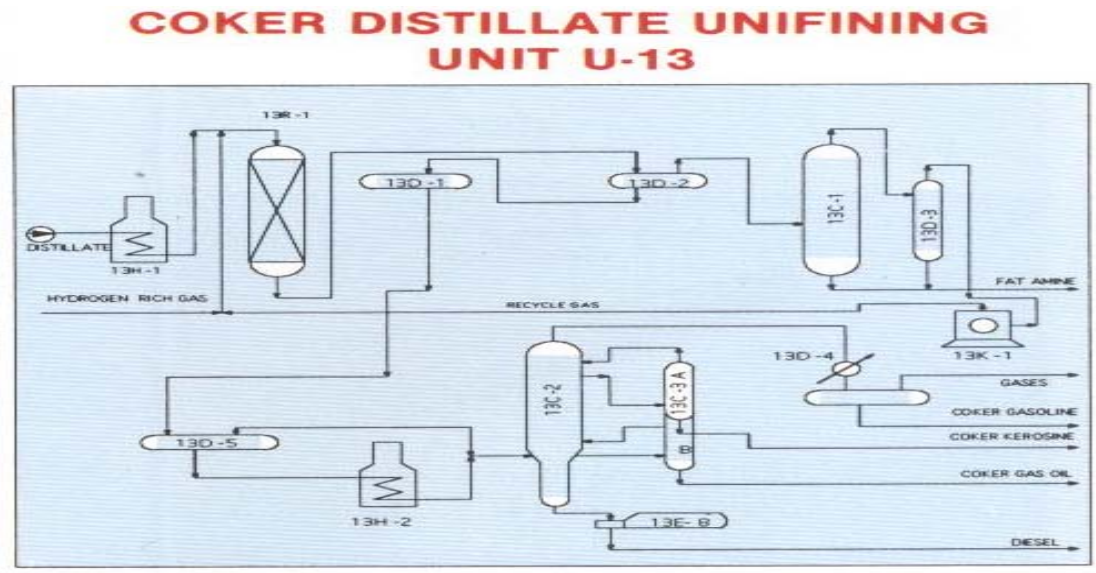

Figure (15): Coker Distillate Unit.

- Sulfur recovery unit:

  Description: The aim of the sulfur recovery unit is to recover elemental sulfur from the H2S rich gas produced from the gas/ amine treating unit.
  The plant is designed with straight through configuration and three conventional catalytic Claus reactors capable to achieve 97:98% of sulfur recovery efficiency.

- Hydrogen Plant:

  Description: The aim of the hydrogen unit is to produce 42 metric tons/day of 99.99 % purity hydrogen by processing two alternative feed stocks (Natural gas or L naphtha).

- Lube Oil Complex:

- Deasphalting unit:

Description: Feed is mixed with propane and fed to extractor (1). While HP flasher (2) LP flasher (3) and asphalt flasher (4) recover propane. Products are steam stripped in (5,6).

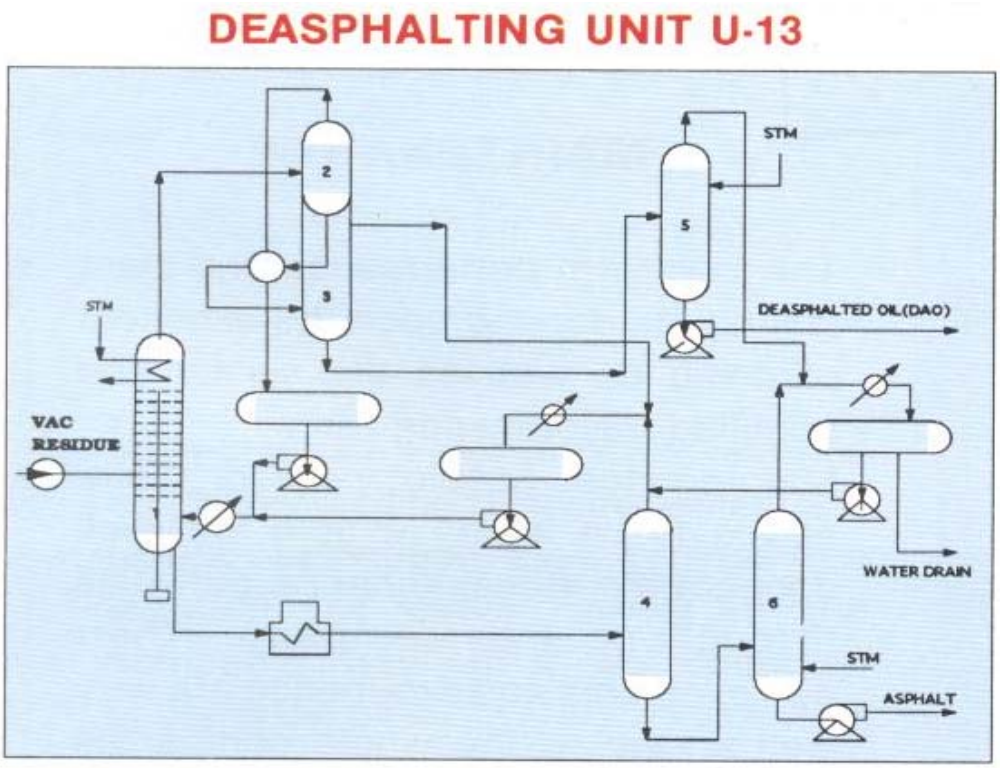

Figure (16): Deasphalting Unit.

- Phenol extraction unit:

Description: Feed from storage tank is mixed with phenol in extractor K-1. Raffinate from K-1 is fed to solvent recovery towers K.(2-3) through heater (N-1). Extract is fed to solvent recovery towers K.(4-6) through heaters N(2,3).

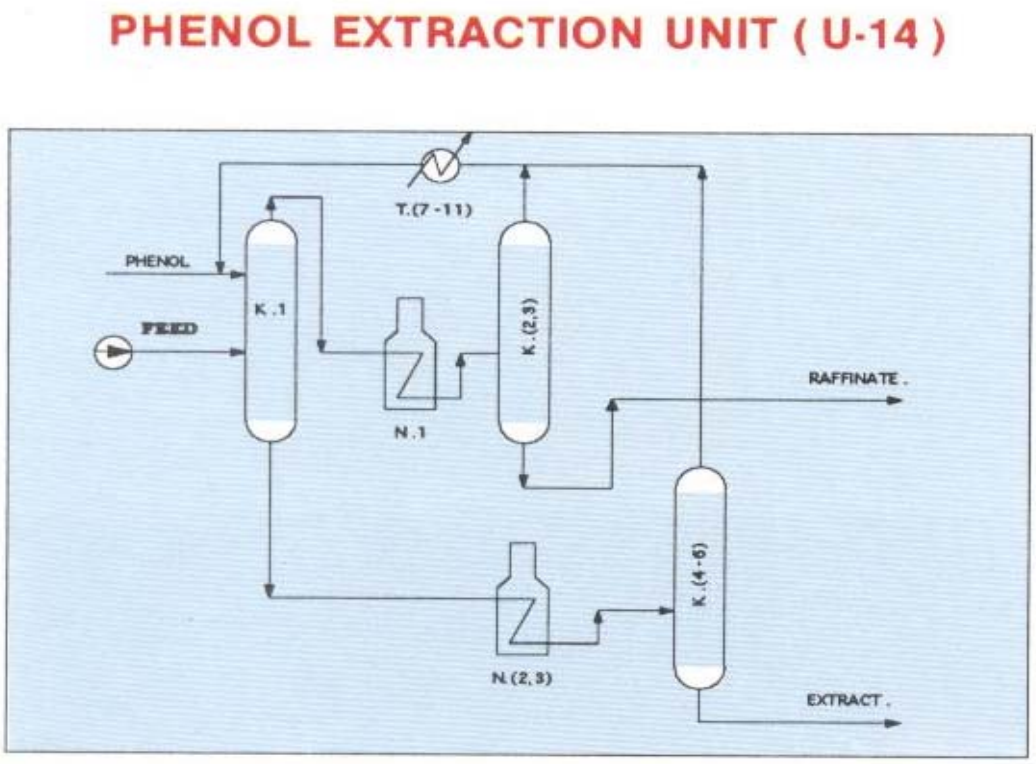

Figure (17): Phenol Extracting Unit.

- Dewaxing unit:

Description: Feed from storage tank is mixed with solvent &pumped to chillers KP (1-7) &filtered through Q(1-12).
Solvent is recovered from filtrate &slack wax through towers K. (1-8).

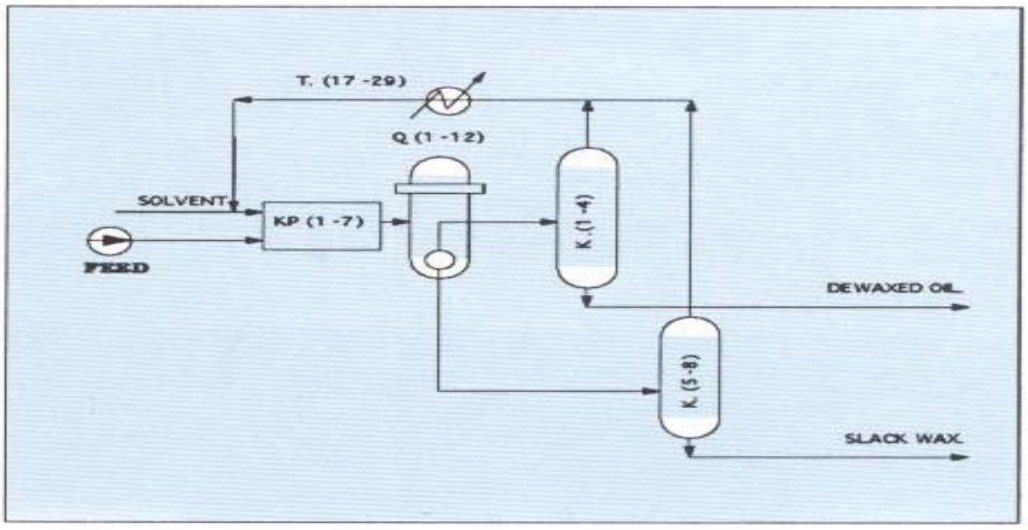

Figure (18): Dewaxing Unit.

- Hydro finishing unit:

  Description: Feed is mixed with hydrogen and fed to the reactor to remove sulfur and contaminates from the oils and saturate the hydrocarbons to improve the color.

The points of the technology where Annex C POPs might be generated and released are from the two flares.

Off gases produced from the different processing units are directed to the fuel gas network to be utilized as fuel gas for process fired heaters requirements and the excess is routed to the existing two separate flares headers (dist. & lube oil flare and Coker & reformer flare).

SOPC`s two flares (distillation and coker flare) data are as follows:-
-Distillation & Lube oil flare:
Normal gas flow rate is 2 mt/hr and in case of emergency is 15 mt/hr.
-Coker & -Reformer flare:
Normal gas flow rate is 5 mt/hr and in case of emergency is 30 mt/hr.

1.5.2 Hurghada landfill – Red Sea Governorate

The landfill was designed to include four steps as mentioned above. There is lack in the needed criteria for the landfill understudy to fulfill the criteria of sanitary landfills; as from the available data the bottom liner system is not suitable for separate waste and leachate from the ground and groundwater. Additional, there is no storm water drainage system nor leachate collection system to collect the liquefied wastes and the rain falls to avoid contamination of the groundwater. There is also no pipes collection system for the emitted gases during the biological breakdown of waste (such as: methane, carbon dioxide and sulphur dioxide). Moreover, the landfill has no covering or cap to seals off the top of the landfill, but, the solid wastes collected in ponds. Each pond will be closed or burned open whenever it became full, and further solid wastes will be collected in another pond and so on.

Figure (19): Status of work in Hurghada landfill

Figure (20): Hebca compost plant

In terms of dioxin and furan releases into the environment, uncontrolled waste incinerators (solid waste and hospital waste) are often the worst culprits, due to incomplete burning.

Dioxins and furans (PCDD/Fs) are formed during incomplete combustion of organic materials into the four municipal cells which the landfill includes where chlorine is available in the feedstock or in the air supply during the combustion process

1.6 Pollution Control System:

1.6.1 Suez Oil Processing Company – Suez Governorate {SOPC}

The Waste management principles are intended to assist SOPC in preparing specific policies and procedures to manage effectively the wastes generated by their own activities or by contractors acting on their behalf. Local, legal and environmental requirements, available treatment and disposal options, and the specific waste streams involved all need to be taken into account.

Inadequate waste management may lead to considerable environmental damage and financial liabilities.

Waste management is relevant to virtually all types of operation, ranging from raw material extraction, refining and manufacturing, distribution and marketing of products, and their final disposal.

It covers the identification, separation and recording of the quantity, composition and / or nature and destination of domestic, industrial and chemical waste and includes waste minimization, and disposal. These aspects should be considered at all stages of a project, from preparation (design of installations, development of products) during operation, or decommissioning of facilities.

The Egyptian Environmental Affairs Agency has adopted a system of inclusive listing of specific hazardous. In other cases, the determining factor is either the concentration level of the substances or other indicated criteria such as toxicity of the waste or an extract of it, ignitability or flammability, corrosiveness or reactivity.

The available disposal methods, taking into consideration the types of wastes for which they would be suitable, the conditions necessary for efficient operation, and the distance the waste would be transported. If technically and economically viable, preference should be given to methods enabling the disposal of waste as close as possible to the location they were generated. Among the methods of disposal which can be considered are: landfill, incineration, disposal at sea, chemical treatment, chemical fixation, physical fixation, storage fixation.

Waste arising from the various operations has to be properly managed and handled. This is as important as the proper management of finished products, and implies that responsibilities, administrative procedures and documentation should be defined and established for all steps of the disposal chain, from the source to the final point of disposal.

All waste must be disposed of correctly. Samples should be taken to identify nature of waste to channel it along the route specified for that type of waste. No non-domestic waste must be dumped over the side.

The packaging and transport of any waste to the beach must comply with the specifications and requirements of the International Maritime Dangerous Goods Code and the International Air Transport Association Dangerous Goods Regulations.

Off gases produced from the different processing units are directed to the fuel gas network to be utilized as fuel gas for process fired heaters requirements and the excess is routed to the existing two separate flares headers (dist. & lube oil flare and Coker & reformer flare).

1.6.2 Hurghada landfill – Red Sea Governorate

There is lack in the needed criteria for the landfill understudy to fulfill the criteria of sanitary landfills; as from the available data the bottom liner system is not suitable for separate waste and leachate from the ground and groundwater. Additional, there is no storm water drainage system nor leachate collection system to collect the liquefied wastes and the rain falls to avoid contamination of the groundwater. There is also no pipes collection system for the emitted gases during the biological breakdown of waste (such as: methane, carbon dioxide and sulphur dioxide). Moreover, the landfill has no covering or cap to seals off the top of the landfill, but, the solid wastes collected in ponds. Each pond will be closed or burned open whenever it became full, and further solid wastes will be collected in another pond and so on.

The landfill has no pollution control system. During work the workers use safety equipments like gas masks, gloves, and safety shoes; also they have 6 fire fighting equipments.

1.7 Proposal for BAT/BEP implementation:

1.7.1 Suez Oil Processing Company – Suez Governorate {SOPC}

Off gases produced from the different processing units are directed to the fuel gas network to be utilized as fuel gas for process fired heaters requirements and the excess is routed to the existing two separate flares headers (dist. & lube oil flare and Coker & reformer flare).

SOPC is planning to purchase a complete gas recovery system to minimize the flared gas routed to the flare headers and utilize it as a fuel gas for process fired heaters that simultaneously resulted in reduction of COX, NOX and UP- POPs emissions and extend flare tips lifetime.

SOPC`s two flares (distillation and coker flare) data are as follows:-
-Distillation & Lube oil flare:
Normal gas flow rate is 2 mt/hr and in case of emergency is 15 mt/hr.
-Coker & -Reformer flare:
Normal gas flow rate is 5 mt/hr and in case of emergency is 30 mt/hr.

Flare gas knock-out drum pressure 0.05-0.1 $Kg/cm^2.g$

The required discharge pressure: 6 $Kg/cm^2.g$
Existing flare header size: 20 inch/each flare.

Flared gas analysis:

Item	Dist. & Lube Oil Flare		Coker & Reformer Flare	
	Min. vol.%	Max. vol.%	Min. vol.%	Max. vol.%
H_2	0.57	13.30	39.75	56.62
CO_2	0.24	0.87	0.14	0.21
H_2S	0.01	0.09	2.00	4.00
C1	1.1	18.23	9.78	13.61
C2	3.64	26.48	5.96	8.97
C2``	0.00	1.75	0.51	0.81
C3	20.19	38.28	5.31	7.63
C3``	0.09	5.07	1.53	2.44
i-C4	4.88	17.92	0.83	1.27
n-C4	9.22	34.84	2.41	3.6
C4``	0.18	2.21	0.97	1.98
neo-C5	0.12	1.53	0.5	0.91
i-C5	1.91	11.41	0.9	3.51
n-C5	0.55	10.41	1.16	3.8
C5``	0.00	1.18	0.48	2.26
C6+	0.00	5.09	0.15	6.36
M.Wt.	35.15	55.80	17.49	28.46
R. Density @ air=1	1.3173	1.9267	0.6039	0.9826
L.H.V. (Cal/g)	10844.3	11063.63	9776.24	10743.31

Table (2): Flared gas analysis.

Proposed scheme for the flare gar recovery project

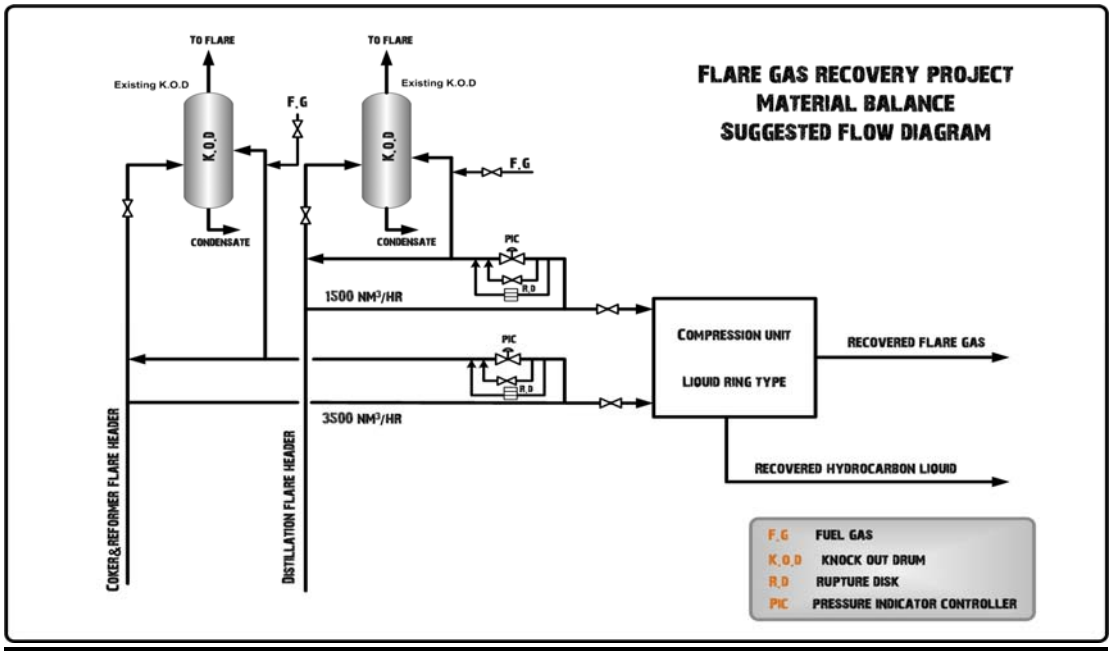

Figure (21): Proposed scheme for the flare gar recovery project.

Flare gas recovery can result in near 100 percent reduction of normal flaring, limiting flare operation to emergency releases and scheduled maintenance. Captured flare gas can then be reused as valuable fuel or feedstock. Near-zero flaring reduces costly emissions, giving you environmental control with an immediate return on investment.

The Clean Development Mechanism (CDM) project activity with Egyptian Bureau- EEAA involves installation of a flare gas recovery system (FGRS) for recovery of process flare gas that was being traditionally flared off. The recovered flare gas will be used as fuel for meeting process heating requirements. In the absence of this activity, gas flaring would continue to be modus operandi at SOPC. Currently, the process heating requirements are being met by firing Fuel Gas (FG) and Internal Fuel Oil (IFO). Thermal energy generated from the recovered flare gas will directly displace equivalent amount of thermal energy that would have been generated by firing IFO, thereby leading to reduced IFO consumption and a reduction in the Greenhouse Gases that get emitted from combustion of IFO. The project activity leads to conservation of hydrocarbons that are otherwise wasted; this contributes to increasing the energy efficiency of the overall system.

In addition to the above, the project activity also results in significant reduction of plant emissions. The project is expected to reduce 120,000 tons/year CO2.

Flaring of hydrocarbons produces combustion by-products such as co2, co, NOx that are emitted to the atmosphere. When utilizing flare gas recovery, no such by-products are produced.

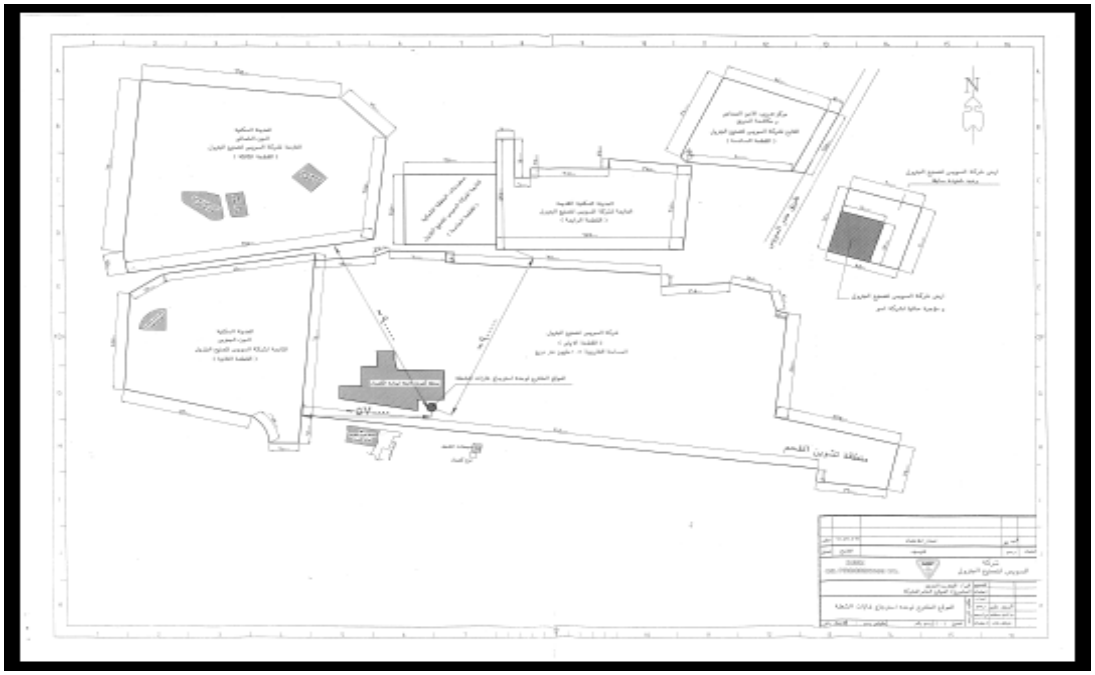

Figure (22): Proposed Position for the flare gar recovery Unit.

Project's contribution to greenhouse gas emission reduction:

After implementation of the project activity, the recovered flare gas will be fired along with fuel gas and (IFO), the resultant thermal energy generated from firing of the recovered flare gas will displace equivalent amount of thermal energy that would have been generated from firing of IFO .the reduction in IFO combustion will also lead to a reduction in emission of greenhouse gases that are emitted from combustion of IFO.

Project's contribution to Sustainable development:

- Reduction in thermal energy losses by recovery of the gas that would otherwise have been fired.
- Conservation of fuel oil, non renewable natural resources.
- Reduction in CO2 emissions.
- Reductions in the emission of other harmful gaseous pollutants like Sox and sulphides which results in ambient air quality improvement.
- Creation of additional employment opportunities for skilled professionals.
- Enhancing the technical knowledge base of employees and personnel working on implementation of the project activity

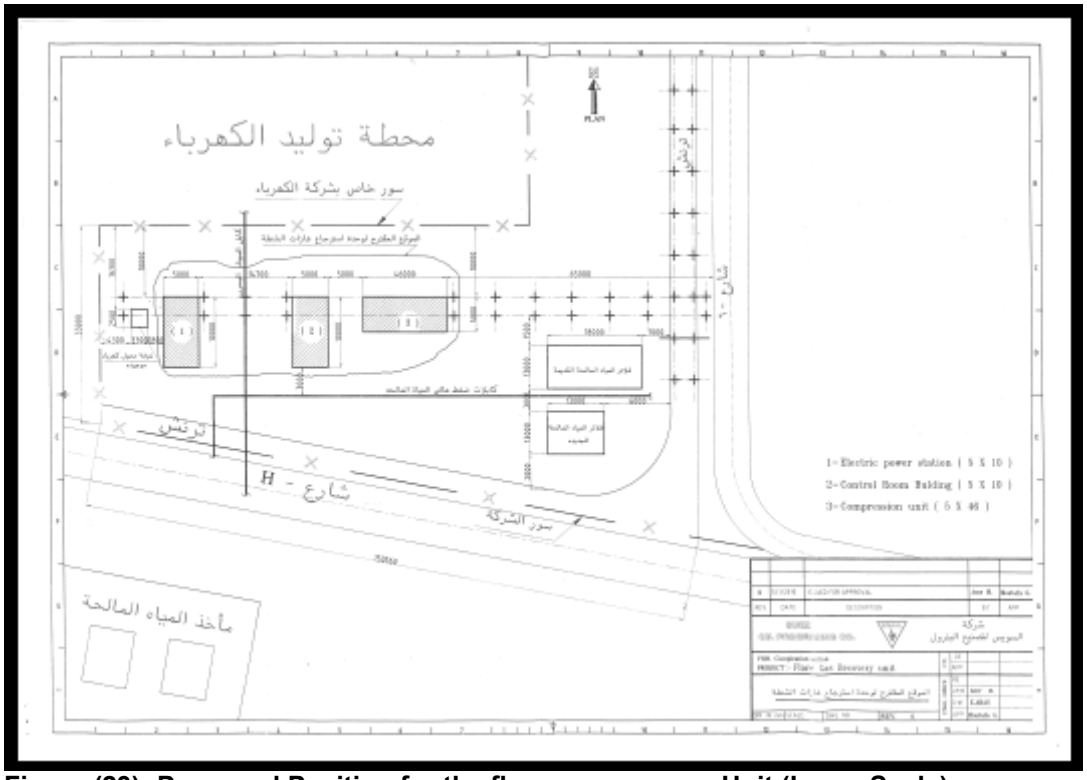

Figure (23): Proposed Position for the flare gar recovery Unit (Large Scale).

1.7.2 Hurghada Landfill – Red Sea Governorate

A sanitary landfill must be carefully designed structure built into or on top of the ground in which waste is isolated from the surrounding environment (groundwater, air, soil). The modern landfill offers much more protection for the environment and for local people than traditional dumps did. Problems with odors, litter, vermin, etc., are greatly reduced by the careful management of the site. Most landfills are made up of the following elements:

- Bottom liner system - this separates waste and leachate (liquid that gathers at the bottom of the waste mass) from the ground and groundwater
- Cells (old and new) - where the waste is stored within the landfill
- Storm water drainage system - this collects rain water that falls on the landfill
- Leachate collection system - this collects water that has percolated through the landfill itself and contains contaminating substances. The leachate should be treated and disposed of in a safe way.
- Gas collection system - pipes collect the methane, carbon dioxide and sulphur dioxide gases that are formed during the biological breakdown of waste. Where possible, these gases are used for the production of electricity.
- Covering or cap - this seals off the top of the landfill with a gas drainage layer, an impermeable mineral layer, a drainage layer of at least 0.5 meter and at least one meter of top soil.

The management to reach a zero waste with no landfill at El Gouna:

Only 22 kilometers of the Hurghada international airport, El Gouna perfectly situated along the exquisite red sea coastline.
Built along 10 km of beachfront and spreading across a myriad of islands interlinked by beautiful lagoons ,the resort is marked by its distinctive architectural charm .The resort is a luxury leisure.

Recycling unit consists of three factories and one small bio gas unit beside two stores and galleries.
It has 50 workers among machines technicians and separation technicians, five medium trucks & two small trucks beside five rented tractors to transfer all garbage from El Gouna every day.
About 50 tons of garbage enters daily with 20 different kinds of solid wastes.

The procedure for manual separation consists of:

- The types which re- sell (carton, beverage cans [aluminum- steel], polyethylene terephthalate [mineral water bottles], newspaper and magazine, glass.
- The types which recycle (plastic bags, propylene, tetra pack, polystyrene, very exhausted plastic.
- The types which are reused (organic matter, bio gas, agriculture waste [compost], dry palm and trees, industrial waste).

Map (5): El Gouna- Hurghada- Suez Governorate

Table (3): El Gouna- Solid waste monthly quantities

Figure (24): Status of work in El Gouna recycling unit

2 – ENVIRONMENT AND HEALTH RELATED RESEARCH AND MONITORING ASSESSMENT

2.1 Summary:

The persistent organic pollutants (POPs) are one of the most common emissions from open burning of waste including burning of landfills and petroleum refineries all over the world, and the concern is continuously increasing about its possible adverse health effects for the population living near landfill/company and workers within them.

Meany studies showed that PCDD/F concentrations in vegetation were higher in unpolluted zones at far distances from the landfill/ company than in industrial and residential areas. Therefore, it can be thought that long-range transport and/or uncontrolled emission sources play an important role in the environmental levels of these pollutants. People living near this industrial area may be more environmentally exposed to PCDD/Fs because of the comparatively higher levels in air, water and soil. Also, the indirect exposure due to dietary ingestion of PCDD/F can occur to the people living in downtown. Overall, people of residential areas are more exposed to PCDD/Fs. and non-carcinogenic and carcinogenic risks associated to that exposure would be assumable.

Although the risk by POPs is not notable, continuous measurements of these and other pollutants in the industrial and urban area are highly recommended. And there should be continuous efforts to reduce the environmental levels of POPs.

SOPC is uniquely located in an area with specific geographical criteria. It is located in Suez, Egypt, on the Gulf of Suez, at the entrance of Suez Canal. It is also situated 4-km from Suez city-center; this region includes a coastal area on the red sea with a nearby harbor called Zaitia. It also includes both residential area of the Suez city and industrial area for petroleum refining; the local environment is also influenced by the presence of some roads.

Hurghada landfill as shown in map (2) is located in the desert away from Hurgahada by 17 kilometer. It is away from the nearest residential area by 7 kilometers. This region includes a residential area of the Hurghada city. Moreover, the local environment is also influenced by the presence of some roads.

The landfill is about 250,000 meter2. It includes 4 municipal cells. It is suitable to receive 120,000 tons of solid waste per year.

On-site sampling points will be identified within the premises of the sources, preferably at the point of releases also

Off- site sampling points from Soil, sediment, water and habitat will be identified and marked by GPS.

The samples were collected from air, water, soil and vegetation. Based upon the best available scientific knowledge and according to the type of chemicals (POPs); the optimal number of samples is about 42 samples (from air, water, soil and vegetation, as mentioned in table (6).

The workers in the petroleum refinery and in the landfill, in addition to the families within the areas near the landfill are exposed to different pollutants including the POPs; however, the levels of exposure in the work environment are unique as it usually exceeds the levels encountered in environmental pollution.

Waste collectors with middle age and with low level of education were at higher risk. Waste collectors should be provided with the necessary protective measures. Education and training programs should be provided to all, and routine medical check up program should be implemented and maintained, to keep them safe and secure.

The Personal protective equipment (PPE) is used as the last and least effective method of protection and is often uncomfortable or difficult to work with; it includes: gloves, rubber boots, plastic or rubber overalls and aprons, respirators; and dust masks.

The training program should be conducted on a regular basis and also being tailored according to the type of audience in Hurghada landfill (90% of the workers read and write only) and in SOPC as it has different categories of employees with 19% of them had higher education. So, the training modules should be adapted to the needs of the employees.

Proper incineration of contaminated material, recycling of wastes and flare gas recovery is the best available method of preventing and controlling exposure to dioxins. The incineration process requires high temperatures, over 850°C. For the destruction of large amounts of contaminated material, even higher temperatures - 1000°C or more - are required; prevention or reduction of human exposure is best done via source-directed measures.

Petroleum refiners are common point sources of some types of POPs as PCDD/Fs and PAH and the monitoring of air and water emissions from the petroleum refinery helps much to identify and control those hazardous pollutants.

The persistent organic pollutants (POPs) are one of the most common emissions from open burning of waste including burning of landfills.

Landfill site must be monitored on a regular basis to make sure it is being run efficiently and safely. The responsibility for this monitoring rests with the EEAA and landfill operators themselves. This process begins after the application for a waste license. Monitor of various aspects of the site is needed to ensure they remain in compliance with their license.

POPs in the environment pollute the food supply, especially fish, meat, butter and cheese. When people eat POPs-contaminated foods, the POPs accumulate in their fatty tissue. Mothers pass on POPs from their own bodies to their offspring. In humans and other mammals, POPs enter and contaminate the fetus while it is still in its mother's womb. Since breast milk also contains POPs, infants are further exposed to POPs while nursing. In non-mammal species, POPs are passed from the mother to offspring though the eggs. POPs have the potential to harm humans and other organisms even at concentrations that are commonly found in ordinary foods.

PCDD/Fs can bio-accumulate very easily in the human body because they present a high solubility in lipids. PCDD/F retention by lipids is also linked to bio-magnification of dioxins and furans in the food chain, whose final step is human diet. In turn, maximum values of 63% were reported studying PCDD/Fs absorption through the digestive tract.

Although some PCDD/Fs have complex structures, their capacity to be adsorbed by air particulate matter lets them travel to affect environments far away from the emission sources (long range transport).

2.2 Background:

Promotion of strategies to reduce unintentional production of POPs (specially Dioxins and Furans) have been identified as a respective national priority for the Red Sea and Gulf of Aden Coastal Zone Countries of PERSGA, and that they are committed to take appropriate actions towards the reduction of the releases of unintentionally produced persistent organic pollutants (UP-POPs).

UP-POPs and their effects are not regularly monitored in the coastal zone of the participating countries. There is no entity at the regional context to undertake the regular monitoring activities, to harmonize and provide an organizational back up for UP-POPs release reduction measures. General lack of information on the laboratory capacities and expertise in POPs

analysis further encumbers the current situation. Therefore, due to the lack of monitoring activities, the information on human and environmental health impacts of UP-POPs sources and the level of exposure have not been assessed.

There is a lack of information relating to socio-economic considerations associated with the introduction of new industrial control measures to inform the industries and local governments on decisions that need to be undertaken and their impact to the communities in the coasts. Such information should reflect the different capabilities and changing conditions among the participating countries to accommodate the socio- economic effect of new technologies.

The main objective of BAT/BEP implementation would be to achieve meaningful release reductions of the Annex C POPs releases. Egypt has selected one specific source (petroleum refineries at Suez Oil Processing Company – Suez Governorate {SOPC}, and the 3rd Project Management Committee has selected a common source for the whole region(landfills) {Hurghada landfill – Red Sea Governorate- Egypt}.

In this respect, Egypt has prepared the report of the stage (1) of this project to explain the current situation of unintentional releases of POPs in the Red Sea coastal areas within the borders of Egypt, specifically the governorates of the Red Sea, South Sinai and Suez.

There are no special indicators for coastal zones that would link together the positive and/or negative impacts on society when implementing the possible control measures such as their effects on public health, environmental and occupational health, and agriculture including aquaculture, biota (biodiversity), economic aspects, movement towards sustainable development and their social costs.

The formulation of suitable and effective management framework to reduce or eliminate releases from UP-POPs sources should be underpinned by adequate scientific and socio-economic data and information. Under the baseline scenario, decision makers could not take into account threats posed by POPs on human health and the environmental resources in the regional context. The costs incurred by possible ecological changes and therefore identification of realistic remedial measures needed for effective management could not be easily identified.

Difficulties in providing an adequate scientific and socio-economic data (including the absence of specific coastal zone scientific data with special emphasis on the risk POPs pose to human wildlife, marine life and the environment) further escalated the current weaknesses.

As an activity of the cooperation between countries of PERSGA, an integrated assessment report will be compiled for BAT/BEP implementation in Hurghada landfill and the Suez Oil Processing Company (SOPC) and this following part of the assessment report will deal with the environmental and health related research and monitoring assessment in these facilities.

For Suez Petroleum Processing Company , Off gases produced from the different processing units are directed to the fuel gas network to be utilized as fuel gas for process fired heaters requirements and the excess is routed to the existing two separate flares headers (dist. & lube oil flare and Coker & reformer flare).

The persistent organic pollutants (POPs) are one of the most common emissions from petroleum refineries especially from flares all over the world, and the concern is continuously increasing about its possible adverse health effects for the population living near company and workers within it.

The practice of disposal of hazardous waste to landfills is fairly common. Landfills might be considered as pollution hot spots and as potential sources of releases of dioxins and furans.
Many landfill sites are designed to deal with specific types of waste and some only accept inert waste, such as, soil, stones and contruction/demolition waste. In an effort to increase recycling and re-use of items, many landfill sites now have civic amenity centres purely for domestic waste.

Since 1970's, when it became apparent that even controlled landfills were causing significant water pollution, sanitary landfill technology was developed to provide barriers to pollutant migration, as well as to provide leachate and gas management system (Cointreau-Levine, 2004).

If solid wastes are not managed properly, they can have an adverse impact on the environment, and public health arising from contamination of oil-water and pollution of air through spread of diseases via vectors living on waste (Garg, 2002).

This report gives an idea about the environmental exposures in Hurgada Landfill sited in the desert in the road to Hurghada and in Suez oil processing company sited on the coast of Suez Gulf in Suez City, which may produce Persistent Organic Pollutants (POPs) such as Dioxins and Furans. The information in this report will provide suitable recommendations which will help in overcoming the possible health hazards that may emerge from them.

2.3 General geography, climate and environmental information:

2.3.1 Suez Oil Processing Company – Suez Governorate {SOPC}

General geography:

SOPC is uniquely located in an area with specific geographical criteria. It is located in Suez, Egypt, on the Gulf of Suez, at the entrance of Suez Canal. It is also situated 4-km from Suez city-center within a petroleum processing area adjacent to Nasr Refinery (El Nasr Petroleum Company), the largest Egyptian refinery with 146,300 barrels per day of capacity, and the Zaitia harbor on the Red sea.
The approximate population of the Suez governorate is 512,000 according to a survey of 2006.

Climate:

The average temperature in Suez range from 10.5 °C in winter to 36.1°C in the summer and precipitation (raining) occurs only in the winter season.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average high °C	19.4	21.2	23.6	28.5	32.4	35.1	36.1	35.7	33.2	30.1	25.4	20.7
Average low °C	10.5	11.3	13.1	16.4	19.5	22.4	23.9	24.2	22.8	20.0	15.7	11.8
Precipitation mm	5	2	4	1	0	0	0	0	0	0	2	3

Table (4): Climate data for Suez (Source: Climate Charts)

Environmental information:

This region includes a coastal area on the red sea with a nearby harbor called Zaitia. It also includes both residential area of the Suez city and industrial area for petroleum refining which

comprises 2 of the largest petroleum refineries of Egypt. Moreover, the local environment is also influenced by the presence of several roads with an important traffic density.

Due to the specific nature of this region, a lot of measures have been taken for environmental protection as follows:

- Environmental impact assessments
- Cessation of discharging into the sea of oil based mud and cuttings, produced
- Waste water treatment
- Use of compressed natural gas (CNG).
- Proper sewage treatment processes
- State of the art oil spill contingency plans

2.3.2 – Hurghada landfill - Red Sea Governorate

General geography:

The total population of Hurgahada is estimated 100,000 persons. The landfill as shown in map (2) is located in the desert away from Hurgahada by 17 kilometer. It is away from the nearest residential area by 7 kilometers. The landfill is about 250,000 meter2. It includes 4 municipal cells. It is suitable to receive 120,000 tons of solid waste per year.

Climate:

The climate in Hurghada is hot and wet in summer as the evaporating sea water caused by hot sun rays, raise the level of humidity. This high humidity level increases thick mists in the early morning over the water and on land. And generally, it is known for little rain, but sometimes heavy rains occur in winter (especially in January and February). The average temperature in Hurghada range from about11 °C in winter to about 37 °C in the summer.

Environmental information:

This region includes a coastal area on the Red Sea. It also includes residential area of the Hurghada city. Moreover, the local environment is also influenced by the presence of some roads.

Hurghada is blessed with a variety of regional merits such as climate, coastal beaches that are famous for water and marine treasures, including coral reef and different kinds of fish and snails … etc. Such merits directed developmental activities towards the touristic sector as a pioneer project of integrated development that could be invested in the marine environment that in turn could be a base for touristic attraction.

The studied landfill was designed to receive solid waste inform of agricultural, commercial and residential wastes generated in municipal or notified areas in either solid or semi-solid with excluding the industrial hazardous wastes.

2.4 Detailed description of on- site and off – site sampling points:

2.4.1 General:

Sampling is a crucial step to monitor the presence of pollutants in order to draw a time-trend analysis and for assessment of their environmental and occupational hazards. The sampling procedure includes the following stages:

On-site sampling points will be identified within the premises of the sources, preferably at the point of releases and marked by GPS.

Off- site sampling points from Soil, sediment, water and habitat will be identified and marked by GPS. The assessment will include a brief description of the geography and climate of the location as well as the migration path ways of the pollutants and the possible recipients. These sampling sites will be used to monitor the presence of pollutants and draw a time-trend analysis.

Planning stage:

Selecting the best locations for sampling is very important to represent the long- and short-term environmental pollution. Every sampling point was selected depending on:

- The location of potentially important focuses of contamination,
- The possibility of getting meteorological data in the zone (in order to get a better understanding of the process of contaminants dispersion)
- The proximity to residential areas in which people could be affected by emissions from the industrial area.
- Determining the number of locations needed.

Determining the number of locations needed:

Based upon the best available scientific knowledge and according to the type of chemicals (POPs); the optimal number of samples is determined according to the following table:

Medium	Area			Total
	Location (Habitat)	Near Residential	Unpolluted (Far)	
Air	6	3	3	12
Water	4	1	1	6
Sediment	4	1	1	6
Soil	6	3	3	12
Vegetation	6	3	3	12
Total	26	11	11	48

Table (5): The total number of samples needed

Technique of air sampling:

Passive air samplers (PAS) offer a cheap and versatile alternative to the to conventional high volume air sampling and they have been currently recommended as one of the methods suitable for the purpose of new long term monitoring projects. It helps to compare the contamination on various sites or for verification of information obtained by active samplers.

Passive air samplers operate without the aid of a pump and consist of an accumulating / absorbing medium that has a high retention capacity for the target analytes.
Low sensitivity to accidental short-time changes in the concentration of pollutants is a basic characteristic of passive air samplers. They provide information about the long-term contamination of the studied environmental compartment (for example air).
The air streams freely around a filter, membrane or other medium (sorbent), which captures pollutants during the period of passive air sampling. It is possible to use polyurethane foam (PUF) for persistent organic pollutant (POPs) sampling.

Passive air samplers using PUFs are suitable for monitoring of POPs such as polychlorinated biphenyls (PCBs) and organo-chlorinated pesticides (OCPs); while, less volatile compounds (high molecular PAHs) are also collected on the filter, but only partially (sorbed onto dust particles and sampling rates between 3-5 m3/day.

- Passive air samplers are hung vertically with the bigger bowl facing upwards.
- They are paced 1.5-2.0 m above ground during sampling.
- The duration of the sampling is four weeks (28days).
- Aluminum foil is used during removal of the filter; then, it is being wrapped into two layers of aluminum foil to prevent erroneous results from contamination of the filter.

Figure (25): Air sampler containing the PUF filter

Figure (26): The PAS sampler is ready for deployment onto monitoring site

Technique of water sampling:

Water samples were collected from wastewaters of the facility and from the drinking water within the area.
In Japan, the environmental quality standard for dioxins in water is 1 pg WHO-TEQ/L or less. While in the USA, the highest level of 2,3,7,8-TCDD that is allowed in drinking water is 3 × 10–8 mg/L (equal to 30 pg/L), which was set by US EPA (2003). PCDD/Fs enter the aquatic environment can occur with the discharge of wastewater (UNEP Chemicals, 2005) as well as dry and wet deposition from the atmosphere.

Technique of soil sampling:

- Soil samples were taken from the upper 3 cm of soil
- Kept in polyethylene bags
- Moved to aluminum foils in the laboratory to prevent adsorption by plastic
- Dried at room temperature until constant weight
- Sieved through a 2 mm mesh screen.
- uncultivated land), located 30 km far away from the area of direct influence of all suspected sources of contamination.
- Several subsamples were also collected at the same time as bulk samples within approximately 10 m2 in each sampling site.

Technique of vegetation sampling:

- Samples were collected when the weather was sunny.
- There was no precipitation at least during the 10 days previous to collection.
- Samples were obtained by cutting the aerial part of the plant
- Packed in aluminum foils.
- Dried at room temperature
- Shredded with a manual shredder.
- Kept in a double aluminum foil,
- Packed in labeled plastic bags,
- Stored at room temperature and protected from the solar light till analysis.

2.4.2 Suez Oil Processing Company – Suez Governorate {SOPC}

The sampling points are specified using the Global Positioning System (GPS) to ensure the accuracy of sampling.

Collection of samples:

Air Samples

6 samples were collected from different locations within SOPC:

- A sample from every flare header (distillation and lube oil flare, coker and reformer flare.
- A sample from every processing complex (atmospheric distillation complex, lube oil complex, catalytic reformer complex, coker complex).

3 samples from the nearby residential area and 3 samples from the unpolluted area.

(Secondary samples for confirmation can be collected within 10 m2 in each sampling site).

Water samples:

2 water samples were collected from wastewaters of SOPC and 2 samples from the drinking water within the industrial area in addition to 1 sample from the nearby residential area and 1 sample from the water in the unpolluted area.

Soil samples:
Sampling points were chosen as follows:

- 6 samples collected near oil refinery and petrochemical industries
- 3 in the nearby residential area
- 3 samples from the unpolluted sites

(Secondary samples can be also collected at the same time as bulk samples within approximately 10 m2 in each sampling site).

Vegetation samples
Vegetation samples were collected in 12 sites in which soil samples were taken.

- 6 samples were collected from the industrial zone
- 3 samples from the residential zones,
- 3 samples from unpolluted sites

Samples are taken from the areas with the following GPS coordinates:

Sampling Location	Sample Type	Points	GPS coordinates
At flare complexes	Air, Water, Soil	1	N : 29° 57° 13.9° E : 032° 35.3° 10°
		2	N : 29° 57° 04.5° E: 032° 30° 21.5°
		3	N : 29° 57° 04.5 ° E: 032° 30° 21.4°
		4	N : 27° 04° 10 E: 033° 46° 51°
On- site the company	Air, water, soil, vegetation	1	N : 29° 57° 38.9° E: 032° 30° 46.6°
		2	N : 29° 57° 16.8° E: 032° 29° 46.9°
		3	N : 29° 57° 16.7° E: 032° 30° 53.2°
		4	N : 29° 57° 0.54° E: 032° 30° 16.9°
		5	N : 29° 57° 0.26° E: 032° 29° 55.7°

Table (6): GPS coordinates for SOPC (on- site sampling points)

(Secondary samples can be also collected at the same time as bulk samples within approximately 10 m2 in each sampling site).

2.4.3 Hurghada landfill - Red Sea Governorate:

The major release routes of POPs should be identified and sampling points set and marked by Global Positioning System (GPS).

Based upon the best available scientific knowledge and according to the type of chemicals (POPs); the optimal number of samples is determined according to the following table:

Sampling Location	Sample Type	No. of cell	GPS coordinates
At landfill cells	Air, Water, Soil	1	N : 27° 04° 12° E : 033° 47° 10°
		2	N : 27° 04° 08° E: 033° 47° 01°
		3	N : 27° 04° 18 ° E: 033° 46° 56°
		4	N : 27° 04° 10 E: 033° 46° 51°
Above wind direction (near residential area)	Air, water, soil, vegetation	1	N : 27° 04° 07° E: 033° 47° 09°
		2	N : 27° 04° 07° E: 033° 47° 05°
		3	N : 27° 04° 11° E: 033° 46° 57°
		4	N : 27° 04° 07° E: 033° 46° 50°

Table (7): GPS coordinates for Hurghada landfill (on- site sampling points)

(Secondary samples can be also collected at the same time as bulk samples within approximately 10 m2 in each sampling site).

2.5 Detailed description of off – site sampling points:

2.5.1 Suez Oil Processing Company – Suez Governorate {SOPC}

Air, water, soil and vegetation Samples

3 samples from the nearby residential area and 3 samples from the unpolluted area.

(Secondary samples for confirmation can be collected within 10 m2 in each sampling site).

Sampling Location	Sample Type	Points	GPS coordinates
Unpolluted (Far) near residential area	Air, water, soil, vegetation	1	N : 00° 00° 38.9° E: 000° 00° 46.6°
		2	N : 00° 00° 16.8° E: 000° 00° 46.9°
		3	N : 00° 00° 16.7° E: 000° 00° 53.2°
		4	N : 00° 00° 0.54° E: 000° 00° 16.9°
		5	N : 00° 00° 0.26° E: 000° 00° 55.7°

Table (8): GPS coordinates for SOPC (off site sampling points)

2.5.2 Hurghada landfill - Red Sea Governorate:

3 samples from the nearby residential area and 3 samples from the unpolluted area.

(Secondary samples for confirmation can be collected within 10 m2 in each sampling site).

Sampling Location	Sample Type	Points	GPS coordinates
Unpolluted (Far) near residential area	Air, water, soil, vegetation	1	N : 00° 00° 38.9° E: 000° 00° 46.6°
		2	N : 00° 00° 16.8° E: 000° 00° 46.9°
		3	N : 00° 00° 16.7° E: 000° 00° 53.2°

		4	N : 00° 00° 0.54° E: 000° 00° 16.9°
		5	N : 00° 00° 0.26° E: 000° 00° 55.7°

Table (9): GPS coordinates for Hurghada landfill (off- site sampling points)

2.5.3 Migration pathways of POPs through different environmental media:

Proper evaluation of persistent organic pollutants (POPs) should take into consideration the assessment of their potential to undergo long-range transport (LRT) from source regions. Transport in air is generally the most important mechanism, but water borne transport can be significant for some POPs. Many models have been developed to provide an assessment of chemicals' potential for LRT. These models provide rankings of transport potential for chemicals using a characteristic distance they are likely to travel or a measure of the fraction of the global environment they are likely to affect.

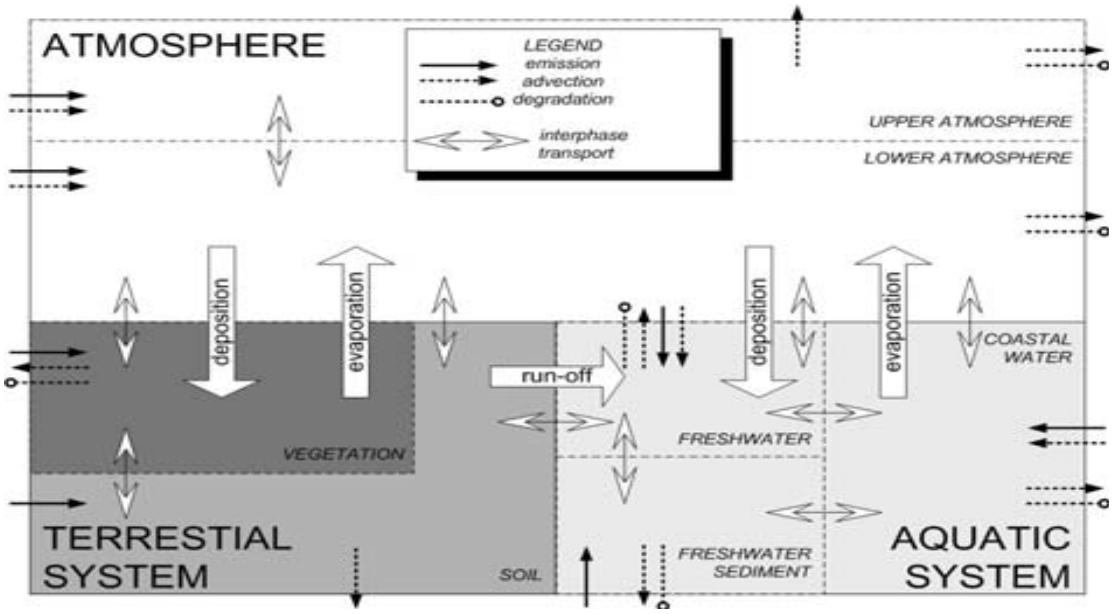

Figure (27): Migration pathways and transformation possibilities in environmental compartments.

2.5.4 Possible recipients of POPs and methods of exposure:

Main recipients of POPs are the humans, animals, plants and aquatic organisms. Humans and animals can be exposed to POPs through 3 main routes: air, food and drinking-water. The latter two sources are relevant for LRTAP. It seems likely that food accounts for the majority of the intake.

POPs in the environment pollute the food supply, especially fish, meat, butter and cheese. When people eat POPs-contaminated foods, the POPs accumulate in their fatty tissue. Mothers pass on POPs from their own bodies to their offspring. In humans and other mammals, POPs enter and contaminate the fetus while it is still in its mother's womb. Since breast milk also contains POPs, infants are further exposed to POPs while nursing. In non-mammal species, POPs are passed from the mother to offspring though the eggs. POPs have the potential to harm humans and other organisms even at concentrations that are commonly found in ordinary foods.

When POPs fall from the air, they sometimes land on the surface of water bodies, and they sometimes land on grasslands, tundra, forests or farmers' fields. In all these locations, POPs become part of the food web. When a living organism eats food that has been contaminated by POPs, the pollutant is not easily excreted, metabolized or broken down, but rather, accumulates in the organism's body tissues. This process is called bioaccumulation.
In the aquatic ecosystems, the POPs that enter from the air are initially taken up by small microorganisms. These are then eaten by larger organisms, then small fish, then large fish, and then sometimes by birds or mammals. The average concentration of POPs in a predatory species will tend to be around ten times higher than the average concentration of POPs in its prey. Since the food web has many steps, this causes bio-magnification and very high concentrations of POPs in top predator species. According to Environment Canada, POPs contaminants in the eggs of some fish-eating birds may be as much as 25 million times the concentrations found in the waters where the fish live.

2.6 Occupational safety measures:

2.6.1 Sensitive subgroups:

The International Labor organization (ILO), in paragraph 6 (1) of the afore-mentioned recommendations N0.121 defines occupational diseases as follows; "Each Member should under prescribed conditions, related diseases known to arise out of the exposure to substances and dangerous condition in process, trades, or occupations as occupational diseases".

The developing fetus is most sensitive to dioxin exposure. The newborn, with rapidly developing organ systems, may also be more vulnerable to certain effects. Some individuals or groups of individuals may be exposed to higher levels of dioxins because of their diets (e.g., high consumers of fish in certain parts of the world) or their occupations (e.g., workers in the pulp and paper industry, in incineration plants and at hazardous waste sites, to name just a few).

The workers in the petroleum refinery and in the landfill are exposed to different pollutants including the POPs; however, the levels of exposure in the work environment are unique as it usually exceeds the levels encountered in environmental pollution.

In the present study, the target population for the hazardous impact of the landfill are the workers (136 workers in the Hurghada landfill and 50 workers in the Gonaa landfill), in addition to the families within the areas near the landfill.

2.6.2 Protective Measures

To ensure health and safety for such workers, different definitions and laws were implemented, and local and global strategies were put to decision makers for further investigations and suggestions.

Waste collectors with middle age and with low level of education were at higher risk. Waste collectors should be provided with the necessary protective measures (face mask, protective gloves, overall, and rubber boot). Education and training programs should be provided to all, and routine medical check up program should be implemented and maintained, to keep them safe and secure (Milhem, 2004). He also found that it showed that 93.8% of waste collectors were not vaccinated for tetanus and 85.6% were not vaccinated for hepatitis.

Air monitoring needs to be regularly conducted at all land disposal and solid waste handling facilities. Direct reading instruments which measures methane and oxygen deficiency are of primary importance, and include combustible gas indicators, flame ionization detectors, and oxygen meters (National Institute for Occupational Safety and Health, 1985).

The following chart for SOPC shows increased numbers of persons with specific diseases that could be partially attributed to their occupational exposure:

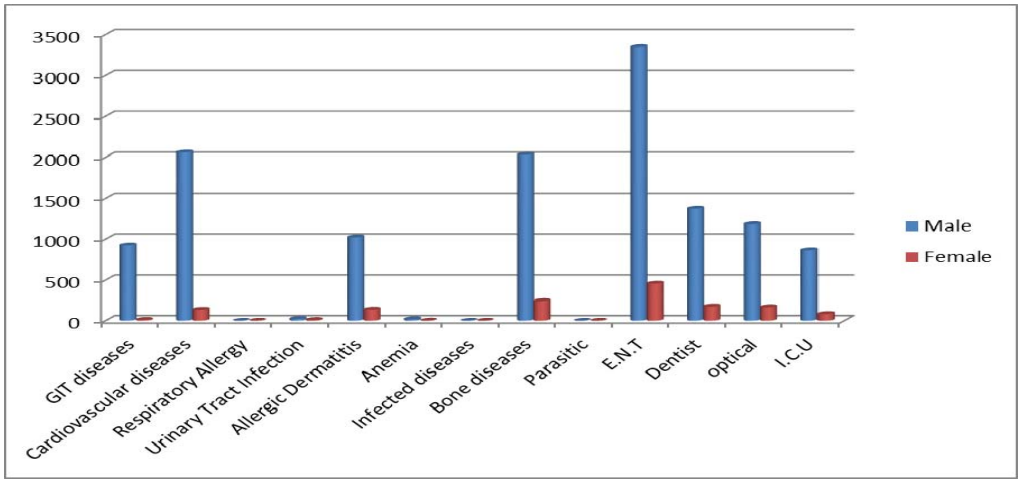

Chart (8): number of males and females in relation to different diseases in SOPC (From July to December 2010)

Although, there are different programs for Occupational Health and Safety that can be applied in the work environment to minimize the health risks and protect workers (e.g.: OSHAS 18001); but, they all have some common items as:

- Risk control measures
- Training programs

2.6.3 Risk control process

It follows a certain hierarchy of steps which is simplified in the following figure:

Figure (28): hierarchy steps for risk control

The elimination of the hazards is the most effective control measure for any hazardous chemical to remove it entirely from the workplace and replace it with a less hazardous chemical; however, this is very difficult to be applied with the effluent POPs from the petroleum refineries.

The next best solution is to enclose the resulting effluent to prevent it from coming into contact with either workers or the environment. For example, open tanks where chemical vapors can escape into the workplace air can be replaced with closed tanks with inlet and outlet ports for filling and emptying. Ventilation systems also can help in the removing of

contaminated air from the workplace; however, it remains difficult to avoid pollution of the environment.

The Personal protective equipment (PPE) is used as the last and least effective method of protection and is often uncomfortable or difficult to work with; it includes: gloves, rubber boots, plastic or rubber overalls and aprons, respirators; and dust masks.

2.6.4 Training programs:

Workers sensitization to risks caused by chemical products is the key to being able to prevent these risks. To identify the sensitization and capacity needs and to attune training accordingly it is necessary to know the perception and knowledge workers have about chemical risk.

The training program should include the following topics:

- Types of exposure to POPs within the facility.
- Possible health hazards due to exposure to POPs.
- How to use the appropriate PPEs.
- Maintenance of the PPE.

The training program should be conducted on a regular basis and also being tailored according to the type of audience in Hurghada landfill (90% of the workers read and write only) and in SOPC as it has different categories of employees with 19% of them had higher education. So, the training modules should be adapted to the needs of the employees.

2.6.5 Prevention and control of dioxin exposure:

Proper incineration of contaminated material, recycling of wastes and flare gas recovery is the best available method of preventing and controlling exposure to dioxins. The incineration process requires high temperatures, over 850°C. For the destruction of large amounts of contaminated material, even higher temperatures - 1000°C or more - are required.

Prevention or reduction of human exposure is best done via source-directed measures. This is the responsibility of national authority, but in recognition of the importance of this approach, the Codex Alimentarius Commission adopted in 2001 a Code of Practice for Source Directed Measures to Reduce Contamination of Foods with Chemicals (CAC/RCP 49-2001), and in 2006 a Code of Practice for the Prevention and Reduction of Dioxin and Dioxin-like PCB Contamination in Food and Feeds (CAC/RCP 62-2006).

2.7 Implications and measures of environment and human health impacts

Petroleum refiners are common point sources of some types of POPs as PCDD/Fs and PAH and the monitoring of air and water emissions from the petroleum refinery helps much to identify and control those hazardous pollutants.

2.7.1 Main sources of POPs in SOPC:

- Mostly from the flare headers
- Rest of emissions from the waste sources:
    - Oil contain drilling mud and waste and oily and grease waste
    - Waste from washing and removal grease and machinery maintenance
    - Waste paint, varnish, ink, adhesive, sealants contain solvent
    - Waste from laboratory chemicals
    - Spent ion exchange resins
    - Waste organic solvent
    - Sludge's from tank storage contain oil or chemical
    - Absorbent , wiping clothing , filter material and protective clothing contaminate with hazardous waste or material
    - Packaging contain residue contaminated by dangerous substance

2.7.2 Criteria and monitoring for Sanitary landfills:

Criteria:

The persistent organic pollutants (POPs) are one of the most common emissions from open burning of waste including burning of landfills.

A sanitary landfill must be carefully designed structure built into or on top of the ground in which waste is isolated from the surrounding environment (groundwater, air, soil). The modern landfill offers much more protection for the environment and for local people than traditional dumps did. Problems with odours, litter, vermin, etc., are greatly reduced by the careful management of the site.

Monitoring:

Landfill site must be monitored on a regular basis to make sure it is being run efficiently and safely. The responsibility for this monitoring rests with the EEAA and landfill operators themselves. This process begins after the application for a waste license. Monitor of various aspects of the site is needed to ensure they remain in compliance with their license.

All landfill operators must apply to the EEAA instructions and requirements to satisfy a number of criteria, including the kind of monitoring they will undertake. Different sites will be required to monitor for different pollutants, depending on the location and potential environmental impact of their sites.

Landfill gases, such as methane, carbon dioxide and sulphur dioxide are produced by the breaking down of waste and can cause pollution and odour problems. Analysis for organic pollutants such as pesticides and chlorinated chemicals such as dioxin and furan in leachate samples must be done regularly. Groundwater must be sampled and tested for the presence of leachate chemicals. Monitoring is also carried out for dust, noise pollution, ordour and emissions to sewers, including leachate analysis.

Monitoring must also fulfill the landfill sites design; as the present landfill site is designed to deal with inert waste only, such as domestic and agriculture solid wastes, soil, stones and contruction/demolition waste. EEAA must review the application form during monitoring of the landfills, and can prohibit a landfill from accepting certain kinds of waste; such as industrial hazardous wastes as well as biomedical wastes, according to the provisions set out in the application to prevent the risk of environmental pollution.

2.7.3 Possible recipients of POPs and methods of exposure:

Main recipients of POPs are the humans, animals, plants and aquatic organisms. Humans and animals can be exposed to POPs through 3 main routes: air, food and drinking-water. It seems likely that food accounts for the majority of the intake.

POPs in the environment pollute the food supply, especially fish, meat, butter and cheese. When people eat POPs-contaminated foods, the POPs accumulate in their fatty tissue. Mothers pass on POPs from their own bodies to their offspring. In humans and other mammals, POPs enter and contaminate the fetus while it is still in its mother's womb. Since breast milk also contains POPs, infants are further exposed to POPs while nursing. In non-mammal species, POPs are passed from the mother to offspring though the eggs. POPs have the potential to harm humans and other organisms even at concentrations that are commonly found in ordinary foods.

When POPs fall from the air, they sometimes land on the surface of water bodies, and they sometimes land on grasslands, tundra, forests or farmers' fields. In all these locations, POPs become part of the food web. When a living organism eats food that has been contaminated

by POPs, the pollutant is not easily excreted, metabolized or broken down, but rather, accumulates in the organism's body tissues. This process is called bioaccumulation.

In the aquatic ecosystems, the POPs that enter from the air are initially taken up by small microorganisms. These are then eaten by larger organisms, then small fish, then large fish, and then sometimes by birds or mammals. The average concentration of POPs in a predatory species will tend to be around ten times higher than the average concentration of POPs in its prey. Since the food web has many steps, this causes bio-magnification and very high concentrations of POPs in top predator species. According to Environment Canada, POPs contaminants in the eggs of some fish-eating birds may be as much as 25 million times the concentrations found in the waters where the fish live.

2.7.4 PCDD/Fs

They are commonly known as dioxins and furans, and they comprise a large group of chemical compounds of high environmental interest. The total PCDD/Fs emitted to the atmosphere are not yet defined; however, the primary source of those pollutants is the combustion of solid wastes in addition to the secondary sources as petroleum refineries and combustion of wood.

Toxicity

PCDD/Fs are usually found in the environment as mixtures of several congeners, whose individual toxicity can vary in a 1000-folder magnitude for health and environmental impacts.
In order to express PCDD/F concentration, Toxic Equivalents (TEQ) are calculated as the summation, for all the congeners

Health effects

The US EPA has being studying the PCDD/Fs carcinogenicity since mid-eighties of the 20th century, on the basis of animal models, and human data from industrial exposures and accidents. Dioxins are classified by US EPA as Group B2 (sufficient evidence in animals, insufficient evidence in humans) when considered alone, but complex mixtures of dioxin and related compounds (i.e., chlorophenols and phenoxyherbicides) are considered "likely to be carcinogenic to humans" (Group B1).
With respect to non-cancer effects, acute exposure to PCDD/Fs can cause a variety of harmful effects over the reproductive, developmental, immunological, and endocrine systems.

Bioaccumulation

PCDD/Fs can bio-accumulate very easily in the human body because they present a high solubility in lipids. PCDD/F retention by lipids is also linked to bio-magnification of dioxins and furans in the food chain, whose final step is human diet. In turn, maximum values of 63% were reported studying PCDD/Fs absorption through the digestive tract.

Persistence

PCDD/Fs are very persistent in the environment. These compounds can be adsorbed very easily by particles present in air, soils and sediments, and according to the WHO, this powerful absorption makes mobilization as negligible. With respect to degradation processes, photolysis and microbial decomposition have been pointed out as the most influent mechanisms of PCDD/F loss, especially in air but also in vegetation; even though, very high half-lives have been suggested in all environmental compartments.

Long-range transport:

Although some PCDD/Fs have complex structures, their capacity to be adsorbed by air particulate matter lets them travel to affect environments far away from the emission sources. Most PCDD/F emissions tend to be transported beyond 100 km from where they were released.

What does it take to identify and measure dioxins in the environment and food?

The quantitative chemical analysis of dioxins requires sophisticated methods that are available only in a limited number of laboratories. The analysis costs are very high and vary according to the type of sample, but range from over US$ 1700 for the analysis of a single biological sample to several thousand US dollars for the comprehensive assessment of release from a waste incinerator.

Increasingly, biological (cell- or antibody) -based screening methods are being developed. Nevertheless, such screening methods will allow more analyses at lower cost. In case of a positive screening test, confirmation of results must be carried out via more complex chemical analysis.

2.7.5 Recommendations:

Reducing dioxin exposure is an important public health goal for disease reduction. In order to give guidance on acceptable levels of exposure, WHO has held a series of expert meetings to determine a tolerable intake of dioxins to which a human can be exposed throughout life without harm.

In responding to the needs of the Stockholm Convention on POPs, a number of actions should be considered to reduce the production of dioxins during incineration. Use technology that allows for controlled waste incineration with low emissions.

In order to understand whether and how future policy decisions will influence dioxin-related health risks, it is critical to identify and assess the nature of any historical temporal trends that relate sources to exposures in the general population. Such information should lead to more informed decisions regarding the gain in health benefits associated with the cost of current and additional regulatory controls. This paper provides a review of temporal trends in quantified dioxin emissions from industrial and non-industrial sources, dioxin levels in the environment and foods, and dioxin body burdens of the general population. This review also summarizes regulatory agencies_ assessments of tolerable exposures to dioxin and provides a critical comparison of recent U.S. and international assessments of dioxin hazards. We integrate the information on exposure trends and international hazard assessments to provide perspective on past, current, and future risks of general population exposure to dioxin.

3 – SOCIO - ECONOMIC AND PUBLIC PARTICIPATION ASSESSMENT

3.1 Summary

POPs use and reduction have very important social and economic implications. As can be seen from the next figure, the interaction between the POPs and the surroundings including the socio-economic setting, lie in 5 main areas:

- Production
- Uses
- Emissions
- Stockpiles
- Polluted sites (hot spots)

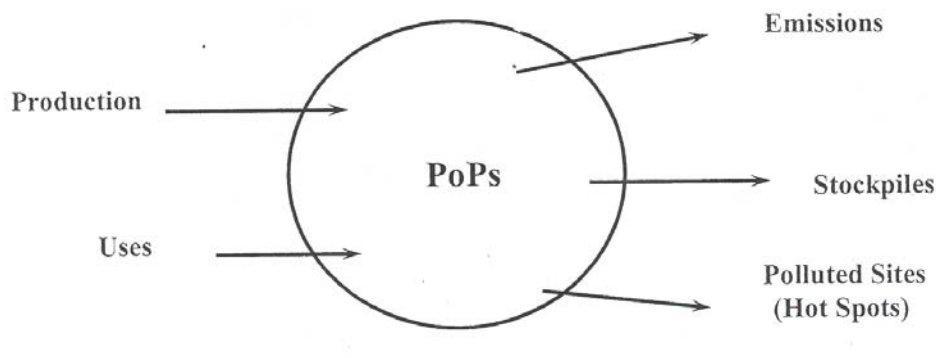

Figure (29): Social and economic implications use and reduction of pops

The UP- POPs sources would have drastic negative impacts on human health as well as on the environment unless suitable mitigation measures are taken. Such measures would necessitate intensive and informed social participation (in addition to government entities) and sufficient funding to economically (cost-effectively) implement appropriate mitigation measures.

As stated in Article 10 of the Stockholm Convention, stakeholder awareness on consequences, requirements and practices for applying effective measures to reduce or eliminate releases from an unintentional production of POPs needs to be continuously raised.

Moreover, without the GEF support and public participation of all concerned parties, addressing all these issues and corrective actions would not be facilitated and promoted. Provision of vital scientific as well as socio-economic data to politicians and policy makers is generally inadequate due to the following:

(a) Lack of effective tools to communicate appropriate messages in a form that is easily understood.
(b) Lack of adequate resources for them to undertake outreach and public participation programmes.
(c) Lack of awareness among decision makers on the importance of public participation to implement the provisions of the Convention.

About the landfill, all the workers (136 workers), in addition to a sample representing the population in the nearby residential area are target for the programme of raising awareness of POPs issues related to human health and how to protect against it.

The public awareness plan should include development and initiation of a sustainable and periodic POPs information dissemination system for the public and for government stakeholders and decision-makers, including non-governmental organizations (NGOs) and media representatives.

According to Article 10 of the Stockholm Convention and according to the situation in the Suez Oil Processing Company, the target groups are about 4349 workers and their families including their children, who are residentially nearby the company in addition to a sample representing the population in the nearby residential area. They are particularly sensitive for POPs. Also the stockholders and the managerial staff of the company will be included as a target group; as their role is important for the successful implementation of the Convention.

According to the educational levels of the target workers in the Suez Oil Processing Company and Hurghada landfill, there is need of manuals in the Arabic language on public inventories of banned and obsolete POPs, their eco-toxic properties and rules of their safe application. The manuals must be depend mainly on pictures specially in the issue of safety and protective measures, as well as the proper handle for these exposures, to be accepted by the workers (especially those read and write only) .

About the landfill, all the workers (136 workers), in addition to a sample representing the population in the nearby residential area are target for the programme of raising awareness of POPs issues related to human health and how to protect against it.

This information should be put in an efficient system that will ensure its dissemination in a sustainable manner, and must highlight the issues of health and health related impacts of dioxins/furans being unintentionally released into the environment.

In this respect, Egypt is preparing a plan for the awareness and education of the public concerning the POPs. This plan is also prepared for authorities and decision makers, for women and children and it will be presented in special workshops, in which heads of competent authorities and woman and child organizations will participate. The plan also includes training of workers, employees and administrators on how to manage POPs in the way of reducing their effects on human health and environment.

Engage local NGOs into primary inventories and proper handle of banned POPs; particularly for the general populations in the residential areas nearby SOPC and the landfill, to develop a reference manual for local NGOs based primary how to discharge materials that release furan and dioxin during burning in the landfill and proper replacement of these materials by safer ones.

Prepare training and awareness-raising materials and technical guidelines to promote environmentally sound management and assist stakeholders to dispose of POPs materials in a manner compatible with the Convention.

Hold training and information meetings to disseminate information and guidance to national and provincial officials and for key stakeholders that possess POPs wastes requiring, or likely to require, disposal or who operate disposal facilities.

Benefit cost analysis of BAT/BEP implementation:

Due to the application of BAT/BEP the atmospheric pollutants of local impact and Un- POPs releases will be reduced, also less greenhouse gas emissions.

Environmental benefits: The project activity and the application of BAT/BEP will save fusil fuel and thus reduces GHG emission as compared to baseline for SOPC, further by recovering flared gases, thermal pollution at the vicinity of the plant is avoided, and Un- POPs releases will be reduced, and the same result will be fro Hurghada landfill.

Economical benefits: The project will contribute towards creation of new jobs by utilizing the waste flared gases in the production processes to increase the productivity of SOPC, and by recycling solid wastes in landfill processes to produce useful new products.

Social benefits: The project helps to improve livelihood of the local people by creating opportunities for jobs, job enhancement, and establishment of new public gardens.

Technological benefits: The project activity implements energy efficient technology and thus promoting fossil full conservation through adoption of advanced energy efficient technology at SOPC, and new recycling technology for the sanitary landfill.

3.2 Background

The work to disseminate POPs information coinciding with Article 10 of the Stockholm Convention on Persistent Organic Pollutants emphasizes public awareness and environmental information through awareness and educational programs. The Convention states the following:

- Each Party shall, within its capabilities, promote and facilitate:
    - Awareness among its policy and decision makers with regard to persistent organic pollutants;
    - Provision of all available information on persistent organic pollutants to the public, taking into account paragraph 5 of Article 9
    - Development and implementation, especially for women, children and the least educated, of educational and public awareness programmes on persistent organic pollutants, as well as on their health and environmental effects and on their alternatives
    - Public participation in addressing persistent organic pollutants and their health and environmental effects and in developing adequate responses, including opportunities for providing input at the national level regarding implementation of this Convention;
    - Training of workers, scientists, educators and technical and managerial personnel;
    - Development and exchange of educational and public awareness materials at the national and international levels
    - Development and implementation of education and training programs at the national and international levels.
- Each Party shall, within its capabilities, ensure that the public has access to the public information referred to in paragraph 1 and that the information is kept up-to-date.
- Each Party shall, within its capabilities, encourage industry and professional users to promote and facilitate the provision of the information referred to above at the national level and, as appropriate, sub regional, regional and global levels.
- In providing information on persistent organic pollutants and their alternatives, parties may use safety data sheets, reports, mass media and other means of communication, and may establish information centers at national and regional levels.
- Each Party shall give sympathetic consideration to developing mechanisms, such as pollutant release and transfer registers, for the collection and dissemination of information on estimates of the annual quantities of the chemicals listed in Annex A, B or C that are released or disposed of.

On the other hand, Law 4/1994 which was amended by Law 9/2009 (Article 5 about EEAA responsibilities) supports these issues where it emphasizes public awareness and environmental information through awareness and educational programs as follows:

- Preparing programs for the environmental education of the public and assisting in their implementation.

- Participating with the Ministry of Education in the preparation of training programs for the protection of the environment within the scope of the various curricula in the basic educational stage.
- Collecting and publishing national and international information related to the environment on a periodic basis in cooperation with information centers of other agencies. They should also evaluate and utilize this updated information on environmental management and planning.
- Preparing and publishing periodic reports on important environmental indicators.

Preparing programs for public environmental education and soliciting their cooperation in the implementation of environmental initiative

There is a lack of information relating to socio-economic considerations associated with the introduction of new industrial control measures to inform the industries and local governments on decisions that need to be undertaken and their impact to the communities in the coasts. Such information should reflect the different capabilities and changing conditions among the participating countries to accommodate the socio- economic effect of new technologies.

3.3 Detailed description of target groups

Formation and release of dioxins and furans are likely to occur during the process in the Suez Oil Processing Company and in the landfill.

According to Article 10 of the Stockholm Convention and according to the situation in the Suez Oil Processing Company, the target groups are about 4349 workers and their families including their children, who are residentially nearby the company. They are particularly sensitive for POPs. Also the stockholders and the managerial staff of the company will be included as a target group; in addition to a sample representing the population in the nearby residential area also the importance of participation of public and citizen advocacy groups and NGOs as their role is important for the successful implementation of the Convention.

About the landfill, all the workers (136 workers), in addition to a sample representing the population in the nearby residential area are target for the programme of raising awareness of POPs issues related to human health and how to protect against it.

Public Awareness Plan

The plan should include development and initiation of a sustainable and periodic POPs information dissemination system for the public and for government stakeholders and decision-makers, including non-governmental organizations (NGOs) and media representatives.

The public should also be informed about POPs pollution. This would support active participation as people become aware of their contribution to the pollution problem (e.g. landfills, vehicles, chemicals and petroleum industry). In addition, informed and aware individuals would take precautions to protect themselves and their families when they understand the health hazards they face.

The purpose of this plan is to create a sustainable system to disseminate technical and general information to the broad range of audiences. Such a system will guarantee that the information would be disseminated on a regular basis especially for target groups. The plan includes steps to be taken by EEAA Regional Branches to ensure implementation of the plan, starting with the information that should be disseminated to the public on a daily basis.

3.4 Detailed description of adequate and effective tools for awareness raising

One of the major goals of POPs enabling activities is to raise public awareness at different levels across the board in order to bring full participation of all relevant stakeholders and also the public at large, including women and school children. The Government is giving greater attention to this aspect as long as public awareness and understanding of POPs is vital for human health.

The Audiences for Information Dissemination Diagram was designed illustrating the influence of the media, scientific and academic communities, senior political NGOs and influential group on information dissemination to the primary target groups and decision–makers. At this stage the information would be available for dissemination to the general public including educating it to school children as shown in figure( ).

The cooperation among EEAA and competent authorities including NGOs in the field of public awareness is very important.

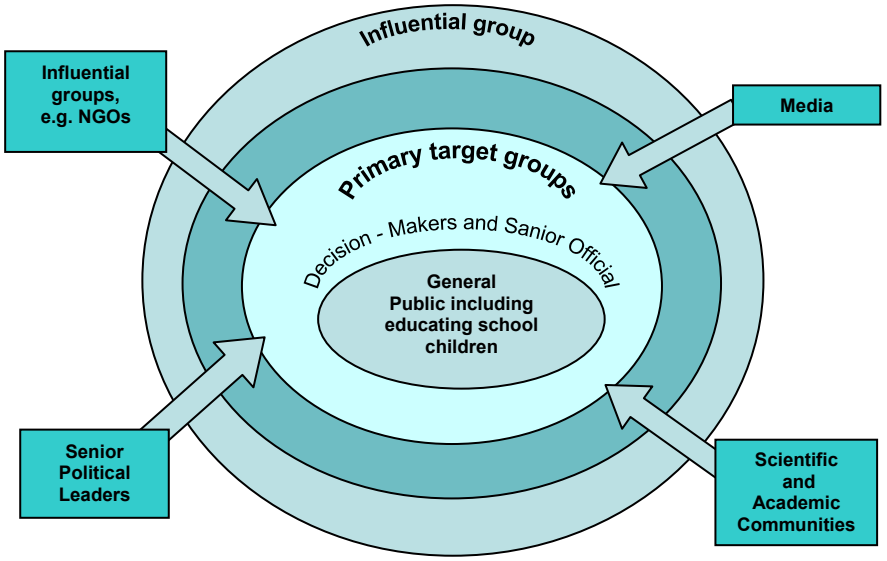

Figure (30): Public awareness schematic

EEAA website (www.eeaa.gov.eg/egpops) is one of the tools used for promoting pubic awareness and the other important tool is the use of NGOs that are already playing an important role in Egypt on various issues related to environmental protection. As any misinformation could cause more damage than “no information”, the Government is giving emphasis to multidisciplinary teams under one umbrella to collect information, verify the validity of information especially in sensitive areas connected to, among others, agriculture, trade, tourism and public health matters. It also recognizes that Egypt lacks information on actual data coming from environmental, human and aquatic matrices, and the capacity to measure actual emissions of unintentional POPs from various categories implicated in Stockholm Convention. This is one of the major areas of Egypt’s need for capacity building so that cleaner production programs could be initiated by application of BAT / BEP in different industrial categories and the actual situation for information collection and dissemination could be clarified as it exists in Egypt.

Preparation of common projects and activities to increase the public awareness of POPs issues related to human health determine must be conducted in conjunction with manager stakeholders, in particular to the target groups. This project includes appropriate educational schemes to raise the awareness of the hazard posed by the inappropriate use and management of POPs chemicals in public health programmes. Devise appropriate programmes and materials can be delivered, for example through the public health network, to promote the safe handling and use of those POPs chemicals remaining in use, environmentally sound alternatives to POPs, or integrated disease management techniques minimizing or eliminating the need for POPs chemicals.

Finally, public awareness staff should use any of the success stories in the public awareness programs. In addition, they should arrange for representatives of appropriate institutions to appear on TV and radio programs or to be interviewed for newspaper and magazine articles to present information about POPs effect on human health and environment, and how to avoid their effect.

3.4.1 Preparation of manuals in the Arabic language:

According to the educational levels of the target workers in the Suez Oil Processing Company (Chart3), and Hurghada landfill, there is need of manuals in the Arabic language and workshops on public inventories of banned and obsolete POPs, their eco-toxic properties and rules of their safe application. The manuals must be depend mainly on pictures specially in the issue of safety and protective measures, as well as the proper handle for these exposures, to be accepted by the workers (especially those read and write only) .

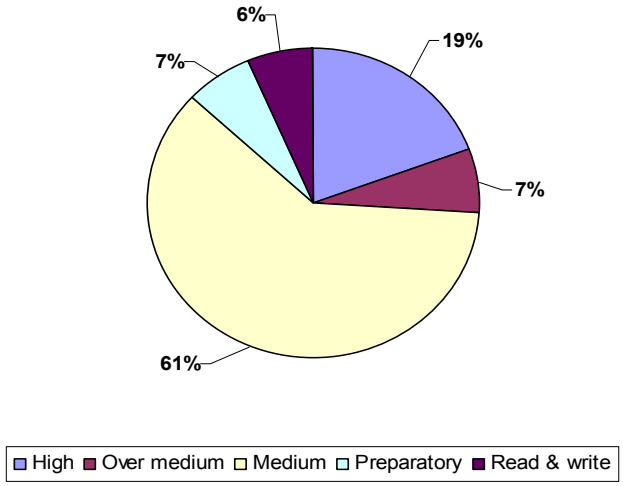

Chart (9): Distribution of the target population in Suez Oil Processing Company according to their education levels

About the landfill, all the workers =136 workers (about 90% of them read and write only), [125 worker, 5 security persons, 5 supervisors and 1 responsible person from the contractor]), in addition to a sample representing the population in the nearby residential area are target for the programme of raising awareness of POPs issues related to human health and how to protect against it.

Such information must highlight the issues of health and health related impacts of dioxins/furans being unintentionally released into the environment. But, assessment of the public awareness and participation opportunities and prepare recommendations must precede the design of the programme for increasing awareness and participation. Environmental and agriculture specialists must be involved in preparation of these manuals; according to their sufficient professional experience in that field.

The Scientific material concerned with raising awareness of the different public categories, including woman and children must include;

- Identification of types and hazards of POPs
- Source categories for UP-POPs
- Preventive measures and treatment
- Symptoms and indicators of children poisoning with these chemicals
- Elderly people poisoning
- First aid in case of poisoning.
- General principles to be taken into consideration in cases of poisoning
- Symptoms of poisoning.
- Guidelines for prevention of poisoning.
- Pollutions which results from interior combustion
- General actions to be taken into consideration in cases of poisoning with chemicals
- Domestic advice
- Importance of using PPE.

In this respect, Egypt is preparing a plan for the awareness and education of the public concerning the POPs. This plan is also prepared for authorities and decision makers, for women and children and it will be presented in special workshops, in which heads of competent authorities and woman and child organizations will participate. The plan also includes training of workers, employees and administrators on how to manage POPs in the way of reducing their effects on human health and environment.

In order to increase awareness at the national level for those who are dealing with pops, the system data network has been connected with the internet in which any information on hazardous substances is available; furthermore data on hazardous substances found on the database of the system can be printed.

3.4.2 Establish pilot training programme:

Establish pilot training programme to facilitate national expert group meeting to reach consensus on key technical and logistical issues and to promote awareness of POPs issues. Each pilot programme shall conduct workshops to raise awareness of POPs health and safety issues, inventory, management, storage and destruction methods and techniques for key stakeholders.

Hold meetings to raise stakeholder awareness and to gain their support in the preparation and promotion of the training programme for raising awareness. Awareness of the Convention amongst stakeholders has been raised through a series of workshops organized during the preparatory phase. Representatives from all different government departments viz. health, agriculture, electricity, power, municipal corporations, chemical and fertilizers as well as representatives from industry, non-governmental organizations (NGOs), research and educational institutions attended these workshops.

The Convention also obliges Parties to promote and facilitate public awareness and education, especially for women, children and the least educated. The project contains provision for the development of public awareness strategies and educational materials.

Develop sustainable awareness programme

Develop a proposal for a permanent, sustainable training programme to address all aspects of POPs identification, inventories, analysis and disposal work. In addition, put identification posters of POPs health, safety issues, storage and destruction methods of POPs in clear suitable sites.

3.4.3 Engage local NGOs:

Engage local NGOs into primary inventories and proper handle of banned POPs; particularly for the general populations in the residential areas nearby SOPC and the landfill, to develop a reference manual for local NGOs based primary how to discharge materials that release furan and dioxin during burning in the landfill and proper replacement of these materials by safer ones.

3.4.4 Engorgement examples in other countries:

Engorgement examples of best practice in other countries for methodologies useful in the country to devise appropriate awareness raising programmes and materials that can be delivered in conjunction with schemes to promote the improved performance of industry.

3.4.5 Conjunction of best practice with POPs in the educational schemes:

Determine, in conjunction with the national and local government, municipalities, relevant ministries and their development partners and other stakeholders, appropriate educational schemes; specially primary educational schemes, to raise the awareness of administrations, industry and the public of the hazards posed by the inappropriate disposal of wastes comprising POPs or products containing POPs.

3.5 Detailed description of information content dissemination approach

Information Dissemination System Components:

This information should be put in an efficient system that will ensure its dissemination in a sustainable manner. The following subjects should be included in the communication system, shown in (Figure 23). These subjects are:

- Deciding what information should be disseminated to target groups
- Defining roles and responsibilities of each sector, department, or unit within the responsible authorities
- Agreeing on the flow of information to reach the appropriate target groups in a timely manner
- Developing an information release plan to communicate each type of information to target groups
- Proposing a framework to disseminate different types of information (including specific tasks and activities)

Prepare training and awareness-raising materials and technical guidelines to promote environmentally sound management and assist stakeholders to dispose of POPs materials in a manner compatible with the Convention.

Hold training and information meetings to disseminate information and guidance to national and provincial officials and for key stakeholders that possess POPs wastes requiring, or likely to require, disposal or who operate disposal facilities.

Finally, public awareness staff should use any of the success stories in the public awareness programs. In addition, they should arrange for representatives of appropriate institutions to appear on TV and radio programs or to be interviewed for newspaper and magazine articles to present information about POPs effect on human health and environment, and how to avoid their effect.

An important aspect of participation is empowerment through capacity building, public awareness and education, particularly in those groups most at risk from exposure to POPs chemicals. Capacity building that started during the preparatory phase of the project will continue. A technically sound, feasible and knowledge based approach that satisfies the needs of all concerned stakeholders will be developed.

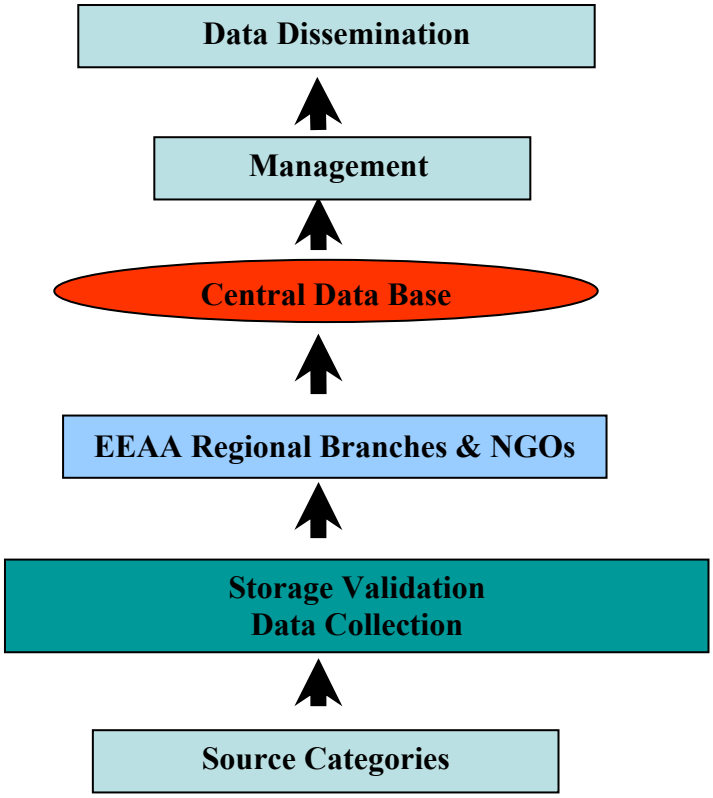

Figure (31): Schematic process of data dissemination

Assess opportunities to encourage industry compliance with Convention objectives and obligations through market-led voluntary approaches, such as Cleaner Production, ISO accreditation or eco-labelling initiatives. Assess opportunities to encourage voluntary compliance with Convention objectives and obligations amongst users of POPs chemicals through the take-up of integrated POPs management and improved health awareness.

However, considering the scale of work to be undertaken and the limited duration and financial resources available, it is not feasible to address all the items of capacity building requirements in terms of the Convention within the full project. In order to do this, the government and non-government agencies as well as individuals working for environment must come together and create awareness at all levels in the society. In addition, special training programmes on train the trainers must be conducted so that they in turn can educate all concerned stakeholders.

3.6 Benefit cost analysis of BAT/BEP implementation

There is a lack of information relating to socio-economic considerations associated with the introduction of new industrial control measures to inform the industries and local governments on decisions that need to be undertaken and their impact to the communities in the coasts.

Such information should reflect the different capabilities and changing conditions among the participating countries to accommodate the socio- economic effect of new technologies.

The UP- POPs sources would have drastic negative impacts on human health as well as on the environment unless suitable mitigation measures are taken. Such measures would necessitate intensive and informed social participation (in addition to government entities) and sufficient funding to economically (cost-effectively) implement appropriate mitigation measures.

Some steps have already been started in this direction through EEAA. Efforts have been made to initiate work on the much needed public awareness required to arouse sufficient social involvement. This was made by inviting media and civil society organizations to actively participate in most of the workshops and public activities.

On the other hand, economic implications would require some sort of cost/benefit analyses since at least, the social cost of POPs – induced pollution is related to environmental and public health factors that are rather difficult to quantify.

Also much more intensive public and media involvement will be induced to ensure full participation of the civil society, and anticipated consequent positive social, health and environmental impacts will be required.

Expected environmental and socio – economic benefits

Due to the application of BAT/BEP the atmospheric pollutants of local impact and Un- POPs releases will be reduced, also less greenhouse gas emissions.

Environmental benefits:
The project activity and the application of BAT/BEP will save fusil fuel and thus reduces GHG emission as compared to baseline for SOPC, further by recovering flared gases, thermal pollution at the vicinity of the plant is avoided, and Un- POPs releases will be reduced. and the same result will be fro Hurghada landfill.

Economical benefits:

The project will contribute towards creation of new jobs by utilizing the waste flared gases in the production processes to increase the productivity of SOPC, and by recycling solid wastes in landfill processes to produce useful new products.

Social benefits:

The project helps to improve livelihood of the local people by creating opportunities for jobs, job enhancement, and establishment of new public gardens.

Technological benefits:

The project activity implements energy efficient technology and thus promoting fossil full conservation through adoption of advanced energy efficient technology at SOPC, and new recycling technology for the sanitary landfill.

Further the trainings imparted to the employees to make them familiar with the technology will not only improve the technical skills but will also have a contribution towards enhancing their soft skills.

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Annex (1): Stakeholders Contacted in the Survey:

The concerned Ministries:

- Ministry of Petroleum.
- Ministry of Health.
- Ministry of Labor Force and Immigration.
- Ministry of State for Environmental Affairs

Governorates:

- Suez Governorate.
- Red Sea Governorate.

Agencies and Authorities:

- Egyptian Environmental Affairs Agency (EEAA).
- Egyptian General Petroleum Corporation.
- Central Agency for Public Mobilization and statistics (CAPMAS)

EEAA Regional Branches:

- Regional Branch for East Delta.
- Regional Branch for Red Sea Governorate.

Companies:

- SOPC

Annex (2): Some Pictures from SOPC:

Figure (32): Distillation unit

Figure (33): Charcoal unit

Figure (34): Hydrogen unit

Figure (35): Sulpher unit

Figure (36): Training Center

Annex (3): Calculations

Calculation Table of PCDD / PCDF Emissions

Category 6 – Open Burning Processes

B. Waste Burning and Accidental Fires

Governorate/City	Production t/year▫	Classification	Emission Factor µg TEQ/t of material burned					Emission g TEQ/a				
			Air	Water	Land	Product	Residue	Air	Water	Land	Product	Residue
Red Sea	237250	1-Landfill fires	1000		600		[600]	237.25		142.35		[142.35]
Hurghada	73000	1-Landfill fires	1000		600		[600]	73.00		43.80		[43.80]

▫Ws suppose that 50% of the total amount were burnt.

Calculation Table of PCDD / PCDF Emissions

Category 9 – Disposal / Landfill

A. Landfills and Waste Dumps

Governorate/City	Production t/year▫	Classification	Emission Factor pg TEQ/L in water & µg TEQ/t in Residues Disposed of					Emission g TEQ/a				
			Air	Water	Land	Product	Residue	Air	Water	Land	Product	Residue
Red Sea	237250	2-Non-hazardous wastes	NA	30	NA	NA	6		0.0007			1.4235
Hurghada	73000	2-Non-hazardous wastes	NA	30	NA	NA	6		0.0002			0.4380

▫Ws suppose that 50% of the total amount were disposed
▫Ws suppose that the leachate represents about 10% of the total amount.

Calculation Table of PCDD / PCDF Emissions

Category 7 – Production and Use of Chemicals and Consumer Goods

C. Petroleum Industry (Refineries)

Governorate/ Company	Amount of Gas Burned (m^3 /year	Classification	Emission Factor µg TEQ/ m^3 of gas burned			Emission g TEQ/a		
			Air	Water	Residue	Air	Water	Residue
Suez	210829591	Flares	0.0003	ND	ND	0.063249	ND	ND
SOPC	87600000	Flares	0.0003	ND	ND	0.02628	ND	ND

- 1 ft^3 = 0.028 m^3.
- For Suez Governorate, the amount of gas burned =7529.62825 x 10^6 ft^3/year = 210.829591 x10^6 m^3/year.