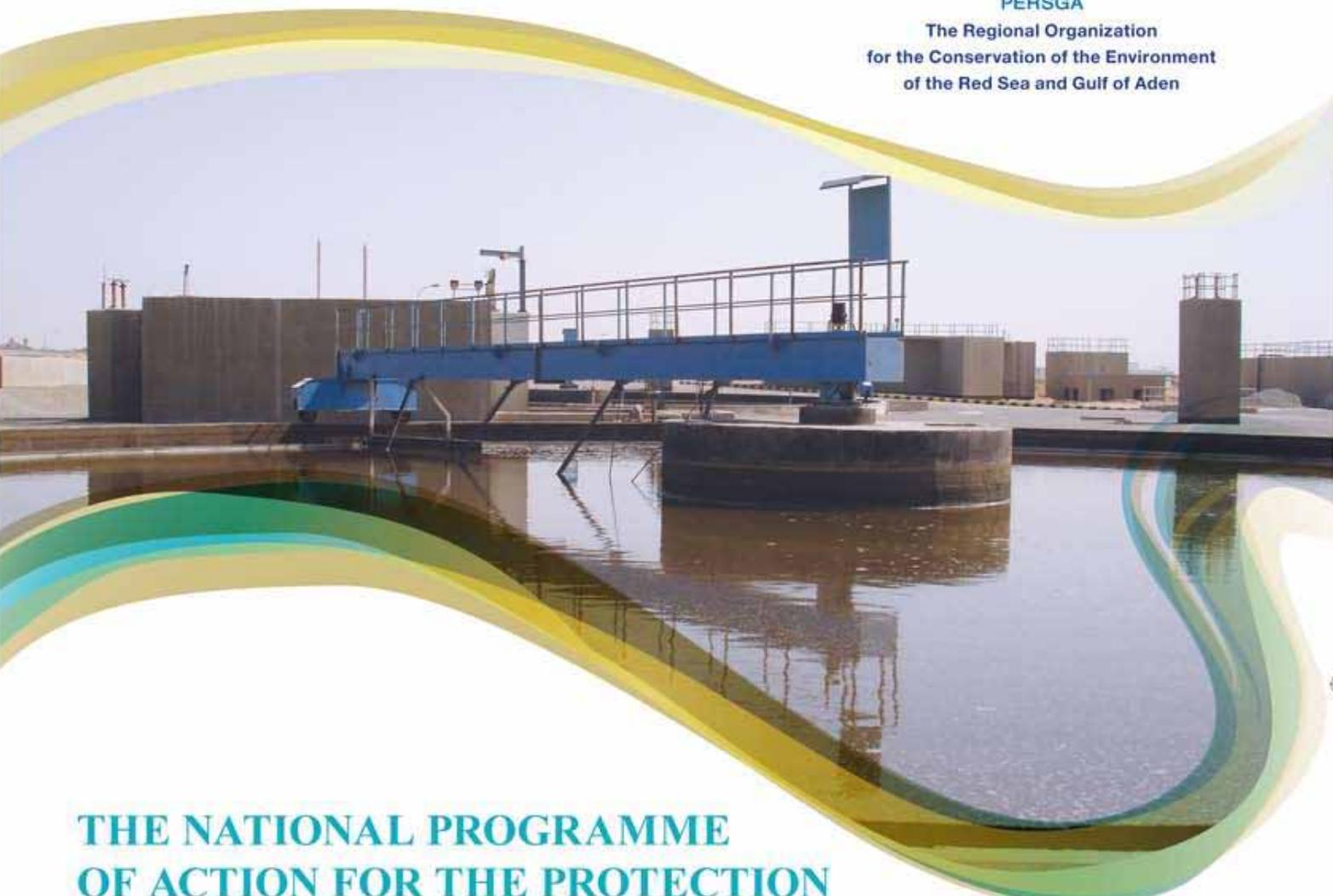




PERSGA

The Regional Organization
for the Conservation of the Environment
of the Red Sea and Gulf of Aden



THE NATIONAL PROGRAMME OF ACTION FOR THE PROTECTION OF THE MARINE ENVIRONMENT OF THE SAUDI ARABIAN RED SEA COAST FROM LAND-BASED SOURCES



Presidency of
Meteorology and Environment
Kingdom of Saudi Arabia

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The Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden

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Kingdom of Saudi Arabia**

2011



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PREFACE

The Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA) is devoted to the protection of the marine environment from all sources of pollution and for ensuring the sustainable use of marine resources and the sustainable services provided to the community. This is only possible through the effective control of various types of pollution to the coastal and marine system. It is well documented that more than 75% of pollution affecting the marine environment comes from sources on land. Based on that premise, PERSGA established the LBA (Land-based Activities) program which aims to eliminate all land-based sources of pollution to the Red Sea and Gulf of Aden. PERSGA has been successful in facilitating the preparation of National Action Plans (NPAs) for LBA in all its member states.

Each NPA is tailored to suit the needs and capabilities of each individual state. The Kingdom of Saudi Arabia has a long and enviable record of incorporating environmental protection into its development initiatives as the government recognizes the importance of healthy ecosystems for long term sustainable growth. This is epitomized in the mandate and activities of the Royal Commission for Jubail and Yanbu which oversees the development and environmental management of these two key industrial cities.

The Presidency of Meteorology and Environment (PME) is the authority charged with oversight and prevention of terrestrial and marine pollution. Exacting standards and quality control measures have been set for the release of gaseous and liquid discharges to the environment; monitoring of emissions is a crucial activity to determine that the maximum limits for pollutant discharges are not exceeded. In general, improvements are being made, especially in the area of domestic wastewater treatment. According to the NPA report, the new National Water Company plans to upgrade existing facilities, develop new ones, and work towards a goal of 80% water reuse or recycling within the next ten years.

This National Plan of Action for the Kingdom of Saudi Arabia highlights the priority issues and actions required at the national level to deal with these issues.

**HIS ROYAL HIGHNESS PRINCE TURKI BIN NASSER BIN ABDULAZIZ
PRESIDENT
PRESIDENCY OF METEOROLOGY AND ENVIRONMENT**



1. INTRODUCTION

Following the adoption of the United Nations Convention on the Law of the Sea (UNCLOS) in 1982, member states have addressed the problem of marine pollution from land-based sources from a global perspective. UNCLOS obligates Parties to protect and preserve the marine environment by cooperating regionally and globally, and to adopt laws and regulations to deal with land-based sources of marine pollution. In order to minimize impacts on their marine ecosystem some countries, such as the Kingdom of Saudi Arabia, already had regulations in place to control discharges from land-based facilities to the marine environment, for example, 'Performance Standards for Direct Discharge (PSDD) to the Sea' (1980-1981) which specifies maximum limits for pollutant discharges.

Preparation for the 'Global Programme of Action for the Protection of the Marine Environment from Land-based Activities' (GPA) was started in 1992 by the United Nations Environment Program (UNEP) following the provisions of paragraph 17.26, chapter 27 of Agenda 21. The GPA is an action plan for curbing and controlling pollution, habitat destruction and other land-based activities affecting coastal and marine ecosystems. Although it is not binding, the agreement provides a framework for addressing some of the most significant threats to marine ecosystems.

The GPA was adopted at an intergovernmental meeting held in 1995 in Washington D.C. with commitment declared by 180 governments and the European Commission. At this meeting UNEP was appointed to act as Secretariat for the GPA. UNEP's functions also included the promotion and facilitation of its implementation at national and regional levels in coordination with relevant regional and national organizations and agencies. Accordingly, to fulfil its obligations, UNEP established the UNEP/GPA Coordination Office in the Hague (The Netherlands) for this purpose. This office held the First Intergovernmental Review Meeting in November 2000, in Montreal, Canada.

UNEP's Regional Seas Programme provides an important mechanism to help implement the GPA. In 1998, UNEP dedicated the International Year of the Ocean to helping implement the GPA in all the Regional Seas. Its aim was to ensure that over 140 participating countries include the GPA's provisions and commitments in their long-term regional and national activities. Bordering the Red Sea and Gulf of Aden are the seven member states of PERSGA—Djibouti, Egypt, Jordan, Kingdom of Saudi Arabia, Somalia, Sudan, and Yemen, each committed to protecting and preserving the marine environment from pollution, including pollution from land-based activities.

This report has been prepared as part of PERSGA's initiative for member states to submit their National Programme of Action to protect the coastal and marine environment of the Red Sea and Gulf of Aden from land-based activities.

During the last four decades, the Kingdom of Saudi Arabia has witnessed rapid urban, industrial and agricultural growth. Diversification of the predominantly oil based economy into other sectors has been at the core of the government's approach in recent years. The government of the Kingdom of Saudi Arabia, recognizing the importance of environmental protection and sustainable development, has established institutions and formulated regulations and standards to control and regulate environmental pollution and minimize its impacts on natural resources to ensure sustainable development, especially protection of marine ecosystems from land based activities and sustainable use of marine resources. This has been reflected in the Five-year Development Plans of the government of Saudi Arabia since the fourth Five-year Development Plan back in 1990.



Saudi Arabia is flanked by the Arabian Gulf on the east and the Red Sea on the west. Several cities and towns are located on these two coasts. The economy and living conditions of these towns depend largely on the status of their coastal ecosystems and marine habitats. The Red Sea coast of Saudi Arabia is approximately 1,970 km long from Haql in the north to Jazan in the south. The Red Sea and Gulf of Aden form a unique ecosystem with high biological diversity. The natural resources of the Red Sea and the Gulf of Aden provide substantial economic support to the coastal inhabitants. However, development along the coast, especially in large coastal cities, poses threats to both the marine ecosystem and to public health. Damage to the marine ecosystem adversely affects tourism and has an adverse impact on the fishing industry. There are several urban developments along the Red Sea coast of Saudi Arabia with a population of more than 50,000.





2. DEVELOPMENT OF THE NATIONAL PROGRAMME OF ACTION

The Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA), like other respective regional organizations, committed to develop the GPA at the regional level. In 1997, the Kingdom of Saudi Arabia and other member states located along the Red Sea and Gulf of Aden coast were involved in an assessment of the effects of land-based activities on the marine environment.

2.1 GUIDING PRINCIPLES

Saudi Arabia's NPA is based on the following guiding principles:

- The Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA).
- PERSGA's Regional Programme of Action for the Protection of the Marine Environment from Land-Based Activities in the Red Sea and Gulf of Aden.
- The Kingdom's commitment to various international and regional conventions, protocols and agreements.
- The approach and commitment of the government of Saudi Arabia to protect the environment and conserve natural resources including marine ecosystems and their resources.
- The government of Saudi Arabia's commitment to ensuring sustainable development, i.e., achieving a balance between development and environment which has been reflected in the programmes and projects for the protection of the environment and conservation of natural resources as envisaged in the five-year development plans since 1990, including the current 9th Five-year Development Plan.
- The legal and institutional framework dealing with various aspects of land-based activities affecting the marine ecosystem.
- A practical and dynamic approach.

2.2 GOAL

The main goal of Saudi Arabia's National Program of Action (NPA) is to assess and evaluate various land-based activities having the potential to contaminate coastal areas and marine ecosystems and to find ways and means to protect Saudi Arabia's Red Sea coastal and marine ecosystems from these activities.

2.3 APPROACH

The approach of the NPA is similar to other pollution control activities:

- Locate the source/activity and identify facilities,
- Prepare inventory,
- Assess and evaluate legal issues and identify lead agencies and other stakeholders,
- Suggest ways and means to reduce/minimize impact by developing strategies and measures,



- Recover/rehabilitate the impacted area by identifying methodologies, constraints and opportunities,
- Monitor the source and the receiving ecosystem to determine the effectiveness of the strategies and measures put in place.

The government of the Kingdom of Saudi Arabia considers its marine ecosystem as an important pillar of sustainable economic development for the country and for the welfare of its people. Therefore, the government of the Kingdom of Saudi Arabia is keen on sustainable governance of both marine ecosystems—the Red Sea on the west and the Arabian Gulf on the east of the country. The Presidency of Meteorology and Environment (PME), being the lead agency for the protection of the environment, is working to tackle the problems facing the Red Sea ecosystem by using the various tools available in its mandate such as (i) by formulating policies and regulations, (ii) by developing national programmes and strategies aiming at sustainable governance of marine ecosystems, (iii) by strengthening coordination among stakeholders including public entities, and (iv) by encouraging public-private partnerships.

3. NATIONAL CONTEXT

Saudi Arabia lies at the crossroads of three continents, Europe, Asia and Africa. It has two coastlines: the Red Sea on the west which is approximately 1,970 km long and the Arabian Gulf on the east which is approximately 650 km long. There are 34 coastal cities along the Red Sea, from Haql at the northern end to Jazan (Jizan or Gizan) at the southern end. (Figure 1).



Figure 1: Red Sea coastal cities of Saudi Arabia.



For this study, the Saudi Arabian coast of the Red Sea is divided into three zones:

- Northern Zone: which includes Haql, Duba, Al-Wajh, Umlaj, and Yanbu. The coastline between Haql and Yanbu is approximately 826 km.
- Central Zone: which includes Rabigh, Dhahban, Jeddah, Al-Lith, and Shoaiba. The coastline between Yanbu and Shoaiba is approximately 470 km, and
- Southern Zone: which includes Ash Shuqaiq, Jazan and the Farasan Islands. The coastline between Shoaiba and Jazan (Gizan) is approximately 670 km.

In addition to the above mentioned cities, there are a number of other smaller towns—Masturah, A Muzayif, Al Quz, Al Fariq, Makhshush, Al Wasqah, Ajah, Al Kidasah, As Salamah, A Maq, Thuwal, Mastabah, Muqal Al Ulya, Al Qunfudah, Unnykir Al Ma'aysah, Al Birk, Al Tirq, As Sahi, Al Qamah, Al Hanashali, Qulinah, Tuhamah, Al-Ka'ashm.

3.1 MARINE RESOURCES

Coral reef and mangrove forest habitats form the basic framework of the coastal and marine ecosystem. They provide shelter and food for a wide array of marine life. Fish populations and other marine life are important marine resources and key parts of the marine ecosystem supporting human life. Fishing is an important economic activity and takes place along the entire Saudi Arabian coastline.

Coral Reefs

Coral reefs represent the most significant habitat found along the Saudi coast of the Red Sea. More than 194 species of coral from about 74 genera have been recorded, with the highest coral diversity occurring in the central Saudi Arabian Red Sea area. Coral reefs harbour a longstanding and important artisanal fishery. Coral reefs of the Red Sea are among the most spectacular in the world. Most are situated along the coast and surrounding offshore islands and are in relatively good condition. However, along some stretches, such as some portions of the coast surrounding Jeddah and the industrial city of Yanbu, coral reefs are gradually becoming affected by development. Five areas along the coast are noted for their extensive coral reefs namely: Tiran Island area, Al-Wajh coast, the area north of Yanbu, coastline between Obhur and Tuwwal north of Jeddah, and the outer Farasan Islands.

Coral reefs play an important role in the coastal ecosystem. They provide habitats for a wide variety of marine species and protect coastal lands from erosion and storm damage. In the Red Sea, coral reef communities generally form extensive and productive reef flats which create protected habitat for many juvenile species as well as lagoons which also serve this purpose.

Mangroves

Mangroves generally grow in the waterlogged and saline soil of the intertidal zone and are often associated with areas of runoff. Only two species have been recorded along the Red Sea coast: *Avicennia marina*, which is widespread, and *Rhizophora mucronata*, found at only six sites. They are found in such areas as broad coastal plains, protected shores, over shoals and spits, and in lagoons.

Marine Sanctuaries

The Farasan Island group is a large archipelago of Red Sea coral islands lying 40 km offshore from Jazan, with many low-lying islands and islets. Some islands are bare and surrounded by coral, while others are sandy. The largest island is Farasan Kabir, being approximately 66 km long and 5-8 km wide, and the highest point does not exceed 72 m. It has the greatest biological diversity of any site in the Saudi Arabian waters of the Red Sea.





The Farasan Sanctuary is located in the southern Red Sea zone and occupies an area of approximately 696 km². It was established in 1989 as a Natural Reserve. The sanctuary is managed by the National Commission for Wildlife Conservation and Development (NCWCD) to protect the mangroves, dugong and gazelles.

There are several dense stands of mangrove, mostly the black mangrove (*Avicennia marina*) and the red mangrove (*Rhizophora mucronata*). Seven species of seagrass are also present in the surrounding waters. Important plant communities include Commiphora, Acacia and Salvadora. The important biodiversity includes about 231 species of fish, 49 species of reef building coral, 3 species of dolphin, a wide diversity of molluscs and crustaceans, large numbers of breeding seabirds as well as breeding populations of ospreys (*Pandion haliaetus*) and sooty falcons (*Falco concolor*). The Farasan Islands include the largest wild population of gazelles (*Gazella gazella farasani*), an endemic subspecies of the idmi gazelle. A remnant population of endangered dugong (*Dugong dugong*) and the only known confirmed breeding site for crab plover *Droma sardeola* also exist here.

3.2 PHYSICAL AND CHEMICAL PROPERTIES OF RED SEA WATER

Physical Properties

Surface waters of the Red Sea are always warmer than the deep waters. Deep water temperatures in the Red Sea are remarkably high compared to those formed in the deep water of the open ocean at the same depth. The deep water temperature is about 21°C at 1000 m. The Red Sea can be characterized in terms of three water layers. (i) A mixed layer, which develops because of mixing induced by the wind stress and is formed immediately beneath a thin surface-water layer. The water temperature in the mixed layer is almost constant. During the summer months the mixed layer is about 50 m deep and it becomes deeper with the increased strength of the wind in the winter season. (ii) A thermocline layer is formed beneath the mixed layer and is found to extend from 50-100 m to about 700 m. The temperature gradient is large in this layer because of the fairly rapid decrease in temperature with depth. During winter, this layer deepens because of the increase in the vertical mixing processes in the upper layers. (iii) A deep layer occupies most of the depth of the Red Sea, extending from about 700 m to the seabed. The water temperature in this layer is almost constant (21°C) throughout the year.

Tides in the Red Sea are semi-diurnal and are simply represented by a standing wave having a single central node. The period of tidal oscillation is approximately 12.8 hours for a depth of 500 m and length of 1600 km. The average spring tidal range is about 0.5 m at either end of the Red Sea, but the magnitude decreases towards the central region. South of the Strait of Bab Al-Mandab, the time of high water changes by several hours, and the spring tidal range increases to about 1.0 m.

Chemical Properties

Red Sea water quality has been monitored and reported by a number of organizations, agencies, academia and research groups. Some of these entities are mentioned below:

- Royal Commission at Yanbu Industrial City (1980 to date)
- MEPA-IUCN Red Sea Study (1974)
- PME-KAU Study at Al-Haql (2006)
- Researchers from KAU, KFUPM and other institutions



Table 1: Range of values of ambient seawater quality from the Saudi Arabian coast of the Red Sea.

| S. No. | Parameters | Values (mg/l) | |
|--------|----------------------------------------------------|-----------------------------------|----------------------------|
| | | Yanbu Industrial City (2004–2005) | Other parts of the Red Sea |
| 1. | Temperature (°C) | 22–32 | 25.5–34.8 |
| 3. | Salinity (g/l) | 36.8–43.1 | 40–61 |
| 4. | pH units | 8.0–8.5 | 8.0–8.4 |
| 5. | Total suspended solids | 2.8–27.5 | 2–25 |
| 6. | Dissolved oxygen | 4.4–7.8 | 4.4–8.2 |
| 8. | Free ammonia | 0.069–0.145 | <0.1–9.8 |
| 11. | Total phosphorus | 0.001–0.106 | <0.1–1.5 |
| 12. | Cyanide | - | <0.005 |
| 13. | Oil and grease | - | <0.2 |
| 14. | Arsenic | - | <0.01 |
| 15. | Cadmium | ND–0.00002 | <0.002 |
| 16. | Chromium | - | <0.05 |
| 17. | Cobalt | - | <0.03 |
| 18. | Copper | ND–0.0014 | <0.005 |
| 19. | Iron | ND–0.008 | - |
| 20. | Lead | ND–0.00008 | <0.005 |
| 21. | Mercury | < 0.0001 | <0.0001 |
| 22. | Nickel | ND–0.00008 | <0.01 |
| 23. | Manganese | ND–0.0003 | |
| 24. | Zinc | ND–0.00008 | <0.05 |
| 25. | Total petroleum hydrocarbon | - | <0.02 |
| 26. | Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX) | - | <0.01 |
| 27. | Phenol | - | <0.005 |

Note:

- (1) All parameters except temperature, conductivity and turbidity are expressed as mg/l.
- (2) Temperature is expressed as °C and turbidity as NTU.
- (3) The range covers the data obtained on a monthly basis and averaged on an annual basis.

3.3 COASTAL CITIES

Seven coastal cities—Haql, Yanbu, Rabigh, Jeddah, Shoaiba, Ash Shuqaiq and Jazan—were selected for this study because of their socio-economic activities and their historical and cultural importance to the Kingdom, others for their population size.

Haql

Haql is a small coastal city on the Red Sea in the north west of Saudi Arabia with a population of 28,442. The city has no significant industrial base except for a small desalination plant producing 4,400 m³/day of potable water and with 7.5 MW of electricity generation capacity. There are beautiful clean beaches here. Ambient seawater and sediment samples were collected from locations along the coast and analyzed. The results showed that the seawater and sediments were free from any significant pollution. There is no significant coastal development activity.

Omluj

Omluj is a small city with 53,790 inhabitants. There is a small desalination plant with a water production capacity of 4,400 m³/day and an electricity generation capacity of 10.9 MW. The city has no other significant industrial or coastal development activity.

Yanbu Al-Bahr (Yanbu City)

Yanbu Al-Bahr is an ancient town whereas Yanbu Industrial City is modern; together there is a total population of 250,244. Yanbu is famous as a centre for fishing activity. A considerable number of inhabitants depend on fishing for their livelihood. Yanbu al Bahar has one desalination and one power plant. These facilities discharge cooling water and brine back to the sea. Currently, there is no significant coastal development activity.

Yanbu Industrial City

Yanbu Industrial City is located 350 km north of Jeddah on the Red Sea coast. It is the location for petroleum and petrochemical companies, power and desalination plants, and the terminal of the East-West Pipeline. The city was developed in the late seventies. The total population of Yanbu Al-Bahr and Yanbu Industrial City was recorded as 250,244 in 1425 H (2004). It is a well planned industrial city having environmental management as a core issue. All domestic (27,000 m³/day) and industrial wastewater (24,000 m³/day) is treated in two separate tertiary level sewage and industrial wastewater treatment plants at the tertiary level. Treated domestic wastewater is reused for irrigation while some of the treated industrial wastewater is recycled and reused in industry. Seawater used for cooling, with a delta temperature (increase) of not more than 3°C and free from oil and other contamination, is returned to the Red Sea. Yanbu also has port facilities for import of goods for industry and export of crude oil.

In Yanbu Industrial City the Royal Commission for Jubail and Yanbu, following national policy, adheres to balanced industrial productivity with strict environmental protection. This has resulted in the protection of marine resources. Yanbu Industrial City has implemented a comprehensive environmental management programme including regular monitoring of (i) ambient air quality (ii) source emissions (iii) marine ecosystems (iv) wastewater discharges (v) solid and hazardous waste control and management. There are eight (8) major industrial facilities in Yanbu which include two (2) oil refineries, four (4) petrochemical plants, a titanium dioxide plant and a cement plant.

Rabigh and King Abdullah Economic City

Rabigh, located on the Red Sea coast north of Jeddah, has a total population of 68,966 according to the census of 1425 H (2004). It is the location for an oil refinery, a desalination plant and a power plant. In addition, some fishing and agricultural activities also take place.

King Abdullah Economic City (KAEC), announced by the Custodian of the Two Holy Mosques in 2007 with a total investment of US\$ 27 billion, is located approximately 100 km north of Jeddah along the coast of the Red Sea. The city has a development area of approximately 168 km² with six components: sea port, industrial zone, central business and commercial zone, financial zone, education zone and residential zone with resorts. The plan

Table 2: Population of the principal Red Sea coastal cities of Saudi Arabia.

| | Name | Population |
|----|--------------|------------------|
| 1. | Jeddah | 2,883,169 |
| 2. | Jazan | 252,488 |
| 3. | Yanbu | 250,244 |
| 4. | Rabigh | 68,966 |
| 5. | Omluj | 53,790 |
| 6. | Haql | 28,442 |
| 7. | Duba | 21,939 |
| 8. | Qunfudah | 20,317 |
| | Total | 3,573,185 |

is for the first stage of the city to be complete in 2010, and the whole city to be fully built by 2020.

Environmental issues such as zero discharge to the sea and protection and conservation of the marine ecosystem were taken into consideration at the feasibility stage.

Jeddah

Jeddah is a large bustling and thriving commercial city. Its port is the biggest port in the Kingdom. The city is situated towards the middle of the Saudi Arabian Red Sea coast in the Western Region. It is bordered to the east by a group of small hills and to the west by the Red Sea. The census of 1425 H (2004) recorded the population of Jeddah at 2,883,169.

Jeddah has a number of industrial and wastewater treatment facilities, a power plant, a desalination plant, an oil refinery, six secondary and tertiary level public sector sewage treatment plants with a cumulative capacity of approximately 200,000 m³/day, and a 20,000 m³/day tertiary level industrial wastewater treatment plant. The current sewerage network is under expansion to cover all of the city and sewage treatment capacity is planned to increase to one million cubic metres per day, with a target of 100% reuse of the treated wastewater. The industrial wastewater treatment plant is already recycling more than 50% of its treated wastewater for industrial use.

Shoaiba

Shoaiba is a small town on the coast of the Red Sea approximately 120 km south of Jeddah. The town has one desalination plant and one power plant. The capacity of the desalination plant is 582,689 m³/day while it cogenerates 62 MW of electricity. The capacity of the power plant is 4,400 MW. The principal discharges from these facilities are gaseous pollutants, cooling and brine water returns.

Ash Shuqaiq

Ash-Shuqaiq is a small town on the Red Sea coast approximately 140 km north of Jazan. The town has one desalination and one power plant. The capacity of the desalination plant is 212,000 m³/day while it cogenerates 108 MW of electricity. The capacity of the power plant is 850 MW. The main discharges from these facilities are once again, gaseous pollutants, cooling and brine water returns.

Jazan

The area of Jazan, located on the Red Sea coast in the southwest of Saudi Arabia, covers 40,000 km² and includes some 5,000 villages and cities with a total population of 252,488 (census 1425 H). Attached to it are 100 islands, including the biologically important islands of Farasan.

The Jazan area consists of fertile plains, forests and mountains. The fertile plains, which extend behind the coastal swampland, have been created by alluvial deposits brought down from the mountains by rain and flood. The forest region (the Alhazoun district), which is also subject to flooding, consists of forest interspersed with some areas of rich pasture. The mountain region is part of the Sarawat mountain range. The highest peak in Jazan is Fifa Mountain which rises 11,000 feet.

Jazan is the Kingdom's third most important seaport on the Red Sea after Jeddah and Yanbu. Jazan city has a 20,000 m³ tertiary level aerobic biological sewage treatment plant due to be expanded to cover the whole city. The treated wastewater from the plant is to be reused for irrigation.



Jazan Economic City (JEC)

Jazan Economic City (JEC), located 60 km northwest of Jazan city, has been announced by the Custodian of the Two Holy Mosques, King Abdullah bin Abdulaziz, for the development of the Jazan region. The city has an area of 100 million m² with facilities such as an industrial park, seaport, fisheries, business and cultural centre, health and education areas. The city will be completed in 20 years and will have best environmental management strategy from the feasibility stage with sewage and industrial wastewater treatment plants, treated wastewater recycling and reuse, monitoring and compliance assessments and required pollution control measures. The city will have a 4,000 MW power plant and 200,000 m³ capacity desalination plant to meet energy and water requirements.

3.4 MAJOR ACTIVITIES ALONG THE RED SEA COAST

Figure 2 shows the location of the major activities—housing, commercial, recreational, and industrial—along the Red Sea coast of Saudi Arabia. Fishing takes place along the entire coastline.

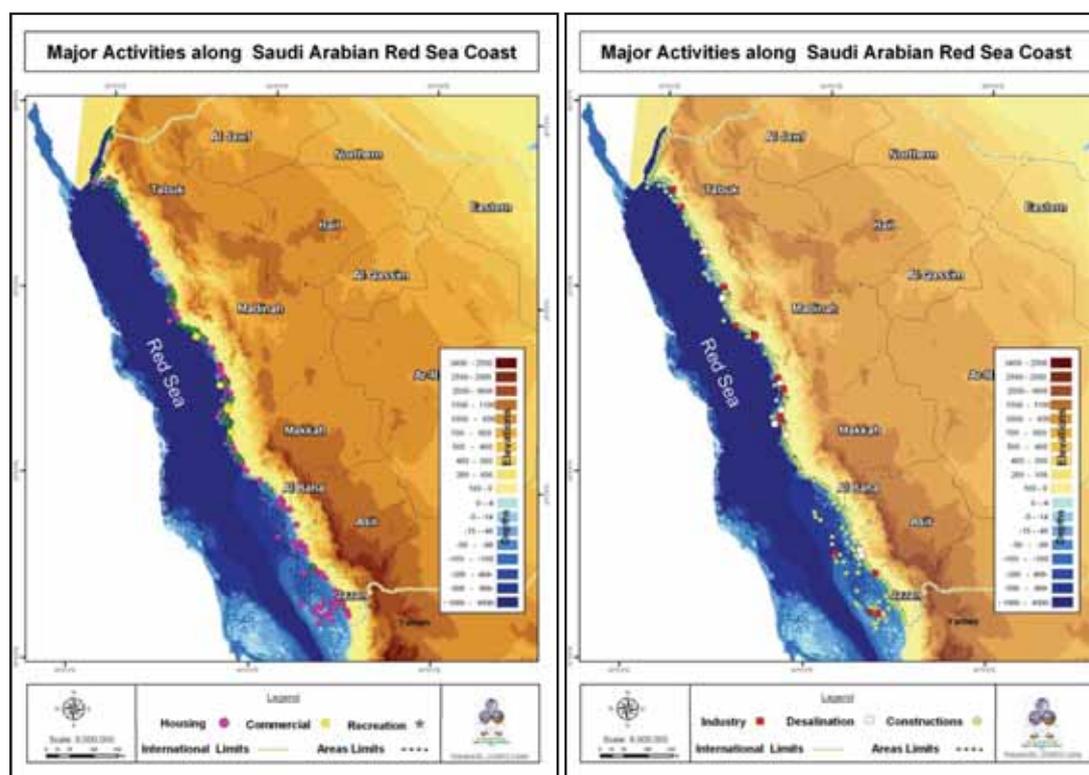


Figure 2: Major activities along the Red Sea coast of Saudi Arabia.



4. LEGAL FRAMEWORK FOR THE ENVIRONMENT

During the last three decades the Kingdom of Saudi Arabia has witnessed rapid urban, industrial and agricultural growth. This has led to increased emissions and discharges to the atmosphere, hydrosphere and to the land. The government of the Kingdom of Saudi Arabia, recognizing the importance of environmental protection, has developed institutions and formulated regulations and standards to control environmental pollution, minimize its impact on natural resources, and ensure sustainable development.

This section describes the environmental laws, regulations, standards and guidelines for the protection of the environment in general and especially for protection of the marine environment from land-based activities, as well as the environmental institutions and programmes in place for this purpose.

4.1 INSTITUTIONAL FRAMEWORK

Article thirty two (32) of the Basic System of Governance calls on the government to ensure the protection and conservation of the environment and its development, and to control all kinds of pollution. Keeping this in mind, the government of Saudi Arabia has established various institutions with responsibility for environmental protection, conservation of natural resources, and sustainable development within their respective areas of authority, in particular, the Presidency of Meteorology and Environment (PME), the central environmental agency of the Kingdom.

In addition, the government of Saudi Arabia has taken several steps to control and protect the coastal zone and the marine environment. Coastal zone management is a coordinated responsibility and a participatory process involving various different government bodies, the private sector, NGOs, and the general public. A Coastal Quadripartite Committee has been established comprising, on an equal basis: Ministry of Municipal and Rural Affairs, Ministry of Agriculture, Coast Guard and PME. The main role of this committee is to receive and process applications for coastal development.

4.1.1 ENVIRONMENT PROTECTION COUNCIL

The Environment Council (EC) was established by Decision of the Council of Ministers No. 22 dated 29 Muharram 1430 H corresponding to 26 January 2009 under the chairmanship of HRH Prince Turki Bin Nasser Bin Abdulaziz, President of the Presidency of Meteorology and Environment (PME). The Environment Council, composed of the Ministries of Interior, Foreign Affairs, Finance, Transportation, Health, Agriculture, Municipal and Rural Affairs, Trade and Industry, Water and Electricity, Petroleum and Mineral Resources, Economy and Planning, Culture and Information, King Abdulaziz City for Science and Technology, Saudi Wildlife Commission, and the Higher Commission for Tourism and Antiquities is the highest institutional and decision making authority on environmental issues in the Kingdom.

The functions and responsibilities of the EC are as follows:

- Formulate policies and strategies on national and international environmental issues.
- Formulate environmental regulations for the Kingdom of Saudi Arabia.
- Facilitate coordination among public and private sector entities on environmental issues in accordance with environmental regulations and rules for implementation.
- Follow-up on environmental protection implementation committees in accordance with environmental regulations and rules for implementation.



- Continue with the current regulatory status of the Saudi Wildlife Commission.
- Strengthen the role of other government agencies concerned with environmental protection activities including the responsibility of PME to monitor other government agencies in the implementation of the General Environmental Regulations and Rules of Implementation.

4.1.2 PRESIDENCY OF METEOROLOGY AND ENVIRONMENT

Presidency of Meteorology and Environment (PME), which is part of the Ministry of Defense and Aviation, is the central environmental agency of the Kingdom of Saudi Arabia. PME was established in 2001, upgrading the former Meteorology and Environmental Protection Administration (MEPA) which had been established by Royal Decree (No. 7/M/8903 dated 21 R. Al-Thani 1401 H) in 1980.

PME has been entrusted with a duty to preserve the environment and prevent its deterioration. The functions and responsibilities of PME, as described in Article 3 of the Environmental Regulations, are given below:

- Review and evaluate the status of the environment, develop monitoring systems and tools for the collection of information and conduct environmental studies.
- Document and publish environmental information.
- Prepare, review, develop, interpret and issue environmental protection standards.
- Prepare environmental regulations relevant to its areas of responsibility.
- Ensure that public agencies and private entities abide by environmental regulations, standards and criteria, as well as adopt necessary procedures thereof in coordination and cooperation with the concerned and licensing agencies.
- Review the latest developments in the field of environment and its management at regional and international levels.
- Promote environmental awareness at all levels.

4.1.3 SAUDI WILDLIFE COMMISSION

The Saudi Wildlife Commission (SWC), formerly the National Commission for Wildlife Conservation and Development (NCWCD), was established by Royal Decree No. 22/M on 12/9/1406H. It was given the mandate to prepare and implement plans to sustain terrestrial and marine wildlife, rehabilitate rare and threatened species and their habitats, and to propose the establishment of proper protected areas and reserves for wildlife in the Kingdom, and to manage such areas.

The third article of the Commission's by-laws issued by the Royal decree which established it, states that:

The Commission shall be mainly concerned with the preservation, protection and development of wildlife, carrying out biological research and applying the results to ensure an ecological balance including but not limited to:

- Encouraging and carrying out scientific research in different fields of life science especially in wildlife ecology.
- Urging public interest in ecological aspects of wildlife, and to seek proper solutions to problems through meetings, symposia and conferences attended by concerned specialists.



- Carrying out comprehensive surveys of available data and results of research, concerning wildlife and natural ecology in Saudi Arabia, gained from materials published in both national and international references.
- Developing and implementing plans and projects to preserve and maintain wildlife in their natural ecology by establishing protected areas and reserves in the Kingdom of Saudi Arabia, in addition to the execution of orders and regulations regarding such areas and projects.
- Co-operating with different ministries, authorities, national and international institutions and individuals in pursuance of its planned purposes.

4.1.4 ROYAL COMMISSION FOR JUBAIL AND YANBU

On 21 September 1975, the Royal Commission for Jubail and Yanbu (RCJY) was established as an autonomous organization to oversee the construction and development of two major industrial cities—Jubail on the Arabian Gulf and Yanbu on the Red Sea. From the very beginning RCJY has embedded environmental protection as a core issue into the development and management of these two industrial cities. As a result, pollution levels in Yanbu Industrial City have been kept to a minimum, including pollution of the marine ecosystem from land-based activities, by employing the best available pollution control technologies and implementing continuous monitoring and assessment, audit and inspection programmes. The Commission is governed by a board of directors and its chairman reports to the Council of Ministers.

The functions and responsibilities of RCJY can be given as follows:

- To promote, assist, service and otherwise encourage the development of basic downstream and light industries that would utilize the Kingdom's natural resources to produce value-added products for local use and export.
- To plan, develop, construct, operate and maintain various infrastructure and services needed for the above industries and for the people working in these industries.
- To encourage the use and enhancement of the skills and talents of Saudi citizens in the above activities.
- To maintain a balance between industrial development and environmental safety that is compatible with sustainable development.
- To encourage the participation of local and foreign private investment.
- To work in liaison with other agencies such as Saudi Aramco, the Seaports Authority and others to facilitate the availability of feedstock and other services needed by the industries.
- To function as a 'city manager' responsible for the safety and security of the entire industrial area under its jurisdiction.

RCJY Environmental Programme

To ensure that the two cities (Yanbu and Jubail) were developed to exploit the hydrocarbon resources of the Kingdom sustainably and without adversely impacting the environment, RCJY applied several measures right from the planning stage. These measures and policies are implemented through a comprehensive city-specific environmental management programme which includes inventory, monitoring and assessment, audit and compliance, and a penalty system.

4.1.5 QUADRIPARTITE COMMITTEE

A Coastal Committee (the Quadripartite Committee) has been established with representatives from relevant ministries and other bodies to receive and process applications for coastal development. The committee has an equal representation from its participants: Ministry of Municipal and Rural Affairs, Ministry of Agriculture, Coast Guard, and PME. The committee advises PME and/or any other agency with the power to grant or withhold approvals for coastal development. A developer from either the public or private sector can submit a development application for any of the following activities:

- Land reclamation along the shoreline of an owned area.
- Land reclamation or dredging within the coastal area.
- Utilization or land acquisition of a reclaimed area.
- Development projects on owned coastal areas especially along the waterfront.
- Development projects or rehabilitation of sites that previously had been reclaimed or dredged incompletely or without complying fully with the requirements of the Quadripartite Committee.

The application is submitted by the land owner or his representative to the concerned municipality requesting approval for the proposed development. The municipality forwards the application to the Coastal Committee within two weeks of receiving it from the applicant, having made sure that the following criteria have been satisfied by the applicant:

- Request is viable
- Request is in compliance with rules and regulations
- Proposal is environment-friendly
- Proposal is efficient

The Coastal Committee must respond within 4–6 weeks with its advice to the municipality. The advice will indicate the required actions necessary. The municipality, upon approval of the request, has to notify the Committee of the permit duration.

4.1.6 NATIONAL WATER COMPANY

The government has established the National Water Company (NWC) to look after the sustainable use of water resources. The NWC's vision is to be a world class commercially viable service company providing exceptional water and wastewater services in a cost-effective manner, focusing on the satisfaction of customers, employees and communities while protecting the environment. This water and wastewater utility company will provide water services and sewage collection, develop new wastewater treatment plants, improve and modify the current wastewater treatment plants, and enhance treated wastewater reuse. The company has a plan to achieve treated wastewater reuse of up to 80% within the next 10 years.

Policies and measures are planned with incentives to save water at source by reducing water leakage, reusing wastewater after tertiary treatment, and by more efficient usage of water. These actions will reduce the demand for desalination as well as reduce the burden on aquifers that are being depleted.



4.1.7 OTHER MINISTRIES AND AGENCIES

In addition, there are several ministries and public sector entities playing a crucial role in the protection of the environment in general and protection of the marine environment from land-based activities in particular. These ministries are:

Ministry of Interior

Ministry of Foreign Affairs

Ministry of Petroleum and Mineral Resources

Ministry of National Economy and Planning

Ministry of Transportation

Ministry of Health

Ministry of Agriculture

Ministry of Municipal and Rural Affairs

Ministry of Trade and Industry

Ministry of Water and Electricity

Ministry of Culture and Information

King Abdulaziz City for Science and Technology

High Commission for Tourism and Antiquities

These ministries and agencies are responsible, by Article 4 of environmental regulations discussed below, to ensure that environmental issues are adequately addressed in development projects related to their sphere of competence and that environmental regulations are complied with.

4.2 LEGISLATIVE FRAMEWORK

The Red Sea is famous for the diversity of its corals, marine invertebrates and vertebrates, especially turtles and birds. In addition, the fishing industry is a key element of both local and national economies. Accordingly, conservation of biodiversity and sustainable use of these resources is essential. In Saudi Arabia a number of environmental management regulations, standards and guidelines have been issued. The most significant of these legislative measures are listed below.

4.2.1 ENVIRONMENTAL REGULATIONS AND IMPLEMENTATION PROCEDURES

The current environmental regulations are specified in Royal Decree No. M/34 dated 28 Rajab 1422 H corresponding 15 October 2001. The environmental regulations are laid out in four chapters and twenty four articles. These regulations cover:

- Strengthening and regularization of environmental management in the country.



- Protection of the environment and public health, and prevention of environmental pollution.
- Defining the roles of agencies and organizations and their responsibilities in environmental management.
- Close coordination among competent, concerned and licensing agencies.
- Sustainability of resources by establishing a balance between resources and consumption.
- Recycling and reuse of waste.
- Recognizing the role of raising environmental awareness, education and capacity building.
- Environmental planning at the feasibility stage.
- Environmental impact assessment and compliance with environmental regulations mandatory.
- Provision of a penalty system for violations.

The regulations have the following objectives:

- Preserving, protecting and developing the environment and preventing its pollution.
- Protecting public health from the hazards of activities and actions that are harmful to the environment.
- Preserving, developing and rationalizing the use of natural resources.
- Making environmental planning an integral part of comprehensive development planning in all areas of industrial, agricultural, urban and other development.
- Promoting awareness of environmental issues on an individual and collective basis in order to protect and improve the environment and encourage national voluntary efforts in this regard.

Article 3 (Chapter 2) of the environmental regulations describes the duties and responsibilities of the competent agency, that is the PME, in preserving the environment and preventing its deterioration. To achieve the above mentioned goals the PME will:

- Undertake environmental monitoring and studies.
- Document and publish environmental information.
- Prepare, issue, review, develop and explain environmental standards.
- Prepare environmental regulations in its area of jurisdiction.
- Ensure compliance of private and public sector entities with environmental standards.
- Propagate environmental awareness at all levels.
- Follow-up on latest developments in the environmental field at regional and global levels.



Article 4 specifically deals with public agencies having facilities and development projects with significant environmental impacts.

- Article 4.1 asks all public agencies (supervisory or licensing) having development projects with significant environmental impacts to ensure commitment to environmental regulations, standards and guidelines.
- Article 4.2 asks all public agencies issuing environmental standards, specifications or rules pertaining to the practice of activities impacting the environment to coordinate with the competent agency before issuing these regulations.

Article 5 makes the concerned agency responsible for undertaking “Environmental Impact Assessment Studies” at the feasibility stage, according to the guidelines set by the competent agency.

Article 6 asks the concerned agency implementing new projects, or undertaking major modifications to existing projects, or projects whose term has expired, to use best or most suitable technology or materials that cause least environmental contamination.

Article 7 underlines the importance of environmental education, awareness, training and capacity building in environmental protection. It requires that environmental concepts are included in curricula and encourages propagation by the media.

- Islamic affairs agencies, call and guidance centres are to enhance the role of mosques in the propagation of environmental protection within the community.
- All concerned agencies to promote environmental training and capacity building in the field of environmental protection.

Article 8 deals with the concept of sustainability and rationalization between availability of resources and consumption rates, emphasizes recycling and reuse of resources and the need to use traditional technologies and building materials.

Article 9 deals with environmental emergencies and disasters, and their management. It calls for the competent agency (PME) to cooperate with concerned agencies to develop environmental disaster plans at the local, regional and national level and periodically to review the preparedness of the emergency plans. It also calls for concerned agencies to prepare and develop environmental emergency plans for projects having potential for environmental emergencies during their normal operation.

- Private entities and individuals in-charge of facilities whose operations have potential negative impacts on the environment should also develop plans to prevent or mitigate risks of these impacts and must have means capable of implementing such plans.

Article 10 calls for incorporation of environmental considerations and concepts at the planning stage of development projects, programmes and plans in various sectors.

Article 11 calls on persons dealing with projects having potential environmental impacts to ensure compliance with pertinent standards and regulations, and also to take the necessary steps to limit their effects or decrease their potential occurrences.

Article 12 deals with control of the source of emissions, wastewater discharges and solid waste generated by industrial and municipal facilities including indoor pollution and condition of the work place. It also calls on the owners of facilities to take care of materials and dust resulting from excavation and construction works.





Article 13 deals with production, services and other activities, and calls for taking appropriate measures to prevent direct and indirect contamination of surface, ground and coastal waters as a result of disposal of solid or liquid wastes; protect soil and land from contamination or deterioration in quality and control noise levels as a result of machinery and equipment operations, horns and loudspeakers within the stipulated standards.

Article 14 deals with hazardous, toxic and radioactive wastes, their trans-boundary movement, production, transportation, storage, recycling, treatment and final disposal.

- No hazardous, toxic or radioactive waste is allowed to be brought into the Kingdom including its territorial waters and offshore economic zone(s).
- Persons responsible for production, transportation, storage, recycling, treatment and final disposal must comply with the procedures and controls set forth in the Rules for Implementation.

Article 15 gives a five-year grace period for existing projects to comply with regulations and standards. For special projects, an exception could be given on the recommendation of the Competent Minister if approved by the Council of Ministers.

Article 16 deals with loans for projects. It calls on agencies providing loans and funding to require commitment by the borrower to comply with environmental protection standards and regulations as a pre-qualification for receiving loans for developmental projects.

Chapter 3 has five articles and deals with violations and penalties.

Article 17 (Chapter 3) defines violations and the role of the competent agency (PME), concerned or licensing agency, and the violator. The competent agency, when sure of a violation of environmental regulations and standards should, in coordination with the concerned agency obligate the violator to: eliminate any negative impact; control the process and correct the damage within a specified time frame and submit a report to the competent and concerned agencies about the steps taken to address the violation. The steps taken must meet the approval of the competent agency in advance. If the situation is not rectified, the competent agency in coordination with the concerned or licensing agency would take necessary action against the violator according to the provisions of these regulations.

Article 18 deals with the penalties for violators. Article 18.1 describes penalties for violating Article 14 which deals with hazardous, toxic and radioactive wastes, their trans-boundary movement (import and export), production, transportation, storage, recycling, treatment and final disposal. A maximum penalty of imprisonment for five years or a monetary fine of a maximum of SR 500,000 or both are specified. In addition, the plant or vessel causing the violation may be closed or detained for a period not exceeding 90 days. In case of recurrence, the violator could get double the penalty (imprisonment and monetary) suggested for the first violation. In case of recurrence, the violator (plant or vessel) could be closed temporarily or permanently and the vessel could be temporarily detained or confiscated. The violator is also obligated to remove the violation.

In case of violations of articles other than Article 14, Article 18.2 comes into force. The violator will be penalized to a monetary fine of SR 10,000 and must be responsible for removing the violation. In case of recurrence, double monetary penalty could be imposed on violators and the violator should remove the damage. The facility could be closed for a maximum of 90 days.

Article 19 deals with the documentation of violations. The competent agency would appoint the staff to control and document these violations. Procedures for controlling and documenting violations would be developed as part of the implementation procedures.





Article 20 calls for a Grievance Board to have the jurisdiction to apply the penalties for Article 14 violations as described in Article 18.1. The Concerned Minister would form one or more committees with three members (one member should be specialized in regulations) to look into the violations and apply penalties with the approval of the Concerned Minister. The committee would dispose of the matter of penalty by majority vote. The violator files a petition to the Grievance Board within 60 days from the notification of the penalty.

Article 21 states that the committee formed according to Article 20.2 could decide to order an immediate removal of the violation without waiting for the result of the petition decision from the Grievance Board depending on the extent of damage to the environment.

Article 22 authorizes the Competent Minister to issue the Rules for Implementation of these Regulations within a year of issuance of these regulations. Implementation procedures should be prepared by the competent agency in coordination with concerned agencies.

Article 23 validates the current/existing environmental rules, regulations, decisions and guidelines unless there is a conflict.

Article 24 authorizes the publication and enforcement of these regulations. Implementation procedures were prepared and approved by the Competent Minister and published in the official Gazette by Decision No. 1/1/4/5/1/924 dated 03 Shaban 1424 H. In addition to details of all the above mentioned articles, the Implementation Procedures have six (6) appendices dealing with various rules, regulations and standards, and the types and value of each type of penalty.

The appendices include the following documents:

- National Environmental Standards
- EIA Guidelines and Procedures for New Development Projects
- Environmental Accreditation Procedures
- Rules and Procedures for Hazardous Waste Control
- National Contingency Plan for Combating Marine Pollution by Hazardous Substances
- Violations and Penalties

National Environmental Standards

The National Environmental Protection Standards (1409-01, 1409 H) and associated guidelines are listed below:

- (i) Ambient air quality standards
- (ii) Air pollution source standards
- (iii) Receiving water guidelines
- (iv) Performance standards for direct discharge
- (v) Pre-treatment guidelines for discharge to the central treatment facilities



EIA Guidelines and Procedures for New Development Projects

New development projects are divided into three categories:

- (i) First category projects where only minimal environmental impact(s) are expected. Initial environmental assessment is undertaken by completing and submitting a form (Guidelines Appendix 2.2) to PME for review, deliberation, comments, approval and issuance of an environmental permit.
- (ii) Second category projects where minor environmental impacts are expected. The developer fills and submits an environmental assessment form (Guidelines Appendix 2.3) to PME for review, comments, deliberation and approval, modification or rejection and/or issuance of an environmental permit.
- (iii) Third category projects where considerable environmental impacts are expected. The developer under this category is required to undertake a comprehensive environmental impact assessment of the development project according to Guidelines Appendix 2.4.

Environmental Accreditation Procedures

Companies are accredited for the following purposes:

- Environmental studies and research
- Municipal solid waste management
- Hazardous waste management
- Polluted water and soil treatment
- Non-hazardous industrial waste
- Surveillance and analysis services
- Marine environment services
- Pollution control technologies
- Environmental management services
- Medical waste management
- Monitoring services and environmental laboratories
- Used oil management

Rules and Procedures for Hazardous Waste Control

These rules and procedures contain the following sections:

- (i) Standards for hazardous waste generators
- (ii) Standards for hazardous waste transporters
- (iii) Standards for hazardous waste management facilities



National Contingency Plan for Combating Marine Pollution by Hazardous Substances

This plan was approved by the Council of Ministers Decision No. 157 dated 20/11/1411 H, (June 1991). The decision called for the formation of a committee from five government bodies to be involved in the implementation of this plan. Members of this committee include:

- Ministry of Defense and Aviation (PME)
- Ministry of Interior (Coast Guard)
- Ministry of Petroleum and Minerals
- Port Authority
- Ministry of Municipal and Rural Affairs

The plan contains local, regional and national level contingency plans to protect marine ecosystems in case of emergency situations resulting from an oil spill or other spilled hazardous substances.

Violations and Penalties

This appendix deals with violations and penalties involving:

- Development of environmental studies and consultations
- Preparation of hazardous waste disposal site
- Water quality
- Air quality
- Import and operation of environmental technologies
- Other categories of violations

4.2.2 RULES AND REGULATIONS FOR SAUDI ARABIAN SEA PORTS

Issued under Ministerial Resolution No. 181 (9/10/1395 H) (1975), these rules and regulations are administered by the Seaports Authority of Saudi Arabia. These rules deal with the management of sea ports including control of pollution and import and export of material such as hazardous waste, fertilizers, insecticides and pesticides, etc.

4.2.3 FISHERIES REGULATIONS

Rule for implementation of the Saudi Arabian Regulations for Fishing, Exploitation and Protection of Living Aquatic Resources in the Territorial Waters of the Kingdom of Saudi Arabia were issued under Ministerial Resolution No. 21911 (27/03/1409 H), November 1988. These rules are administered by the Ministry of Agriculture.

4.2.4 WILDLIFE CONSERVATION AND DEVELOPMENT

The National Commission for Wildlife Conservation and Development (NCWCD), now known as the Saudi Wildlife Commission (SWC) was established in May 1986. The main goal of this commission is to preserve, protect and develop wildlife within the Kingdom. Several protected areas, including marine protected areas, have been established and are supervised by SWC. Wildlife Protected Areas Regulations were issued under Ministerial Decision No. 124 (26/10/1415 H), March 1995. These regulations are administered by SWC.



4.2.5 NATIONAL INTEGRATED COASTAL ZONE MANAGEMENT

A proposal for an integrated coastal zone management plan (ICZM) has been prepared by the relevant stakeholders. Implementation emphasizes co-ordination among the operational agencies in order to ensure that each management programme is consistent with the Kingdom's national environmental policy as outlined in the five-year development plans. ICZM, which is in its final review and approval process, addresses the following issues:

1. Development of appropriate institutional arrangements to promote the wise and sustainable use of the nation's coastal and water resources, including resolution of current conflicts among competing use needs and/or responsibility for coastal areas and resources.
2. Improving the information on coastal environments (habitats/ecosystems) that generate economically, socially and environmentally important resources at the local, national and international levels.
3. Planning and management guidelines that will help establish wise and sustainable use of coastal ecosystems.
4. Planning and management guidelines for activities that require location and/or access to coastal land and water resources.
5. Preparation of a basic Coastal Zone Management Plan by PME and then operational local area coastal zone management plans by ministries and agencies with responsibilities for the planning and management of development and conservation activities.
6. Increased public awareness of the economic and social welfare importance of coastal land and water resources.

Local Area Coastal Zone Management Plans

While the national ICZM plan passes through the different stages of review and approval, a separate Local Area Coastal Zone Management plan has been developed and put in place with the following goals:

- (i) Resources in the coastal zone should be preserved, protected and developed in a manner that provides the maximum benefit to both current and future generations.
- (ii) The development and implementation of management programmes should ensure wise use of land and water resources within the coastal zone, giving full consideration to ecological, historic, aesthetic and spiritual values as well as to the needs of economic development. These plans should at least provide for the following:
 - Protection of natural resources (physical and biological) within the coastal zone, including sharms, coral reefs, beaches, dunes, islands, wetlands, fish and wildlife and their habitats.
 - Management to minimize loss of life and property caused by improper development in areas prone to flooding, storm surge or erosion-prone areas and in areas with geological hazards, subsidence or which will become inundated through sea-level rise, or suffer salt water intrusion.

- Protection of groundwater resources from pollution and saline intrusion resulting from poorly planned and managed coastal development.
- Priority consideration for coastal-dependent uses, and orderly processes for locating major facilities related to national defence, energy, fisheries development, recreation, ports and transportation, and, to the maximum extent practicable, of new commercial and industrial development in or adjacent to areas where such development currently exists.
- Public access to the coasts for recreational purposes.
- Assistance in the redevelopment of deteriorating urban waterfronts and ports, and sensitive preservation and restoration of historic, cultural and aesthetic coastal features.
- The coordination and simplification of procedures in order to provide for expedited government decision-making for the management of coastal resources.
- Coordination with national agencies which are affected by decisions.
- Assistance to support comprehensive planning, conservation, and management of living marine resources, including planning for the location of pollution control and aquaculture facilities within the coastal zone.

(iii) In areas where conflicts between multiple users endanger economic efficiency and/or natural resources, the preparation of ‘special area management plans’ is encouraged. Special area management plans provide for increased specificity in protecting significant natural resources, environmentally sensitive areas, areas of special potential for coastal-dependent economic growth, areas with significant natural resources, and areas in which development may be hazardous for property or life, and for improved predictability in government decision making.

(iv) All levels of the Kingdom’s coastal zone management plans should implement actions and policies established in regional and international agreements to which the Kingdom of Saudi Arabia is signatory.

(v) Climate change concerns need to be integrated with the general policy for coastal zone management in order to avoid future socio-economic difficulties caused by sea level rise.

5. REGIONAL AND INTERNATIONAL OBLIGATIONS

Saudi Arabia has been active at the regional and international level in the field of environmental protection and management resulting in ratification and accession to a number of regional and international conventions, protocols and agreements. Some of the more important ones are listed below:

- Kuwait Regional Convention on Protection of the Marine Environment from Pollution, (ROPME).
- The Regional Convention for the Conservation of the Red Sea and Gulf of Aden Environment (PERSGA).
- Protocol Concerning Cooperation in Combating Pollution by Oil and Other Harmful Substances in Cases of Emergency: General Principles for Environmental Protection (adapted by the Gulf Cooperation Council in November 1989).
- Protocol Concerning Marine Pollution Resulting from Exploration and Exploitation of the Continental Shelf (adopted by the ROPME member states in June 1989).
- Protocol for the Protection of the Marine Environment Against Land-Based Sources (adopted by the ROPME member states in February 1990).
- The Arab Declaration on Environment and Development (adopted on 14 October 1986 in Tunis).
- International Convention on Civil Liability for Oil Pollution Damage (CLC).
- The Establishment of an International Fund for Compensation for Oil Pollution Damage.
- World Charter for Nature.
- Gulf Cooperation Council. A draft law concerning environment protection for GCC member states.
- World Conservation Strategy.
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

In addition, the Kingdom of Saudi Arabia is actively involved in several environmental agencies at the international level. For example:

- United Nations Environment Programme (UNEP)
- Intergovernmental Panel on Climate Change (IPCC)
- World Meteorological Organization (WMO)
- Advisory Committee on Pollution of the Sea (ACOPS)
- World Maritime Organization
- International Union for the Conservation of Nature and Natural Resources (IUCN)



6. COASTAL AND MARINE DATA AND INFORMATION

Beside PME, the principal government body involved in marine environmental studies, several other government agencies also contribute to environment issues as a result of environmental responsibilities that have been incorporated into their rules and regulations. These are:

1. Ministry of Agriculture—Fisheries Regulations, Forest and Farmland Regulations (M/22 dated 3/5/1398 H)
2. Ministry of Education—Regulations for Antiquities
3. Ministry of Higher Education
4. Universities and research institutes involved in marine environmental studies.

The Faculty of Marine Science of King Abdul Aziz University on the western coast has conducted an oceanographic survey of marine communities and the properties of the coastal waters between Yanbu and Jeddah, as well as other research programmes which involve chemical, biological and geological aspects of the Saudi Arabian Red Sea coast.

The Water Resources and Environment Division of the Research Institute of King Fahad University of Petroleum and Minerals on the eastern coast, has established three working groups involved in relevant environmental studies:

- Water Resources Group
- Environmental Pollution Group, which in turn is divided into:
 - Water pollution studies
 - Solid waste studies
 - Air pollution studies
- Bioenvironmental Studies Group, comprising:
 - Marine science
 - Oil spill studies

Under the Royal Commission for Jubail and Yanbu, a regular programme was set up to collect data related to selected physical, chemical and biological parameters for pollution control purposes. As a major producer of freshwater from seawater, the Saline Water Conversion Corporation (SWCC) must ensure the quality of its products. The SWCC therefore established a control laboratory in every plant to monitor, on a daily basis, the environment around the site and detect any changes. In 1987, a research centre was established in Jubail to carry out the technical and practical research dealing with desalination processes.

Finally, at King Abdul Aziz City for Science and Technology (KACST), funding has been obtained for environmental pollution and climate change research jointly with PME, the Saudi Arabian Bureau of Standards, and the Ministry of Municipal and Rural Areas.



7. OTHER MEASURES

7.1 NATIONAL OIL SPILL CONTINGENCY PLAN

The National Contingency Plan for Combating Marine Pollution from Oil and Other Hazardous Substances in Emergency Cases was officially initiated in 1991. The decision of the Council of Ministers gives the prime responsibility for oil spill response to the PME thus ensuring that reporting, surveillance and response capabilities are available to deal effectively with any spill originating in Saudi Arabian waters.

The Red Sea is of strategic importance to Saudi Arabia's economic development and this is also the case for neighbouring countries. A large proportion of the world's oil supply is transported through the Red Sea and the threat of an oil spill is significant for all Red Sea coastal waters, especially so in Saudi Arabia due to the large-scale petroleum production and associated marine activities. It is the policy of the Kingdom of Saudi Arabia that the exploration for oil and the transportation of oil and other harmful substances, must be carried out in such a manner as to minimize the risk of environmental and economic damage and threats to public health. In the event of a spill, swift and effective action will be taken to minimize the environmental and public health risks.

The National Contingency Plan is an umbrella plan that is general in nature, but it identifies the authorities and responsibilities of the major agencies and organizations, the national response system, the major resources available, and the national response strategy. Regional and area contingency plans are more specific in nature. These are usually relatively short and are often compared to an aviation pre-flight check list which, during the early moments of a spill, can be scanned quickly and followed to guide the proper actions.

The Plan aims to establish a system for responding immediately and coordinating the actions required for the protection of the Saudi marine and coastal environment from the effects of spilled oil, making full use of the available resources both regionally and internationally. This entails mobilizing and coordinating all of the available equipment, manpower and expertise to combat spill situations. It also aims to honour the Kingdom's obligations assumed under various regional and international agreements entered into by Saudi Arabia for the protection of the marine environment.

The following authorities are required to undertake pollution prevention, protection and combating activities within marine and coastal areas using facilities they have acquired for the purpose:

1. Ministry of Defense and Aviation (PME and the Royal Navy)
2. Ministry of Interior (Frontier Force)
3. Ministry of Petroleum and Mineral Affairs
4. Ministry of Industry
5. Ministry of Municipal and Rural Affairs
6. Saudi Ports Authority
7. General Organization for Distillation of Saline Water
8. Royal Commission for Jubail and Yanbu
9. Any other authority having marine or coastal facilities

Each of these authorities must appoint a responsible person to lead the response activities in each facility or area controlled by them. In addition to the responsibilities it shares with other designated agencies under this plan, PME is also required to prepare, disseminate and monitor the implementation of policies, regulations and procedures for combating and preventing pollution.

7.2 ENVIRONMENTAL IMPACT ASSESSMENT

Since 1985 it has been a requirement under Saudi Arabian law that any new industrial development or private project must undertake an environmental impact assessment (EIA) before obtaining other approvals or permits. The EIA study must be based on the current PME regulations and standards with the objective of minimizing impacts on the environment. This requirement also satisfies obligations taken up under agreements with the Gulf Cooperation Council (GCC) and the Arab Environment Council.

7.3 PROCESS OF COASTAL LAND RECLAMATION AND DREDGING

In principle, any project(s) which will alter the coast or have a negative effect on land or in the water are banned by law; for example, the owners of water frontage whether public or private, are not allowed to dredge or reclaim either for tourist or residential development projects. However, such actions may be permitted for proposals which are considered to be in the wider national interest including significant economic or security interests, e.g., projects related to widening or deepening of navigational channels and their maintenance. These projects are generally initiated or coordinated by one of the following government agencies: Ministries of Defense and Aviation, Interior, Petroleum and Mineral Resources, Agriculture; Port Authorities, RCJY, power companies, Saline Water Conversion Corporation, and other agencies related to scientific research or environmental monitoring. The agency concerned, or its representative, will apply to the municipality of the locality using the prescribed application forms which include the environmental impact study. The application must also address the implementation methods and the disposal plans for the dredging spoil, as well as the duration of the project activities.

The Quadripartite Coastal Committee will assess the viability and the justification of the proposal to reclaim and dredge within the coastal area, assuring itself that the proposed work is required either for security or rehabilitation or general interests or reshaping of the coastline. In agreeing to the proposal, the Committee will prescribe any specific conditions it feels are necessary to minimize impacts on the marine environment, in particular to protect coral reefs.

Development of Private Coastal Water Frontage

Development within the coastal area, particularly along the shoreline, is not allowed except under special conditions pertaining to the national interest, security, economy and public utilities undertaken by designated government sectors. The application by the developer to the local municipality will include four copies of development activities and coastal land deeds along with an EIA study indicating the anticipated effects of the development on the surrounding environment with alternative solutions and/or remediation for any impacts.

In order to minimize future socio-economic impacts resulting from sea level rise, PME needs to conduct many studies to investigate the extent of impact of sea level rise on the coastal zone and to communicate the results of these studies to different sectors. These results should then be integrated into their designs and future development plans.



8. ASSESSMENT OF LAND BASED SOURCES OF POLLUTION AND THEIR IMPACTS

Based on available data, the land-based sources of pollution affecting Saudi Arabia's Red Sea coast have been assessed and evaluated, and their impacts on marine ecosystems have been identified. Threats to the Saudi Arabian Red Sea coastal zone can be classified into two groups, namely: physical alteration to the coastline—principally due to coastal construction (including dredging and reclamation), and pollution by contaminants from land-based activities.

The more serious land-based sources of pollution relate to the development of coastal facilities that create contaminants that are then either discharged into the marine environment or find their way there due to wind or rain. These include domestic and industrial wastewater treatment plants, desalination and power plants, oil refineries, petrochemical plants and other small and medium-sized industries. Activities from a growing population including recreation, agriculture and fishing are secondary sources of pollution.

These threats have impacts on coastal fisheries (both subsistence and commercial), special habitats (mangroves, seagrass meadows and coral reefs), and threatened species such as the dugong. They also have impacts on people by affecting environmental quality, human health, employment and income.

Principal Urban Areas

Much of the Red Sea coastline is sparsely inhabited and almost pristine. However, where the resident population is concentrated, the pollution load is similarly increased.

Along the Red Sea there are fifteen coastal cities and towns distributed in four provinces. These coastal cities occupy a total length of about 210 km and an area of 645 km² (Table 3). From north to south, Yanbu, Jeddah and Jazan have higher population densities than the other cities with a greater variety of socio-economic activities—commercial, agricultural, recreational and industrial—taking place.

8.1 PHYSICAL ALTERATION AND DESTRUCTION TO HABITATS

Shoreline Alteration

All development activities such as construction of housing projects, ports, industrial cities and facilities, power and desalination plants, and refineries within the coastal zone result in the physical alteration of the shoreline and destruction to coastal and marine habitats. Coastal mining and quarrying are important sources of sedimentation.

The Kingdom of Saudi Arabia has embarked upon ambitious urban, commercial and industrial development through a series of five-year development plans since the 1970s. However, environmental protection and sustainable use of resources has been a central theme. A comprehensive Coastal Zone Management Plan takes centre stage for all activities along the Red Sea coast. The Quadripartite Committee has been formed to control and regulate development within the coastal zone and to ensure that relevant policies, laws and regulations are followed.



Table 3: Socioeconomic activities in Red Sea coastal cities and towns.

| Province | City | Coastal Length (km) | Coastal Area (sq.km) | Socio-economic Activities |
|------------|-------------|---------------------|----------------------|------------------------------------------------------------|
| Tabuk | Haql | 5.8 | 6.15 | Fishing |
| | Duba | 8.1 | 4.75 | Fishing – Seaport |
| | Al Wajh | 9 | 8.7 | Fishing |
| | Omluj | 7.5 | 5 | Fishing |
| Al Madinah | Yanbu | 30 | 107 | Industrial - Fishing – Industrial and commercial seaports |
| Makkah | Rabigh | 13.45 | 22.2 | Industrial – Fishing – Industrial seaport |
| | Thuwal | 3.5 | 3.5 | Fishing – Educational |
| | Dahban | 5 | 3 | Fishing – Recreational |
| | Jeddah | 95 | 450 | Commercial and Industrial seaports |
| | Al Laith | 1.5 | 2.4 | Fishing |
| | Alqunfudah | 12.4 | 7 | Fishing |
| | Al Birk | 1.8 | 1.5 | Fishing |
| Jazan | Al Qahmah | 5 | 5 | Agriculture – Fishing |
| | Jazan | 10 | 18 | Agriculture – Fishing – Commercial and Industrial seaports |
| | Al Luhayyah | 2 | 0.8 | Fishing |
| Total | | 210.05 | 645 | |

Impacts on Coral Reefs and Mangrove Ecosystems

In some areas corals are under stress due to sedimentation from coastal development projects, from wind-blown sediments and from sewage contamination.

Good mangrove communities exist along the Red Sea coast of Saudi Arabia generally at the mouth of valleys. To help ensure that damage to mangrove communities from development work is addressed and minimized, PME has recently ensured that new mangrove communities are planted.

8.2 CONTAMINANTS

8.2.1 DOMESTIC SEWAGE

The National Water Company (NWC) was established to address issues related to water and wastewater. The company plans to connect the entire population of Saudi Arabia to secondary or tertiary level wastewater treatment plants and to reuse or recycle treated wastewater in agriculture and industry. This will avoid contamination of the terrestrial and marine environments and reduce use of this precious resource. In addition, a policy of ‘zero discharge’ to the marine environment from the coastal area of the Red Sea is envisaged by PME.

All the major cities in the western, central and eastern regions have a sewerage network for the collection of sewage, and wastewater treatment plants. Although the network only covers



a limited percentage of the population, the authorities are making serious efforts to allocate larger budgets to expand both the networks and the capacity of the current treatment plants.

The percentage of the population connected to the sewerage network varies between cities. Trucking of municipal wastewater from septic tanks to the desert and/or to coastal areas is a common practice in some regions.

There are a number of public sector sewage treatment plants in the Kingdom of Saudi Arabia. The following provides a list of public sector sewage treatment plants with their capacities.

Table 4: Public sector sewage treatment plants.

| Directorate/ Region | Sewage Treatment Plants | | | | | |
|------------------------|--------------------------|---------------------------|---------------------------------------------------|--------------------------|---------------------------------------------------|---------------------------|
| | Secondary Level | | | Tertiary Level | | |
| | Number of Current Plants | Number of Proposed Plants | Volume of Treated Wastewater m ³ /year | Number of Current Plants | Volume of Treated Wastewater m ³ /year | Number of Proposed Plants |
| Tabuk | 1 | - | 720,000 | 0 | - | 14 |
| Makkah Al-Mukarramah | 10 | - | 112,585,500 | 1 | 14,687,251 | 10 |
| Al-Baha | 1 | - | 0 | 0 | 15,000 | 27 |
| Asir | 2 | - | 379,600 | 2 | 21,715,700 | 18 |
| Jazan | 1 | - | 240,000 | 0 | 0 | 12 |
| Total | 15 | - | 113,924,600 | 3 | - | 81 |

Source: Annual Report of Ministry of Water and Electricity, 2005 & 27 Years Sewerage Network Planning

Municipal Wastewater Treatment in the Northern Zone

Yanbu Industrial City operates a tertiary level sewage treatment plant (STP) with a capacity of 28,000 m³/day and an industrial wastewater treatment plant (IWTP) with a capacity of 24,000 m³/day. All treated effluent from the STP complies with irrigation water standards and is reused for this purpose within the Industrial City. Treated industrial wastewater also complies with relevant discharge standards and is partially recycled and reused by industry. The remaining treated wastewater is discharged to the marine ecosystem in accordance with discharge regulations.

In other cities and towns such as Haql, Al Wajh and Omluj, the domestic wastewater is collected in septic tanks and released on land after sedimentation and primary treatment.

Municipal Wastewater Treatment in the Central Zone

Secondary, and tertiary level aerobic biologically treated wastewater is discharged to the Red Sea from the principal urban areas. However, a substantial volume of raw sewage is collected from septic tanks and discharged on land.

In Jeddah there are six municipal wastewater treatment plants operating under the regional Water and Sewerage Authority (WSA) namely Jamiya, Bani Malik, Iskan Plant A and Plant C, and Al-Khomra old and new. However, only 20% of the population is covered by the sewerage network. The first three STPs are small having capacities of 11,000, 3,000 and 9,000 m³/day respectively. They operate, by and large, within their design capacities thus





producing good quality treated wastewater. The other three plants are larger in capacity and operate above their design capacities of 32,000, 40,000 and 40,000 m³/day, respectively. These plants are actually running at capacities of 60,000, 70,000 and 75,000 m³/day. The quality of their treated wastewater does not comply with PME's Performance Standards for Direct Discharge (PSDD). All of these STPs discharge their treated wastewater into the sea except for a very limited volume that is used in the city for irrigation of green belts.

Jeddah wastewater treatment plant (JWWTP) treats approximately 14.1 million cubic metres of wastewater per year. The treatment is carried out at tertiary level with adequate disinfection. The treated wastewater complies with the relevant Royal Commission (RC) standards and is fit for use as irrigation water for plantations. The wastewater is fully used for this purpose.

Most of the treated domestic and industrial wastewater from the industrial city of Jeddah is either recycled by industry or used for the irrigation of green belts within the area of its jurisdiction.

Municipal Wastewater Treatment in the Southern Zone

Wastewater treated to secondary or tertiary level is discharged to the Red Sea from the main urban areas such as Jazan. A considerable volume of treated wastewater is reused for irrigation or recycled for industrial purposes. A substantial volume of sewage is collected in septic tanks and discharged on land.

8.2.2 BRINE FROM DESALINATION PLANTS

Seawater desalination is a major source of potable water in the Middle East and North Africa. Saudi Arabia has a large number of desalination plants. Thirty (30) plants are owned by the Saline Water Conversion Corporation (SWCC). In 2002–2003, Saudi Arabia produced over one billion cubic metres of desalinated water. Two principal desalination technologies employed in Saudi Arabia are: (i) multistage flash (MSF) and (ii) reverse osmosis (RO). Saudi Arabia has a number of dual purpose desalination plants producing electricity as well as potable water, for example Stage 2 of the Shoaiba desalination plant on the Red Sea coast produces 582,689 m³ of water and 500 MW of electricity (Table 5). The Shoaiba desalination plant is the second largest in the Kingdom after the Jubail desalination plant. In 2001, there were 13 desalination plants on the Saudi Arabian coast of Red Sea and their production capacity was 330 million m³ of water annually.

Contaminants from Desalination Plants

Flue gases emitted from the stacks of MSF desalination units contain oxides of sulphur, carbon, nitrogen and particulate matter depending on the quality and type of fuel used to generate energy. The seawater return contains a high salt concentration, chemicals, as well as a higher temperature. The salt concentration factor is 30-70% (1.3-1.7 times) higher than the intake seawater. The following chemicals are used in the process:

- NaOCl (free chlorine to control biological growth as an antifouling agent)
- FeCl₃ or AlCl₃ used for flocculation to remove suspended solids
- Sulphuric or hydrochloric acid for pH adjustment
- Sodium hexametaphosphate Na(PO₄)₆ to prevent scale formation
- Sodium bisulphite used for neutralizing chlorine from the feed water.



Table 5: Major desalination plants along the Red Sea (north to south).

| Zone | S. No. | Desalination Plant | Potable Water Production (m ³ /day) | | Electricity Generation (MW) | |
|----------|--------|--------------------|------------------------------------------------|-------------------|-----------------------------|-------------------|
| | | | Design Capacity | Actual Production | Design Capacity | Actual Generation |
| Northern | 1. | Haql | 4,400 | 3,784 | 7.5 | - |
| | 2. | Duba | 4,400 | 3,784 | 7.5 | - |
| | 3. | Al-Wajh | 3,740 | 3,216 | 3.8 | - |
| | 4. | Omluj | 4,400 | 3,784 | 10.9 | - |
| | 5. | Yanbu | 380,256 | 321,625 | 507 | 285 |
| Central | 1. | Rabigh | 2,300 | 1,978 | 3.3 | - |
| | 2. | Jeddah | 467,620 | 402,153 | 931 | 771 |
| | 3. | Shoaiba | 677,545 | 582,689 | 783 | 497 |
| Southern | 1. | Ash-Shuqaiq | 212,000 | 212,000 | 108 | 62 |
| | 2. | Al-Birk | 2,270 | 1,952 | 3.2 | - |
| | 3. | Farasan | 1,750 | 1,505 | 2.3 | - |

The following environmental pollution problems arise from desalination plants:

- (i) Oxides of sulphur, carbon, nitrogen (acidic) and particulate matter.
- (ii) Noise pollution from high pressure pumps used with the RO process.
- (iii) Chemicals mentioned above, especially iron compounds that produce turbidity and colour in the seawater return which may produce “optical pollution” inhibiting photosynthesis in the water.
- (iv) Other chemicals don’t have a significant impact as they are diluted by the huge volume of brine and also they contain ions (sulphate, phosphate, chloride) which are already in high abundance in seawater.
- (v) Higher salt concentrations may have negative impacts on marine life.
- (vi) Thermal pollution: the temperature of brine ranges from 50-70 °C. The higher temperature of the brine may negatively impact marine life.

Potential Impacts on the Marine Environment

There are limited studies on the impacts of seawater return with higher salt concentration and temperature. The sensitivity of marine organisms to increases in temperature and salinity varies from species to species. Conclusions from these studies can be summarized as follows:

- (a) Bathymetry, currents and depth of the sea play important roles in determining the impacts of brine on marine life.
- (b) The main impacts are on the physical properties such as temperature, salinity and turbidity.



- (c) High energy oceanic coasts are more suitable for desalination plants.
- (d) Mangrove flats are the most sensitive habitats, followed by coral reefs.
- (e) Increases in salt concentration may result in the dehydration of organisms' cells, decreases in turgor pressure and death of larvae and young individuals.
- (f) Algae in the class Bacillariophyceae can tolerate high salinities but most other algal species will not survive.
- (g) The larvae of crabs and other invertebrates which float in the water are more sensitive than the adults to changes in salinity.
- (h) Coral reefs can tolerate only small changes in temperature. Higher temperatures may cause coral bleaching and result in death.
- (i) Marine organisms that are mobile tend to move away from areas receiving higher temperature water thus affecting their distribution and population density.

Mitigation Measures (alternative discharge techniques)

Taking into consideration environmental, engineering and economic aspects, the alternative discharge techniques are as follows:

- Discharging the brine at a greater distance from the shore via a long pipe.
- Discharging the brine via the outlet of a power station's cooling water (for RO brine).
- Directing the brine to a salt production plant.
- Thermal brine plume may be mixed with colder or normal temperature discharges from other nearby industries.
- Thermal brine plume may be discharged through long open flowing channels to dissipate heat.
- Thermal brine plume may be discharged through open air fountains to dissipate heat.
- Thermal brine plume may be discharged after passing through cooling towers.

8.2.3 SEAWATER USED FOR INDUSTRIAL COOLING

Seawater is used as contact and non-contact cooling water in various industries and facilities. Non-contact cooling water is commonly used in industrial facilities. While desalination plants produce brine with a higher salinity and temperature differential, non-contact cooling water shows a temperature differential and often contamination from oils and grease.

The quality of cooling water discharged from different industries in the Jubail and Yanbu Industrial Cities is provided as an attachment. Some physical and chemical parameters of discharge water from Luberef in Yanbu Industrial City are shown in Table 6.



Table 6: Discharge Levels from Luberef.

| Parameter | Levels |
|-------------------|------------------|
| Temperature | 26-36 °C |
| pH | 8.0 – 8.2 |
| Salinity | |
| Oil and grease | 40.3-43.9g/l |
| Phosphate | 0.9 – 148.9 mg/l |
| Residual chlorine | Nil – 0.23 mg/l |

the two major industrial cities of Jubail (east coast) and Yanbu (Red Sea coast) that house primary, secondary and support industries, the Kingdom has developed fourteen additional industrial cities that are located outside the main cities of Jeddah, Riyadh, Dammam, Madina, Makkah Al-Mukarramah, Hofuf, and others.

With respect to pollution of the Red Sea from land-based activities, the principal industrial sources are located in the coastal region from Yanbu in the north to Shoaiba in the south. Other small and medium scale industrial cities in the Kingdom, such as the industrial cities around Jeddah, Dammam and Riyadh, have separate central industrial wastewater treatment plants while other industrial cities discharge their wastewater either into the municipal wastewater network or to the desert.

Most of the wastewater from these industrial cities, treated, partially treated or untreated, ends up in the sea or in the desert and wadi systems.

Yanbu Industrial City

Yanbu was developed in the early 1970s and is now a major industrial city. It hosts power and desalination plants, petrochemical plants, an oil export terminal and oil refineries, as well secondary support industries (Table 7). It was developed with environmental protection in mind and all international environmental standards were followed during construction.

The industrial city operates a tertiary level sewage treatment plant (STP) of 28,000 m³/day capacity and an industrial wastewater treatment plant (IWTP) with a capacity of 24,000 m³/day. All treated effluent from the STP complies with the irrigation water standards and is reused for irrigation purposes within Yanbu Industrial City. Treated industrial wastewater also complies with relevant discharge standards and is partially recycled and reused by the industry. The remaining treated wastewater is discharged to the marine ecosystem in accordance with discharge regulations. Industrial wastewater from Yanbu is adequately collected and treated in well-designed secondary level treatment plants. The treated wastewater is partially discharged to the sea while a portion is reused for irrigation of green belts. The city has a modern hazardous waste management system in place and follows environmental monitoring, audit and compliance systems for keeping the environment safe and healthy.

The city follows a well-established regular monitoring system for the sources of pollution from various facilities and tests the quality of the ambient air, marine ecosystem, ground water and potable water to ensure that the specified standards are followed for the protection of the environment and conservation of natural resources.

Cooling water return of similar quality from other industrial facilities in Yanbu and Jubail have also been provided in the attachment.

8.2.4 WASTEWATER FROM INDUSTRIAL PROCESSES

The Kingdom has witnessed tremendous industrial development over the last four decades. Primary, secondary and support industries have been developed in different parts of the Kingdom. In addition to



Table 7: Major industrial units in Yanbu Industrial City.

| Serial Number | Name of Industry | Type of Industry | Capacity | Completion |
|---------------|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|---------------|
| 1. | YANPET | Petrochemical industry: ethylene, ethylene glycol and polymers | 1.7 million t/year | 1980 and 2001 |
| 2. | SAMREF | Oil refinery | 400,000 b/day | 1978 |
| 3. | LUBEREF | Lube oil refinery | 280,000 t/y | 1978 |
| 4. | SAYREF | Oil refinery | 400,000 b/day | 2015 |
| 5. | IbnRushd Purified Tetrathalic Acid Plant | Petrochemical industry: aromatics, PTA, acetic acid | 350,000 tons PTA/year | 2008 |
| 6. | IbnRushd Polyester | Petrochemical industry: polyester | 550,000 tons/year | 1985 |
| 7. | YANSAB | Petrochemical industry: ethylene, ethylene glycol, high density polyethylene, low linear density polyethylene, polypropylene, butene 1, butene 2, MTBE and BTX | 2.6 million tons/year | 2010 |
| 8. | CRISTAL | Titanium dioxide plant | 180,000 tons/year | 1991 |
| 9. | Best Food | Food industry | | |
| 10. | NGL | Gas industry; ethane, propane, butane, ISO-pentane | 585,000 b oil/day | 1978 |
| 11. | Power Plant | Power plant | 1,700 MW | 2010 |
| 12. | Desalination Plant | Desalination plant | 550,000 m ³ /day | 1980 |

Any new development in this area needs to follow the local and national regulations and submit an environmental impact assessment to obtain an environment permit before construction and operation can commence. New coastal development projects need to obtain clearance from the National Quadripartite Committee including for dredging and filling activities and for disposal or discharge to the marine environment. There is a national consensus developing to refuse discharge permits for pollutants (wastewater) to the marine environment unless it is unavoidable.

Yanbu Royal Commission (RC) is implementing Phase 2 of industrial development in the area with hundreds of billions of dollars of new investment. This development also follows strict environmental regulations to protect the marine and terrestrial environment and safeguard natural resources.





The principal industries south of Yanbu are shown in Table 8 below.

Table 8: Main industries south of Yanbu.

| Serial Number | Name of Industry | Type of Industry | Capacity | Completion |
|---------------|---------------------------------------------------|---------------------------------------------------------|--------------------------------------------|----------------------|
| 1. | Rabigh Power Plant | Power plant | 2,600 MW | 1998 |
| 2. | Petro Rabigh Oil Refinery and Petrochemical Plant | Oil refinery: ethylene and polypropylene based products | 400,000 barrels per day crude oil refining | 1998 |
| 3. | Rabigh Cement Plant | Cement plant | 8,200 tons/day | 1984 |
| 4. | Rabigh Economic City | Secondary aluminium plant and others | Miscellaneous | 2005 |
| 5. | Jeddah Oil Refinery | Oil refinery | 45,000 barrels/day | 1968 |
| 6. | Jeddah Luberef | Lubricating oil | 270,000 t/year | 1978 |
| 7. | Jeddah MSF Desalination Plant | Desalination plant | 448,000 m ³ /day | 1980 |
| 8. | Jeddah Power Plants | Power plant | 4,000 MW | 1980 |
| 9. | Jeddah Industrial City | Approximately 500 small and medium size industries | Miscellaneous | 1980 |
| 10. | Jeddah Islamic Port | Port | 58 berths | 1978, upgraded later |
| 11. | Shoaiba Power Plant | Power plant | 4,000 MW | 1998 |

8.2.5 OIL AND HYDROCARBONS

There are no records of discharge of oils and hydrocarbons from towns in the northern zone except for Yanbu Industrial City. Here all industries, including oil refineries, discharge their wastewater into the industrial wastewater treatment plant and the treated wastewater, which complies with PME and Yanbu Royal Commission discharge standards, is partially discharged to the Red Sea and partially recycled by industries.

Data are scarce concerning hydrocarbon contamination in the central and southern regions. However, treated wastewater from oil refineries and industry is discharged to the Red Sea after ensuring that the water quality meets PME discharge standards.

8.2.6 HEAVY METALS

There are no records of discharge of heavy metals from any towns in the northern zone except for Yanbu Industrial City. Here, industries including oil refineries and the galvanizing industry discharge their wastewater into the industrial wastewater treatment plant. The treated wastewater, which complies with PME and Yanbu Royal Commission discharge standards, is partially discharged to the Red Sea and partially recycled by industries.





In the central zone, discharges containing heavy metals have only been recorded from the Jeddah oil refinery and Jeddah Industrial City. Similar to Yanbu, wastewater is discharged into the industrial wastewater treatment plant, and treated wastewater complies with PME's discharge standards. Some is discharged to the Red Sea while the major part is recycled by industries.

Discharges containing heavy metals are not known from towns in the southern zone except for Jazan Economic city and a few other small industrial facilities. These discharges are disposed of on land after proper treatment, ensuring that they comply with PME's discharge standards.

8.2.7 LITTER

Litter from tourist facilities, especially from the corniches of large urban centres such as Yanbu, Jeddah and Jazan, is collected and disposed of in designated landfill facilities by the respective municipalities. Janitorial staff are hired to pick up the litter from beaches. The municipalities of these urban centres conduct awareness campaigns to explain to the public the dangers to human health and the environment associated with litter on the beach.

8.2.8 PERSISTENT ORGANIC POLLUTANTS

The only known source of persistent organic pollutants (POPs) is from agriculture. Activities such as the application of pesticides and insecticides may allow some chemicals to end up in the marine environment due to run off from valleys after rainfall.

8.2.9 MOBILIZED OR CONTAMINATED SEDIMENTS

Wind-blown sediments from wadis (valleys) along the Red Sea coast as well as sediment from run-off after rainfall may be deposited in the sea.

8.2.10 FISH FARM WASTE

Discharges from fish farms that are high in nutrients and organic material may result in algal blooms.

8.2.11 STORMWATER AND IRRIGATION WATER LEACHATE

Run-off of contaminated water from storm water discharge points or agricultural activities may contain toxic contaminants.

The relative significance of these different pollutants to the marine environment is summarized in Table 9.





Table 9: Significance of pollutant source categories affecting the marine environment of the Red Sea coast of Saudi Arabia.

| | Pollutant Source Categories | Coastal Zones | Significance |
|---------------------------------------------|-----------------------------------------------------|---------------|--------------|
| P A D H | • Shoreline alteration | North | Low |
| | | Central | Medium |
| | | South | Low |
| | • Destruction of marine life (corals and mangroves) | North | Low |
| | | Central | Medium |
| | | South | Low |
| C O N T A M I N A N T S | • Sewage | North | Low |
| | | Central | High |
| | | South | Medium |
| | • Oil and hydrocarbons | North | High |
| | | Central | High |
| | | South | Low |
| | • Heavy metals | North | High |
| | | Central | High |
| | | South | Low |
| | • Litter | North | Low |
| | | Central | Medium |
| | | South | Low |
| | • POPs | North | Medium |
| | | Central | Low |
| | | South | Medium |
| | • Mobilized or contaminated sediments | North | Low |
| | | Central | Low |
| | | South | Low |
| | • Nutrients and organic load | North | Low |
| | | Central | High |
| | | South | Medium |
| • Storm water and irrigation water leachate | North | Medium | |
| | Central | Low | |
| | South | Medium | |



9. RECENT INITIATIVES AND SUCCESSES

1. Administrative upgrade of central environmental agency from Meteorology and Environmental Protection Administration (MEPA) to Presidency of Meteorology and Environment (PME) and an upgrade of the rank of PME President to the rank of Minister.
2. Promulgation of environmental regulations dealing with marine and land-based activities, with the functions and responsibilities of all public and private sector entities determined and a penalty system for violators outlined.
3. Issuance of rules and detailed procedures for the implementation of environmental regulations.
4. Development of five-year development plans with environmental protection and conservation of natural resources as central themes.
5. Establishment of the National Water Company (NWC) as a water and wastewater utility company to look after the sustainable use of water resources. The company will provide water services and sewage collection, develop new wastewater treatment plants, improve and modify the current wastewater treatment plants, and enhance treated wastewater reuse. The company has a plan to achieve treated wastewater reuse of up to 80% within the next 10 years.
6. Encourage conservation and more efficient use of water, and reuse of treated wastewater.
7. Implementation and strengthening of inspection and audit programmes for industry and other commercial facilities.
8. Environmental impact assessment made mandatory for new development projects or major modification to existing projects where developers have to study the potential impacts on the environment (including marine environment) and mitigate these impacts to comply with regulations and standards.
9. Establishment and strengthening of National Oil Spill Contingency Plan and establishment of National Oil Spill Combating Center.
10. Upgrades to a number of sewage treatment plants in various cities of the Kingdom, including cities along the Red Sea coast, and development of new sewage treatment plants to cover all the population in the Kingdom as part of a long term plan.
11. Establishment of the Quadripartite Coastal Committee to act as the final authority to evaluate and approve development projects along the coast.
12. Establishment of industrial wastewater treatment plants for the treatment and disposal of industrial wastewater.
13. Encouraging reuse of treated wastewater to ensure zero discharge to the marine environment.
14. Development of reuse standards for treated wastewater for irrigation.
15. Establishment and strengthening of ambient air quality monitoring system.
16. Development of monitoring programmes for the marine ecosystem.
17. Strengthening of coordination and cooperation among all stakeholders.
18. Implementing periodical beach cleaning programmes.
19. Raising and strengthening environmental education and awareness.
20. Establishment of marine protected areas.
21. Re-plantation and rehabilitation of mangroves in areas where they were damaged as part of development activities, e.g., in the Jazan area.

10. MANAGEMENT OBJECTIVES

Objectives of the Regulatory and Institutional Framework at the National Level

- Preserving, protecting and developing the environment and preventing its pollution.
- Protecting public health from the hazards of activities and actions that are harmful to the environment.
- Preserving, developing and rationalizing the usage of natural resources.
- Making environmental planning an integral part of comprehensive development planning in all areas of industrial, agricultural, urban and other development.
- Promoting awareness of environmental issues on an individual and collective basis in order to protect and improve the environment and encourage national voluntary efforts in this regard.
- Environmental monitoring and studies.
- Documenting and publishing environmental information.

Objectives of the Oil Spill Contingency Plan

- Establishment of a system for immediately responding to an oil spill.
- Coordinating the actions required for dealing with the effects of spilled oil in the marine environment.
- Protection of the Saudi marine and coastal environment from the effects of spilled oil making full use of the available resources both regionally and internationally.
- To honour the Kingdom's obligations assumed under various regional and international agreements entered into by Saudi Arabia for the protection of the marine environment.

Coastal Zone Management Objectives

- Development of appropriate institutional arrangements to promote the wise and sustainable use of the nation's coastal and water resources, including resolution of current conflicts among competing use needs and/or responsibility for coastal areas and resources.
- Improving information on coastal environments (habitats/ecosystems) that generates economically, socially and environmentally important resources at the local, national and international levels.
- Planning and management guidelines that will help establish wise and sustainable use of coastal ecosystems.
- Planning and management guidelines for activities that require location or access to coastal land and water resources.
- Planning and management of development and conservation activities.
- Increased public awareness of the importance of coastal land and water resources for their economic and social welfare.

11. NPA ACTIONS AND INITIATIVES

| Issue | Objectives | Action | Outputs | Responsibility | Linkage | Schedule | Source of Finance |
|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------|------------------------------------------------------------------------------------|---------------------------------------|----------------------------------------------------------------------------------------|----------------------------------------|
| Elimination or minimization of sewage inputs to the marine environment | Zero discharge to the marine environment | Strengthen sewerage network in Red Sea coastal areas with tertiary level treatment | Good quality treated wastewater available for reuse and recycling | Ministries of Water and Electricity, Municipal and Rural Affairs, Agriculture, PME | National Water Company | Construction of new sewerage networks and WWTPs underway in different cities and towns | Public and private sector partnerships |
| Minimization of industrial wastewater discharge to the marine environment | Zero discharge to the marine environment | All industrial cities to have adequate central industrial wastewater treatment facilities | Good quality treated wastewater available for recycling and reuse | Ministry of Industry and Trade | National Water Company | Already in place in Jeddah and Yanbu. Under construction in new developments | Public and private sector partnership |
| Inspection and auditing programme for industrial and other facilities including ports | Control and reduction of pollution and compliance with regulations | All industrial and commercial facilities | Cleaner environment | PME | All concerned facilities | Underway | Public and private sector partnership |
| Reduce oil spill risk, risk of oil spill damage and oil waste discharge risk | Minimize oil pollution to the marine environment | All port facilities and ships | Healthy marine environment | PME and other members of oil spill contingency plan | All concerned facilities and agencies | Implemented | Public sector |
| Control and compensate for damage to coral and other marine life from development activities | Minimize damage to marine life | All along Red Sea coastline | Healthy and vibrant coastal areas | PME and other agencies responsible for Coastal Zone Management Plan | All concerned facilities and agencies | In approval process | Public sector |
| Strengthen regulatory tools on water discharges and ambient water quality for Red Sea | Minimize marine pollution and control land-based sources of pollution | All along the Red Sea coast | Healthy and vibrant Red Sea environment | PME | | On-going process | Public sector |

| | | | | | | | |
|---------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|-------------|------------------------------------------|
| Emphasize the importance of environmental management in investment and operations processes | Draw attention of financial institutions to help protect the environment by putting environmental protection conditions before approval of investment loans | At national level | Healthy environment and sustainable development | PME Financial Institutions | Environmental regulations | Implemented | Banks and financial institutions |
| Implement environmental and ambient air quality monitoring, and monitoring of source emissions from industrial facilities | To follow-up on inspections; environmental audit and compliance | For all industrial and commercial facilities and components of ambient environment | Protection of the environment | PME, concerned facilities and agencies | Environmental regulations and standards | Implemented | Public-private sector |
| Improve public understanding and behaviour regarding civic environmental responsibility | Ensure participation of society to achieve the goals of environmental protection and sustainable development | Society in general and educational institutions in particular | Increased awareness | PME and other agencies and private sector entities | Environmental regulations | Implemented | Public-private partnership |
| Provide funding for environmental protection, education and research | To achieve new ways to protect the environment | Educational and research institutions | Adaptation and development of new technologies | PME, KACST, universities and research institutes | Ministry of Planning, Ministry of Finance and National Economy | Implemented | Ministry of Finance and National Economy |
| Improve the approval process for new developments on the Red Sea coastline | To streamline the approval process | Quadrupartite Committee | Better coordinated approval process | PME | Ministries of Municipality and Rural Affairs, Agriculture, Coast Guard, and PME | Implemented | Concerned ministries and agencies |

