

ES EXECUTIVE SUMMARY

ES.1. Introduction

The RTIP at Jubail II Project (RTIP) is the development and installation of a petrochemical complex on a greenfield site in the Jubail II Industrial City, Kingdom of Saudi Arabia (KSA) within the jurisdiction of the Royal Commission for Jubail and Yanbu (RCJY). RTIP will be built, owned and operated by a joint venture (JV) between Saudi Aramco and The Dow Chemical Company.

The overall complex will process ethane and naphtha as primary feedstocks to produce chemical and polymer products including polyethylenes, propylene glycols, amines, polyols, and urethane chemicals. Products from RTIP will be sold to companies in the Middle East and Asia for conversion to consumer products such as plastic containers and toys, insulation, antifreeze, adhesives and sealants, and paints.

RTIP will incorporate into its design the necessary environmental measures to comply with applicable RCJY standards, international guidelines and standards developed/adopted by Equator Principles Financial Institutions (World Bank and IFC), industry standards and partner companies' requirements and standards. In cases where duplicate or multiple requirements exist, the more stringent will be considered after appropriate risk-benefit analyses. The Environmental Management Plan addresses proposed mitigation measures to be implemented over time in order to ensure that all aspects of the project are in compliance with international standards.

In accordance with the Environmental Protection Standards set by the PME in 2001 [PME, 2001]) and Saudi Aramco and Dow Corporate requirements, as well as the Equator Principles and the IFC's Performance Standards, a detailed Environmental Impact Assessment (EIA) was carried out.

The EIA for RTIP required the following activities:

- Determine the data and analysis requirements to complete an environmental assessment which will meet local requirements and international standards of good practice;
- Ascertain what data are available and what additional surveys would be required;
- Liaise with the regulatory agencies and in particular the RCJY;
- Identify major issues and in particular those which may have an impact on design at an early stage;
- Establish the pre-construction environmental baseline for the RTIP site;
- Assess potential impacts of RTIP during construction, commissioning, operation and decommissioning;
- Identify mitigation measures to reduce any impacts;
- Develop a plan to monitor the implementation of the proposed mitigation measures; and

- Prepare well documented and defensible final reports and present the key findings to the regulatory agencies and the lending institutions.

The EIA is divided into Sections covering the following subjects/aspects: policy, legal and administration framework; project description; baseline sections (air & meteorology; onshore physical environment; ecology; noise; waste management; socio-economic aspects; archaeological and cultural heritage) assessment of impacts and mitigation measures, including cumulative impacts (air & meteorology; onshore physical environment; ecology; noise; waste management; socio-economic aspects; archaeological and cultural heritage); Summary of Impacts; Mitigation Measures; Monitoring Plan; Analysis of Alternatives; Sustainable Development Assessment; Appendices include: a stakeholder engagement plan, an Environmental Management Plan (EMP), and other complementary information. The Environmental Emergency Response Plan (EERP) for the facility prepared in accordance with the RCER 2010 will be provided as a supplement.

ES.2. Policy, Legal & Administrative Framework

The RTIP Project is located in Jubail, in the Eastern Province of the KSA, and lies within the jurisdiction of the RCJY. Although the Presidency of Meteorology and Environment (PME) has the overall authority in the KSA for environmental matters, the RCJY has been delegated responsibility for environmental matters within the boundaries of the industrial cities of Jubail and Yanbu. The RCJY is responsible for environmental management and controlling pollution associated with the development and operation of both industrial cities.

The key environmental regulations and standards applicable to the RTIP at Jubail are:

- “Royal Commission Environmental Regulations (RCER) Volume I, 2010 – Regulations and Standards” that includes all regulations, standards, and guidelines which industries operating in any of the industrial cities shall comply with. The RCER-2010 Volume I supersedes the last version RCER 2004. The RCER 2010 has been adopted by RTIP at Jubail to comply with regulatory requirements;
- “Royal Commission Environmental Regulations (RCER) Volume II, 2010 – Environmental Permit Program” that covers procedures and forms for applying to obtain “Environmental Permit to Construct” (EPC) and “Environmental Permit to Operate” (EPO) permits. The RCER 2010 Volume II supersedes the RCER 2004 Volume II.

“PME Environmental Regulations and Its Rules of Implementation, 2001” that includes the Environmental Protection Standards (Doc. No. 1409-01) has been considered as a reference for this project;

It is likely that RTIP funding will be provided by multiple financial institutions comprising a combination of Saudi Arabian and International banks. The Lenders are yet to be selected by the Project, but it is probable that major international financial institutions would be involved and that they would have adopted the Equator Principles, a financial industry framework for addressing environmental and social risks associated with a proposed project. Even in the absence of involvement of Equator Principles Financial Institutions (EPFIs), the Equator Principles provide an internationally accepted set of guidelines for major developments.

Therefore, international guidelines and standards developed by EPFIs will be also considered by the project.

The KSA is subject to international protocols and agreements adopted by the Kingdom and to other national environmental guidelines and standards, such as those developed by the PME as well as local specific environmental protection criteria developed by the RCJY which apply to industries within the boundaries of the industrial cities of Yanbu and Jubail. Additionally, the operator of a facility shall utilize Best Available Techniques (BAT) for environmental control, and shall apply methods and procedures for compliance, monitoring and sampling in accordance with international accepted standards, such as the American Standard Test Methods, U.S. Environmental Protection Agency (EPA), or Standard Methods for the Analysis of Water or Wastewater (Latest Edition).

ES.3. Project Description

The complex will occupy an area of about 576 hectares (ha), on a greenfield site identified as part of the Jubail II Industrial City, at approximately 3 km to the west of the existing Jubail Industrial City (JIC) in Saudi Arabia. The land area comprising the RTIP site is designated as industrial. The project will also occupy a tank farm and loading and unloading facilities at the Jubail King Fahd Industrial Port (KFIP).

The RTIP project combines multiple petrochemical process units to produce a broad range of chemicals and polymers. In total the site has about thirty different process units. Also the Project will include the utilities and infrastructure facilities required to support the process units.

The primary feedstocks to the Project are ethane and naphtha. The overall complex is configured with a mixed feed steam cracker and an aromatics plant as the core process units producing ethylene, propylene, benzene, and toluene as the four major hydrocarbon intermediate product streams. In addition, a chlor-alkali facility will produce chlorine, caustic soda and some hydrogen, from the electrolysis of brine, for use by the downstream derivative units.

Chemical and polymer products from the complex include polyethylenes, propylene glycols, amines, polyols, and urethane chemicals. All of the products will be sold to companies in the Middle East and Asia where they are converted to consumer products such as plastic containers and toys, insulation, antifreeze, adhesives and sealants, and paints.

The project comprises the following components:

- Hydrocarbon and Chlorine Core Units;
- Chemicals and Plastics Derivative Units;
- Utilities, Infrastructure and Site Logistics; and
- Value Parks (outside the scope of this impact assessment).

JIC has a total of 176 industries in operation and as many as 76 in construction or at the design stage as well as infrastructure support utilities such as the Saudi Electric Company (SEC) for electric power, Marafiq for water desalination and distribution, sea water cooling pumps and network and waste water treatment facilities for sewage and process water (RCJY, 2010). Other infrastructure support utilities or neighbouring industries in the area include the Berri gas Plant, Jubail airport, Jubail Commercial Port (JCP) and King Fahad Industrial Port (KFIP).

Power and Utilities needed for the project, such as industrial water and potable water will be imported into the RTIP complex. Industrial gases such as high priority hydrogen, carbon monoxide, oxygen, nitrogen, ammonia, and compressed air will be supplied by third party Industrial Gas Provider (IGP). The JV's scope includes the site steam generation, demineralised water generation, electrical distribution, cooling water systems, site fire water system, condensate return system and the distribution of site utilities.

Other facilities necessary to support RTIP and within the JV's scope include:

- Hydrocarbons Infrastructure: Offsite pipelines (connecting the main site with the Port Facilities at King Fahd Industrial Port and other third party facilities within JIC), main pipe racks and storage for feedstock, return streams and finished products;
- Environmental facilities for wastewater handling, thermal treatment, and solid waste handling for offsite disposal. Industrial and Sanitary wastewater from the RTIP facility will be sent to Marafiq's Industrial Wastewater Treatment Plant and Sanitary Wastewater Treatment Plant, respectively.
- Port Facilities: raw materials and products loading and unloading docks, and tank farm at the KFIP;
- Temporary Facilities and Early Works: camps, lay down areas, office areas, and other support requirements and Early Works activities needed to support the mobilization of EPC contractors to the site;
- Transportation: roads, parking areas; and
- The site logistics services: Finished Products Packaging Centre Facilities (receiving, storage and shipping facilities) will be provided by third party, but will be located within the RTIP site.

The overall project schedule includes approximately fifty months of Engineering, Procurement and Construction (EPC), with site preparation starting in July 2011. Commissioning and Start-up is due to start in end of 2013 and is expected to last approximately twenty months, and the plant is expected to be in full operation by September 2015. A life of twenty five years has been considered, and it has been estimated that decommissioning will require an equivalent time to that needed for construction of RTIP. The number of personnel associated with RTIP fluctuates depending upon the particular work stage. Workforce during the peak, in construction phase, will reach 55,000 personnel (about 20% will be Saudi Nationals). Approximately 3,600 (about 75% will be Saudi Nationals) persons have been estimated to be involved in the commissioning and operation phases.

ES.4. Baseline

A characterization of the environmental, socio-economic and cultural resources of the area of influence of RTIP has been performed based on literature research, consultation with relevant stakeholders, previous reports and field studies performed as part of the scope of the EIA. The main findings are summarized in the following sections.

ES.4.1. Air Quality & Meteorology

The assessment of air quality and meteorological conditions in the area of influence of RTIP has been undertaken on the basis of ambient air quality data supplied by the RCJY and on surface and upper air meteorology data for the King Fahd International Airport at Dammam (hereinafter Dammam Airport) station.

The RCJY collect meteorological and air quality data from a network of seven ambient air quality and meteorological stations located within JIC. Air Quality Monitoring Station number 6 (AQMS#6), located next to the proposed RTIP site, has been selected to provide data for this study.

The RTIP site is surrounded by the following:

- Jubail Export Refinery (SATORP) under construction to the north-east;
- Jubail II undeveloped areas to the west and south;
- Road 274 to the south-east; and
- BeeA'h industrial / chemical landfill facility to the east corner of the RTIP site.

Additionally, other sources of air pollutants in the area, located predominantly to the north-east, are the existing 176 industries at JIC as well as infrastructure support utilities north-east from the site, and the Berri Gas Plant.

Hourly ambient air monitoring data from AQMS# 6 for NO_x, CO, SO₂, O₃, Total Hydrocarbons, PM_{2.5} and PM₁₀, from 1st January to 31st December 2009 were selected to establish the ambient air quality conditions in the area by comparison of different averaging data with the RCER ambient air quality standards:

- Nitrogen dioxide concentrations were within ambient air standards during the monitoring period;
- Sulphur dioxide concentrations were within the standards for all criteria and averaging time periods;
- Ozone concentrations for the 1-hour and 8-hour averaging periods exceeded the RCER standards, ozone is a secondary pollutant and is considered to be a regional issue;
- Carbon monoxide concentrations for the 1-hour and 8-hour averaging periods for AQMS#6, were well below RCER standards; and

- Ambient air concentrations of PM₁₀ and PM_{2.5} greatly exceeded RCER ambient air quality standards for all averaging time periods. For PM₁₀, it is difficult to distinguish between industrial and non-anthropogenic sources of particulate matter. In arid, desert climates very high PM₁₀ concentrations can be caused by sand storms and periods of high wind speed; however, the issue of natural wind blown dust makes interpretation of this ambient data difficult.

ES.4.2. Onshore Physical Environment

Both the Main RTIP site and the Port site were subject to an intensive Geotechnical Investigation followed by a Phase I and Phase II Environmental Site Assessment undertaken by third parties in order to determine the baseline geological, hydrological and soil/water chemical conditions.

Drilling investigations showed that the geology underlying the main RTIP site consist of Aeolian sands at the surface, becoming more dense with depth down the investigation limit of 50 m below ground surface (bgs). Geology at the Port site consisted of mixed granular soils to the investigation limit of 50m.

Groundwater levels at the main RTIP site varied between 2 and 12m bgs in 2010, and between 3.6 and 3.8 mbgl at the Port site. Chemical analysis of groundwater samples at both sites for TPH and PAH were below detection limits while all metals were considered to be at background concentrations.

Soil chemistry analyses were undertaken at both sites at depths of 0.1 and 1.0m bgs for TPH, PAH and metals. Concentrations of TPH and PAH were below detection limit in all samples and the concentration of metals were all below the Dutch Intervention Values. Based on the laboratory analytical report from the Phase II Site Assessments, it is considered that the reported analytical soil concentrations represent the current local background concentrations within the sandy soil down to maximum 1m depth.

ES.4.3. Ecology

Terrestrial Ecology

The RTIP site is surrounded by JIC settlements with the industrial area lying adjacent to the north and northeast. To the south of the site there is an extensive settlement consisting of worker camps, farms and forestry plantations. The BeeA'h landfill site is situated next to the south-eastern corner of the project site.

An area of natural or semi-natural vegetation lies in the southwest corner and along the southern edge of the site, and continues to the west of the site as far as the Abu Hadriyah road. This vegetation consists mainly of a community of moderately saline tolerant shrubs belonging to the family Chenopodiaceae, mixed with a community dominated by perennial grasses (*Panicum turgidum* and possibly *Pennisetum divisum*), and clumps of date palm trees. It is often currently presented in poor condition due to waste or over-grazing.

Such habitats are considered of low ecological value, as they are only likely to support common desert species of breeding, migratory and wintering birds together with resident mammals and

reptiles. These habitats are widespread throughout the Arabian Gulf, and present outside the project site towards the south-western side, therefore the loss of this type of habitat is considered an impact of only local extent.

The project site is located in a low-lying area along the eastern coast, where saline soils covered with halophytic (salt-tolerant) shrubs are predominant, though sand sheet areas, areas of standing water or wet mud basins, and beach habitats are also present.

The project site is situated about 10 km south of the Sabkhat Al-Fasl Lagoons, listed as an Important Bird Area (IBA) by BirdLife International. These are a series of evaporation lagoons on sabkha, which are used for storing excess wastewater from Jubail Industrial City. The Jubail Marine Wildlife Sanctuary, established after the events of the 1991 Gulf War, is the first of a series of proposed marine protected areas along the western coast of the Arabian Gulf which will promote the conservation of endangered species and allow for the appropriate management of the renewable biological resources of the area.

The site is likely to be used by a variety of generally common and widespread desert bird species, present at low densities. These will almost certainly include Hoopoe Lark (*Alaemon alaudipes*) and Crested Lark (*Galerida cristata*). A number of resident species are likely to nest or roost in the date palms, all of which will also be found in urban areas and tree plantations in the surrounding area. The site may also provide some foraging potential for commoner migrant species such as Red-throated Pipit (*Anthus cervinus*), Yellow Wagtail (*Motacilla flava*), Isabelline Shrike (*Lanius isabellinus*), Short-toed Lark (*Calandrella brachydactyla*), Desert Wheatear (*Oenanthe deserti*) and Desert Warbler (*Sylvia nana*).

No comparatively large animals like hares and rodents were identified during the site walkover. Although no domesticated or feral animals were seen during the course of the survey, signs of grazing (likely by goats) were identified. Common species such as feral dogs and Red Fox (*Vulpes vulpes*) could occur on the site. It is likely that the better vegetated parts of the site support populations of the more common and widespread small mammal species such as Cheesman's Gerbil (*Gerbillus cheesmani*) and Baluchistan Gerbil (*G. nanus*). Other species that might occur in this habitat include Cape Hare (*Lepus capensis*), Sundevall's Jird (*Meriones crassus*) and Lesser Jerboa (*Jaculus jaculus*), all widespread in well vegetated sandy areas throughout the Arabian Gulf. One or more species of hedgehog may also occur in this area. Reptile activity on the site appeared to be poor, with only one track identified in the field survey. The most likely species to occur in this habitat is the White-spotted Lizard (*A. schmidti*), a common and widespread species in softer sandy areas.

Marine Environment

The main RTIP site is approximately 18 km from the shoreline. The project will also have a tank farm and loading and unloading facilities at the existing King Fahd Industrial Port (KFIP or Port).

The marine ecology baseline investigation (Section 6.4 of Ecology Baseline) is based upon a literature review focusing on two areas, Jubail and Ras Tanura, between which the KFIP is located. The marine ecology baseline section is also based on prior knowledge of the habitat, flora and fauna of the general region and of other similar areas of the Arabian Gulf region.

KFIP is located within an ecologically diverse area of the Arabian Gulf and whilst the direct impacts at the Port (such as storage tank leakage or spills during loading and unloading) are confined to a smaller area of the Arabian Gulf, these impacts can have regional repercussions. Ras Tanura is approximately 50 km south of RTIP, but information on Ras Tanura provides some regional context for this section. The potential for long shore current to carry a spill of fuel, raw materials, finished product or other cargo from the Port area southward towards Ras Tanura means that this stretch of Gulf waters and coastline between the two points is also considered a potential receptor.

The Jubail Marine Wildlife Sanctuary is located to the north of JIC. The area consists of two large coastal embayment systems (Dawhat ad-Dafi and Dawhat al-Musallamiya) and five offshore coral islands (Harqus, Karan, Kurain, Jana and Juraid) along the stretch of coastline between Abu Ali and Ras az-Zaur. The area covers an area of approximately 2,300 km² and more than 400 km of coastline. The intertidal zone is characterised by sandy beaches, rocky shores, salt-marshes and mangroves. Seagrass beds, coral beds and coral reefs form the major types of subtidal habitats. The Sanctuary contains specimens of all major habitat types of the western Gulf. It includes the northernmost mangrove stands, the largest and most diverse coral reefs, and the most important nesting sites in the Arabian Gulf for marine turtles and several species of seabirds (Alam 1996, Fleming 1996, Krupp & Khushaim 1996, Ziegler & Krupp 1996, Abuzinada & Krupp 1994).

The prevailing long shore current moves southward along the eastern coast of Saudi Arabia. Therefore the habitats of the Jubail Marine Wildlife Sanctuary are an unlikely receptor of any spill or other accidental release of RTIP raw materials or finished products. However, the habitats of the Jubail Marine Wildlife Sanctuary attract species that may move throughout the coastal waters stretching from Ras Tanura, through the KFIP area, to the Sanctuary.

ES.4.4. Noise

A noise baseline investigation has been conducted to characterize existing ambient noise levels in order to assess the potential impacts of noise levels related to the different phases of RTIP. In addition, the areas that could potentially be affected by noise from RTIP activities have been reviewed to identify potential noise-sensitive receptors. The characterization was performed comparing the measured noise levels with the applicable noise standards which are those from the RCER, Volume I and II. Additionally, the World Bank noise limits have been included as a reference (World Bank, 2007a.)

The measurement campaign comprised measurements of noise pressure levels, both continuous (72 hour duration) and short term (10 minutes duration) in several points inside the RTIP main site, at the boundaries and in the closest sensitive receptors. Access to the port was not provided, therefore, the noise baseline study has been focused on the main site of the complex and its surroundings.

The area in which the main site of the RTIP complex will be built is designated as industrial and is currently under development. When the noise measurement campaign was performed, an electric substation was under construction in the northern corner of the site. A contractor camp was also located in the site, close to the northeast boundary. These likely affected the measured noise levels.

The nearest sensitive receptors to the RTIP complex are the following inhabited areas:

- Mixed use area consisting of a construction camp, factory and agricultural farm located at approximately 1.5 km south of the RTIP site;
- Jubail prison, located at approximately 3.8 km east of the RTIP site;
- Jubail Old Town, at approximately 13 km north-east of the RTIP site; and
- Jubail Community Area, located at approximately 17 km north of the RTIP site.

The following conclusions have been extracted from the RTIP Noise Survey:

- Average ambient noise levels (L_{eq} [72h]) and average of the 10 minute L_{10} measured in the long term monitoring locations within RTIP complex and its boundaries are below the RCER and the World Bank noise criteria. The L_{eq} noise levels measured in the Farm adjacent to Mega Coat Factory comply with both RCER standards and World Bank Guidelines. The measurement location in the vicinity of Jubail Prison is above the night-time standard for the World Bank Guidelines. Night exceedances are associated to peaks of traffic that took place every day, between 5:00 and 7:00 am, inclusive.
- While periods of high wind speed were avoided as far as was practicable, wind speed was high during long term noise measurements in certain locations, being perceived as the main noise source during the measurements. Windscreens were used in all the measurements, and in some cases, the noise meter was located in an open box in order to protect it from strong wind and sand.

ES.4.5. Waste Management

Information on the waste management infrastructure available in and around the project has been gathered during the field investigations, together with a desk-based search for information in official web pages. The local hazardous waste disposal and sanitary landfill facilities located in Jubail were visited as part of the field investigation undertaken in November 2010. In addition, a number of regional waste and wastewater treatment and/or disposal facilities were previously visited as part of a field investigation undertaken by the Owner's Environmental personnel in April 2008 (Dow, 2008).

JIC contains various installations able to treat and dispose of industrial and domestic, liquid and solid waste streams. The facility which will manage the RTIP's non-hazardous wastewater will be the Marafiq Wastewater Treatment Facility, which is itself divided into two plants which are the Marafiq Sanitary Wastewater Treatment Plant (SWTP) and the Marafiq Industrial Wastewater Treatment Plant (IWTP). Both of these plants use Primary and Secondary Treatment Processes. With regards to solid waste streams, there are two facilities directly adjacent to the RTIP site, which are able to manage and dispose of both hazardous and non-hazardous wastes. The first of these is operated by the National Environmental Preservation Company (BeeA'h) and includes hazardous waste landfill with both Class I and II landfill cells, and a Thermal Treatment facility. The second facility is operated by the Environment Development Company (EDCO) and also includes both Class I and II landfill cells, although

there is no Thermal Treatment facility at present. In addition to these two facilities there is also the RCJY sanitary landfill which is equipped to handle non-hazardous wastes only.

ES.4.6. Social

A socio-economic baseline survey was undertaken in order to identify and characterise the communities that may be impacted by RTIP.

The proposed RTIP site is to occupy an area of approximately 5.76 km² or 576 ha of land in Jubail II, as well as a tank farm and loading and unloading facilities at the KFIP. It lies within the Jubail Governorate in the Eastern Province of Saudi Arabia.

Jubail's main economic activity is related to the oil and gas industry. The robust increase of the oil sector in the past sixty years has led to a high rate of economic immigrants from other parts of Saudi Arabia and foreign workers from the United States, United Kingdom, Middle East, and Asia. As such, Jubail and other areas in this region are a settlement of multi-ethnic residents from different cultures and backgrounds. Residents are engaged in support activities including fishing, services, education, business, and semi-skilled work.

These settlements have grown as have the housing infrastructure and services that support workers in these developments. There are residential areas located to the north and northeast of the proposed RTIP complex, and Jubail Town to the south. These areas include industrial installations/infrastructures, Corniche installations (restaurants, parks, coastguard buildings, mosque and palace), agricultural and fishing sites in Tarut Bay and some religious, educational and residential features.

This social baseline has identified the services and infrastructure available, and cultural background, of the RTIP site. A field survey conducted in November 2010 found that most of the available administrative, public and civil services are adequate for the current needs of the residents of Jubail. Networks for water supply and drainage, power supply and telecommunications are available to the community.

ES.4.7. Archaeological & Cultural Aspects

An archaeology and cultural heritage baseline study was compiled in order to identify existing or potential archaeological resources and cultural heritage, at the RTIP site that may be impacted by the project and to locate and document all archaeological and cultural heritage resources that may exist in the study area.

In order to carry out the archaeological and cultural heritage study for the RTIP site (a total area of 5.76 km²), a combination of both a desktop study (literature search) and limited physical site "walk-over" survey was undertaken by Dr. Ahmed Abuelgasim El-Hassan, an Archaeologist and lecturer at Hail University, and a cultural heritage specialist. The physical site survey was conducted for the project area, which also included a buffer area of 10 km around the RTIP site.

On the basis of the results of the RTIP literature search and physical site survey conducted as part of the EIA, and previous survey and fieldwork investigations made by the Deputy of Antiquities and Museums in JIC II and its vicinity, it is not likely that any archaeological and/or

cultural resources are present in the project area. None of the sixteen sites of national and regional archaeological interest identified during the literature review are located within the RTIP project area.

ES.5. Impact Assessment

ES.5.1. Introduction

To enable the assessment of impacts, a set of criteria was developed for determining the potential impacts resulting from the construction, commissioning, operation and decommissioning of the RTIP.

The criteria provides definitions of magnitude and significance as they apply to potential impacts from the project on air, marine, biological and onshore physical environments, socio-economic, cultural and health aspects and from noise and wastes. Common criteria definitions were developed as well as impact assessment criteria for each study area, i.e., air quality and meteorology, marine environment, etc., where necessary. Impacts are assessed with respect to their frequency, likelihood, extent, duration and magnitude. Impacts were further defined as positive or negative and direct or indirect. The overall significance was then determined in relation to each study area / environment as high, medium or low.

These criteria are aligned with criteria integrated in other impact assessment methodologies established by European Directives (Directive 85/337/EEC as amended by 97/11/EC and 2003/35/EC on the assessment of the effects of certain public and private projects on the environment); and impact assessment guidelines developed by international organizations such as the Institute of Environmental Management and Assessment (IEMA) which promotes best practices standards in environmental management, auditing and assessment.

ES.5.2. Air Quality & Meteorology

The air quality impact assessment evaluates the impacts caused by RTIP during all project phases. Main project emissions are dust during the construction phase, and those from combustion sources and fugitives, during the operational life of the project.

In order to evaluate the impacts, ambient air concentrations have been predicted based on anticipated emissions from the RTIP complex by means of air dispersion modelling applying the AERMOD or AERSCREEN programmes developed by the U.S. EPA. Thus, project emissions from dust during construction, and from: NO_x, SO₂, CO, PM₁₀, PM_{2.5} and organic compounds to assess their health effect, during operation have been modelled. Additionally spills scenarios have been evaluated.

The current baseline particulate matter (PM₁₀ and PM_{2.5}) concentrations are above the RC ambient air quality standards, as indicated by the data analyzed from AQMS #6 in JIC. During the construction phase, dust emissions from set-up and other construction activities will result in predicted concentrations below the RCJY standards but the existing high baseline particulate matter concentrations when summed with these modelled concentrations results in a potentially high magnitude impact, which cannot be mitigated by the RTIP project. These impacts are also expected to be present during the decommissioning phase of the project.

Impacts from exhaust emission caused by vehicles and construction machinery have also resulted in a high significance impact close to the RTIP boundary.

The predicted modelled contribution to the ground level concentrations for PM₁₀ and PM_{2.5} from RTIP operations are also well below the RC ambient air quality standards, however when summed to the existing high baseline particulate matter concentrations, result in a potentially high magnitude impact, which cannot be mitigated by the RTIP project. For NO_x the maximum modelled concentration is below the ambient air quality standards, and below 50% of the RCJY air quality standard when summed to the baseline. These emissions represent a 27% consumption of the available ambient air quality increment for NO_x, leading to a low magnitude impact and low significance. Available air quality increment is defined as the difference between the baseline and the corresponding ambient air quality standard.

From the organic compounds assessed, benzene resulted in a medium magnitude impact. The benzene modelled concentrations are within the RCJY ambient air quality standard for benzene, but above the assessment criteria for medium magnitude impact of 50% of ambient air quality standards. A risk assessment based on inhalation has demonstrated that the risk of cancer on the nearby population is within internationally acceptable criteria. The other pollutants assessed: Formaldehyde, Toluene, Xylene, Ammonia, Chlorine, Aniline, Ethylene Oxide, Hydrogen Chloride and Phosgene have modelled concentrations below the applicable ambient air quality or occupational standard. Therefore the impact significance associated to those emissions is low.

Finally, several spill scenarios have been modelled to estimate the impact from the release of products into the atmosphere. The assessment has been focused on a Benzene spill from tank and piperack failures, because benzene has the greatest downwind impacts both for tank and piperack spills, representing the worst case spill scenario, resulting in medium significance impacts.

Although the RTIP facility design incorporates many BAT concepts, additional suggestions for appropriate mitigation measures as included in Section 21, Summary of Mitigation which would be expected to lower the significance after mitigation to low. An exception to this is dust emissions where the background concentrations of PM₁₀ and PM_{2.5} already exceed the RCJY ambient air quality standards.

ES.5.3. Onshore Physical Environment

A number of impacts, ranging in significance, were identified as potentially occurring across each phase of the project. Baseline geological, soil and hydrogeological conditions have been evaluated and considered in the assessment of potential impacts. Mitigation measures and monitoring activities are identified for the majority of environmental impacts.

During the construction, commissioning and operation phases of the project there is the potential for negative environmental impacts through the accidental release or spill of hazardous materials such as raw materials and feedstock. The design of the RTIP facilities and operations includes spill prevention and containment measures for all phases of the project to prevent, to a practical extent, releases of hazardous materials to the physical environment and to limit the duration and size of any possible release. The evaluation of impact of releases of

hazardous materials is based on the formulation and evaluation of possible release scenarios and their potential impact on human or ecological receptors. Identified release scenarios were modelled for contaminant transport in groundwater in the alluvial shallow aquifer. None of the modelled scenarios identified the potential for released contaminants to reach any human receptors, the marine environment or sensitive terrestrial ecological receptors.

During the construction phase of the project there is the potential for environmental impacts of low significance through the degradation of soil quality due to activities associated with construction and earth movement; alteration of drainage characteristics and modification to the hydrogeological recharge system; accidental release or spill of hazardous materials.

A number of activities could potentially generate low significance environmental impacts on the onshore physical environment during commissioning. These are primarily related to accidental releases and spills of hazardous materials, continued modification of drainage characteristics and soil quality and modification of the hydrogeological recharge system.

During the operation phase of the project there is the potential for environmental impacts of low to medium significance. Potential environmental impacts of low significance are associated with continued modification of drainage characteristics and soil quality and modification of the local hydrogeological recharge system. Potential environmental impacts of low to medium significance are associated with releases and spills of hazardous materials that occur due to a pipe failure or spill from transportation tanks and containers.

Potentially positive and negative environmental impacts of low significance are associated with decommissioning activities. Potential positive impacts are associated with restoration of the local drainage and recharge patterns after demolition of project facilities, site restoration and remediation of contaminated soil (discovered after the demolition of facilities). The only potentially negative environmental impact associated with decommissioning activities could be generated by degradation of shallow soil and groundwater quality due to decommissioning activities, traffic and management of inert construction debris.

ES.5.4. Ecology

Terrestrial Ecology

During construction, onsite terrestrial biological resources would be affected by habitat disturbance, dust, noise, presence of structures, vehicle traffic and worker activity. Lighting and habitat fragmentation due to road cutting and grading are likely to occur. Small mammals may also be directly harmed or killed by machinery during the preparation process. The main impact will however be the loss of habitat. The total habitat loss associated with construction is not expected to exceed 200 ha and such habitats are considered marginal and of low value habitat for birds, mammals and reptiles due to the sparse distribution of plant cover on the project site. It is noted however that this will have only a small net impact on the ecology of the JIC area, and that the main site is located 10 km south of the Sabkhat Al-Fasl Lagoons, thus avoiding any direct negative impact on this protected area.

Impacts of construction include removal of vegetation, potential displacement of associated fauna, migratory and resident birds and vegetated areas. The construction phase will have an impact of low significance on onsite terrestrial biological resources.

Some impact on vegetation and fauna adjacent to RTIP site, specifically on migratory or resident birds residing at the coastline area (17.5 km from the RTIP main site) is likely due to the effects of dust, vibration, lighting and noise from earth moving vehicles during the construction period. These impacts are considered to be of low significance.

Commissioning is likely to increase ambient lighting and noise levels inside and outside the fence line of RTIP. This would undoubtedly disturb local birds and fauna, but as the impact will be of short duration and sensitive receptors are lacking, the commissioning phase is classified as having a low significance impact.

During the operational phase of RTIP security lighting for the site will have a low significance impact upon nocturnal animals that are in the vicinity of the site. Air emissions from the RTIP may have a low significance impact on vegetation, mammals, birds and reptiles.

The impacts during decommissioning will be similar to those predicted during site construction in terms of disturbance to mammals (and other fauna), although to a lesser degree because most of the RTIP would be unlikely to support wildlife or native vegetation prior to decommissioning. Demolition of structures and removal from RTIP will generate noise, dust, traffic and worker activity.

Only offsite sensitive habitats are likely to be affected by accidental spills, fires or the release of potentially hazardous materials to the environment, should a release to the environment be significant and not managed.

Accidents and spills may occur on the numerous pipelines that lead to and from RTIP and this could impact small numbers of wildlife. Overall, however, the potential impact on vegetation and fauna is considered to be of low significance.

Marine Environment

The main impacts to the marine environment during the life of the project are related to potential accidental events during transport and at KFIP, such as: 1) direct fuel or chemical spill to sea during transportation by a third-party transporter and 2) fuel or chemical spills from vessel collision or breach at the Port Facilities.

A major release of raw materials, finished product or other loss of cargo resulting from a ship collision within the navigation channel could generate a significant impact to the marine environment. All accidental events during transport will be the responsibility of the third-party transport provider. However, the Owners should incorporate certain considerations into their transport procurement activities. Decisions regarding preferred transport providers should consider the condition of a transport provider's fleet and equipment, and the appropriateness of their operating and emergency procedures to RTIP requirements.

The impacts to the marine environment from an accidental tank, jetty topside handling equipment or vessel collision release are expected to be of medium significance given that some of the chemicals to be stored and handled in large volumes at KFIP which would be considered toxic, not biodegradable and not soluble. RTIP will be responsible for loading and unloading trucks and ships, and therefore responsible for accidents and emergency response at KFIP. It must be taken into account that design measures to avoid spills have been considered so that there should be minimal spill volumes reaching marine waters: the Tank Farm is provided with secondary containment; truck loading/unloading and the Jetty areas are curbed and containment is provided by sump, so any spill in these areas will be contained; pipelines have Emergency Block Valves (EBVs); and the Marine Loading Arms (MLAs) are being provided with Powered Emergency-Release Coupler (PERC) systems.

Impacts to the marine environment including water quality can result in loss of marine life and potential longer term impacts to the coral and seagrass habitats along the coastal area north and south of KFIP. In addition, impacts to marine organisms that pass through the coastal waters from Ras Tanura through the KFIP area to the Jubail Marine Sanctuary are of particular concern. The region is diverse in its marine ecology and lacking in sediment contamination. As such the ecological value of the region is considered as moderately high.

Other impacts that could affect the marine environment are related to wastewater effluents from the concrete batch plant (construction phase), hydrotest water (commissioning phase), potentially contaminated stormwater (operations phase) that could be discharged to sea in the event of a failure of the wastewater control testing systems. Contaminated water entering the marine environment can damage or kill marine organism, including important species for the local fisheries industry. Though the impact is considered of medium magnitude, due to the fact that the impact is a consequence of an accidental event associated to abnormal operation which is considered unlikely to occur, the significance of these impacts has been assessed as low to medium.

The marine environment will be affected, to a small degree, by an increase of vessel movements, lighting and noise at KFIP and potential accidental release of construction materials, equipment or fuel. Should a release occur it will likely be a small volume of diesel or petrol and likely confined to the local area. Volumes and concentrations of contaminants would be small and cargo would likely be inert, therefore the potential impacts derived from vessel movements would be of low significance. Potential impacts associated with noise are also considered of low significance, given the known avoidance behaviour of species expected to visit or forage the area, such as dugongs and sea turtles. In addition, the EPC contractors will ensure that all construction equipment has appropriate noise suppression installed and are well maintained.

ES.5.5. Noise

Noise will be generated at the RTIP during construction, commissioning and normal and emergency operations of the project. Decommissioning of the plant would also result in generation of noise from the site into adjoining areas.

Potential noise impacts from activities during each of these phases have been assessed using the noise criteria set in Section 11 – Impact Assessment Criteria (Tables 11-6 and 11-7). Focusing on assessing the noise impacts on areas of interest, which include inhabited areas (Jubail Prison,

Jubail Old Town and JIC Community area) and the mixed use area located at approximately 1.5 km SE of the RTIP Site, which comprises the Mega Coat Factory, agricultural activity and construction areas with associated contractor camps.

The assessment has been performed by comparing expected noise levels during all project phases with existing noise levels and the applicable noise standards both at the site boundaries and at sensitive receptors. The expected RTIP operating noise levels have been predicted using SoundPLAN® software.

After analyzing the expected noise levels it has been concluded that the most significant noise sources are:

- Heavy vehicles circulating close to residential areas (Jubail Residential area and Jubail Old Town). This impact is expected to be of special relevance during the construction phase, as heavy traffic density is expected to be more significant, though heavy vehicle movements will take place during the rest of the project phases. The impact has been considered as of medium significance and some measures to minimize disturbance to the population have been proposed: scheduled good quality maintenance of the vehicles, and minimization of heavy vehicle movement close to or through inhabited areas, during the night period.
- High Pressure Steam Blows and flaring during commissioning. High pressure steam blows associated with commissioning activities could produce high noise levels (high magnitude impact). These events will be of short duration and will not occur under normal operation and are usually confined to daylight hours and the impact significance has been assessed as of medium significance. Temporary portable vent silencers will be used to control noise from steam blows to manageable levels. Low pressure continuous steam blowing will be used where practical. This method maintains relatively low pressures and continuous flowing stream of steam to achieve steady state blowing conditions. There is no information on noise from flaring but it is expected to be lower than steam blows.

Construction activities are considered continuous for the purposes of this assessment, but are not expected to result in any significant noise increase that could affect the population.

Noise levels as a result of operation activities, though of longer duration, are not expected to cause any significant increase of existing noise levels, and are expected to comply with the applicable limits according to the World Bank and the RCER. The impact has been assessed as of low significance.

High pressure steam blows and flaring also might take place during abnormal operations. In that case, though noise levels expected are similar to those in commissioning, due to the fact that the activity would be infrequent, the impact significance has been assessed as low.

Noise levels during decommissioning are expected to be similar to those expected for the construction phase.

ES.5.6. Waste Management

Wastes will be generated during the construction, commissioning, operation and decommissioning of RTIP. The majority of hazardous wastes will be produced during the commissioning and operational phases of the project, although a significant portion will also be generated during the construction phase. Non-hazardous and inert wastes will be generated during all project phases.

Two units will be constructed within the RTIP for the onsite preliminary waste management of solid and liquid waste streams. Wastewater Unit (Unit 773) is composed of Equalization and Diversion (EQ/DQ) tanks and an Emergency Holding Pond, and will be constructed onsite for the handling of any wastewater generated within the facility that meets RCER Table 3B standards. The wastewater stream will be tested to ensure compliance with RCER Table 3B standards, after which it will be sent to the IWTP in the Marafiq facility. In addition to this, a Solid Waste Handling Unit (Unit 778) will also be constructed within RTIP where waste segregation and temporary storage will be carried out for non-hazardous solid waste and both hazardous solid and liquid waste. The waste will be collected from this Unit to be transported to the designated off-site waste facility where it will be managed and disposed of.

The impact of onsite storage and offsite disposal of non-hazardous liquid waste on human health and the environment is expected to be of low significance during all project phases. Non-hazardous liquid waste streams will mainly include sanitary wastewater, process wastewater, surface runoff flows, and hydrotest water, over the course of the four project phases. All sanitary wastewater (mainly made up of grey and black water) generated during the project will be sent to the Marafiq SWTP for treatment, whilst process and hydrotest water will be sent to the IWTP (although in the case of the latter it may be directly discharged into the Marafiq Seawater Cooling Return Header if in compliance with RCER Table 3C). Surface runoff will be sent to the RC Drainage Channel when the water quality is in compliance with the RCER Table 3C, and when not in compliance will be diverted to the RTIP Unit 773 EQ/DQ tank. Specific environmental and quality control methods at the plant are unknown at this stage and the quantities of sanitary (during construction) and industrial wastewater (during operations) expected to be generated are considerable, so a potential impact of medium magnitude has been identified for soil, marine environment and the local population.

Although onsite storage of non-hazardous solid wastes is expected to be of low significance during all project phases, offsite disposal of these wastes is expected to be of medium significance during the construction and decommissioning phases. Non-hazardous wastes will be segregated and stored at the EPC contractor's camp during the construction phase, and then in the RTIP Solid Waste Handling Unit (Unit 778) during the rest of the project phases. Throughout the project, solid waste storage areas will be enclosed within four walls, floor and roof. Off-site disposal will be carried out at the RC sanitary landfill during the construction phase and in either BeeA'h or EDCO's Class II landfills or equivalent licensed facilities during the remaining project phases. Controls in place for off-site disposal management reduce the overall likelihood of potential windblown and subsurface contamination off-site.

The impact of on-site disposal and off-site disposal of hazardous waste on human health and the environment is expected to be of low to medium significance in all project phases, particularly given the materials involved (hazardous, potential long term affect, low quantity).

Offsite disposal will be carried out at either BeeA'h or EDCO's Class I landfills during the all project phases. As per their website, there is no documentary evidence of environmental controls being in place at the EDCO facility but nevertheless the disposal management practices used by EDCO are stated to be in accordance with the standards of the RCJY, PME and USEPA. In the case of BeeA'h, their facilities hold an ISO 14001 certification and their services are provided in accordance with International Conventions. The significance of these impacts can be further lowered if appropriate mitigation measures are taken. These include developing a comprehensive waste management plan, or auditing the waste management facility prior to the start of each phase of the project.

Hazardous waste transportation is expected to be of low to medium significance during all project phases. The significance of this impact depends greatly on the facility selected for hazardous waste disposal. BeeA'h, for example, state that they aim to ensure compliance with all applicable local and international regulations; that their services are provided in accordance with the requirements of the appropriate transport authority; and that in providing hazardous waste transportation services they also assume total liability for all material accepted. In the case of EDCO however, at present it is unclear whether or not they offer waste collection and transportation as part of their services. Therefore, depending on the facility selected there may be uncertainties associated to the transport of hazardous wastes and which would increase the likelihood of potential contamination occurring, as well as potential future liabilities.

During all phases of the project there is the potential for accidental releases of liquid and solid hazardous wastes both in RTIP and during offsite transportation. The significance of the potential impact resulting from an accidental release is considered medium to high but can be reduced to low if the appropriate mitigation measures are taken and comprehensive and adequate Emergency & Incident Response and Contingency Plans are prepared and implemented.

ES.5.7. Social

The implementation of the RTIP project may result in social and health impacts at local, regional, and national levels.

The social baseline included in Section 9 was compiled in order to identify and characterise the receptors that may be impacted by RTIP, and to provide a general understanding of the social and cultural setting for the project. However, limitations in data availability do not permit the development of a thorough local baseline description. For this reason, CH2MHILL has adopted a conservative approach and where local information was not available the worst credible scenario has been considered.

The equator principles and international standards such as the World Bank and IFC Performance standards form the basis for the potential impact assessment.

An archaeological and cultural impact assessment is provided in Section 18 and occupational health is addressed using the operator's health and safety practices and EPC contractor's health and safety standards (see Appendix A EMP). Information regarding impacts related to dust, noise, cultural heritage, and waste management have been addressed and discussed in Section

12 Air Quality & Meteorology, Section 15 Noise Section 18 Archaeological and Cultural Heritage, and Section 16 Waste Management, respectively.

The construction phase of RTIP, estimated to be approximately forty months, will result in a number of social impacts. It is estimated that about 55,000 workers will be required during periods of peak construction activity. The expected increase in road traffic may cause disruption for residents of nearby community areas and local fishermen of medium significance. The increase in income, as a result of additional employment and demand for goods and services, will have a positive impact of medium significance, which will be followed by a decrease in income resulting from the demobilization of the majority of the workforce once construction is completed with a negative impact of medium significance. The importation of workers from other countries will result in medium negative impacts to their families and a low negative impact related to potential increase in demand and hence prices for local housing. The demand for infrastructure and services will result in an increase in impacts on availability which is considered of low significance. The increase in demands on housing will have an impact of high negative significance. The additional need for health provision and the potential spread of communicable diseases will have a negative impact of high significance.

During commissioning, most of the social impacts associated with construction activities are maintained throughout the commissioning phase, though their potential significance is reduced considering the decrease in staff numbers and therefore, in associated traffic levels, and demand for services and infrastructure, amongst others.

During the operation phases of RTIP, there are potential socio-economic impacts relating to RTIP employees. In comparison with the larger workforce of RTIP during construction activities, the workforce during operations is smaller but still significant, at approximately 3,600 (which represents 2.6% of the current total population of Jubail). The main impact is related to the net increase in road traffic (though lower than that expected during the construction phase) which is expected to have a medium negative significance. The increase in employment and related income (while relatively smaller than for construction, is over a longer term) is expected to have a positive impact of low to medium significance. The negative impact resulting from the increase in demand on services during the operation phase is expected to be of low to medium significance considering the existing infrastructure and services offered by the RCJY.

The decommissioning phase is expected to involve the same impacts as construction (increase in road traffic and increase in employment and related income). In addition, the demobilisation of the workforce will result in very low to medium impacts.

The occurrence of accidents and spills at any stage of the project could impact health and the economy of certain residents. Road Traffic Accidents (RTA), fires and explosions, accidental releases are other accidental issues posing health and safety hazards to the community during the project lifetime.

ES.5.8. Archaeological & Cultural Heritage

On the basis of our literature review and baseline assessment, there is a very low probability of finding exposed or buried cultural and archaeological resources within or in the vicinity of the project area.

The significance of impacts of the proposed RTIP site on the local archaeology and cultural heritage resources, if any, has been assessed as having low or medium significance and applicable mitigation measures are identified below to minimize impacts. Project activities and baseline conditions for archaeological and cultural resources have been considered for the assessment of potential impacts. The RTIP site, which will also encompass a tank farm and loading and unloading facilities at the KFIP, is largely disturbed and developed for industrial uses, and no archaeological or cultural resources were previously identified in the area.

Impacts to archaeological and cultural resources are very unlikely in the RTIP site area because no significant archaeological and/or cultural resources were identified as a result of a literature search, physical site survey, and a previous survey and fieldwork investigations made by the Deputy of Antiquities and Museums in JIC II and its vicinity.

The greatest impact on archaeological resources would occur during employment of expatriate workers during all project phases. Potential impacts to cultural heritage from the employment of expatriate workers and cross-cultural tensions with the local community, and disturbance to archaeological resources during expatriate worker's tourist visits if archaeological sites are disturbed or if found artefacts are kept as souvenirs, have been assessed as being of medium significance.

These impacts would be reduced if appropriate mitigation measures are adopted. These mitigation measures include developing "archaeological chance find procedures" for any planned construction work that includes a trained observer to oversee the work, and providing briefing to supervisors before the start of construction activities. After the implementation of applicable mitigation measures, the residual impacts would be low / insignificant.

ES.6. Sustainable Development Assessment

A sustainable development assessment (SDA) for the RTIP complex has been performed through an analysis of how the sustainable development principles are integrated into both RTIP's EIA and the project itself.

The assessment of the three elements (environment, social, and economic aspects) reflects not only the way in which sustainable development principles are integrated within this EIA but also that project activities can be performed in a bearable, equitable and viable manner.

In addition to the KSA's national standards and guidelines, the RTIP design and management policy will incorporate the principles of sustainable development as laid down in Our Common Future (WCED, 1987).

The results of the EIA study have been the basis for the sustainability assessment of the project, though it has been complemented by an analysis of the deviation of this study with regards to sustainable development principles (intragenerational and intergenerational equity).

Based on the sustainability assessment of the EIA, one area where additional focus could be considered is with regards to sustainable development (largely due to cultural norms in the Kingdom) is related to Stakeholder Engagement (public information and participation). Although this has already been addressed through the representation of the Royal Commission, it may be favourable for the JV as a long term goal to undertake more direct communication with the Project stakeholders, as this could be particularly beneficial with regards to public

perception towards the Project. Further areas identified include the limitations of the social impact assessment, and resulting limitations in the integrated assessment of environmental, social and economic factors and associated mitigation measures largely owing to the indirect nature of engagement with the local population. There were also some inherent limitations in the analysis of global impacts, GHG emissions and therefore climate change are discussed in Section 12, but no comprehensive analysis of global impacts or implications was carried out as this was beyond the scope of the EIA.

To assess the sustainability of RTIP, the confluence of the three elements of sustainable development throughout the project's lifecycle (design, construction and operation) were analyzed.

The sustainability concept has been addressed in RTIP from the early stage "the design phase", which has reduced the adverse impact of the project on the environment and community. Some examples of this are:

- Project location (industrial area remote from residential areas);
- Site location (proximity of existing infrastructure and common utilities);
- Feasibility studies involving environmental criteria (EIA, BAT analysis, air dispersion modelling, noise study, process hazards analysis); and
- Concept design (processing hydrocarbon products in the same country where it is extracted implies incomes from both upstream and downstream activities).

The project will create indirect and direct employment, benefits for the local economy through network suppliers, and the economic contribution that the Operator makes to the region. Despite the economic and social benefits that the project will bring to the country, there are negative impacts that were evaluated to understand the implications of achieving these benefits, especially concerning the environment, the community, and on potential global impacts for both present and future generations.

The results of the sustainability assessment of the RTIP project reveal insights into the overall impacts the project will have on local, national and international populations, and the duration of those impacts. One revealing finding is the lack of any impacts for which the effects are expected to exceed a decadal timeframe. It is however important to note in this case that climate change - a process with a duration which is thought to greatly exceed decades - no comprehensive analysis was undertaken of the potential impacts that could arise from the project's GHG emissions as this is generally outside the scope of an EIA. This is the same case as with impacts of an international extent, with the main impact identified being the use of foreign workers during the construction phase. Further to this, it was found that impacts on the physical environment (including air quality and the acoustic environment) were generally found to cover smaller extensions (local – provincial) and have durations ranging from years to decades. Impacts on the marine environment were found to range between a local and regional extent and to have a duration of from months to years. Finally, the impacts which were found to be most relevant to sustainability considerations were the impacts on society, as they covered the largest geographical area as well as lasting for decades.

The key areas where additional project focus is required identified by this assessment, in terms of sustainability, and the high priority ones for which measures are suggested which are:

- Community (direct public participation as a long term objective);
- Water consumption; and
- GHG and energy efficiency.

Recommended sustainability practices have been suggested for RTIP with the aim of making the most advantage of natural resources while minimizing potential impacts. These measures are provided as complementary measures for those suggested in Section 21 to enhance the sustainable performance of RTIP.

ES.7. Project Justification and Analysis of Alternatives

This section provides an overview of the analysis of the justification for the project and the feasible alternatives for the proposed preferred design.

The overall objective of RTIP is to meet the growing global demand for refined petrochemical products used for automotive, appliance and consumer products, and promote a shift from export-oriented petrochemical production to manufacturing of value-added specialty chemicals.

The alternatives considered include:

- *Alternate Project “Do nothing” option (no project):* The option of not proceeding with the RTIP would merely mean that a similar project or projects would be constructed elsewhere to meet the market demands. This alternative is likely to have a negative impact on the Saudi economy, given that a significant percentage of the Kingdom’s national economy is based on the development and export of oil and natural gas resources.; and future investments are focused on the expansion of the petrochemicals industry, and increase the predicted shortfall between global supply and demand;
- *Selection of Project Location:* Key factors that were taken into consideration during the site selection process were: availability and allocation of large quantities of feedstock, primarily ethane and naphtha; availability of existing infrastructure / common utilities; availability of existing port and harbour facilities; KSA policy and environmental protection; proximity to Dhahran-Jubail Highway and Abu Hadriyah Highway; proximity to JIC, which has existing infrastructure and services available for employees and their families; and site accessibility, availability of local construction workforce, and previous experience in the successful completion of other major industrial developments in JIC;

RTIP will be located in Jubail II, which is an extension of JIC and one of the two industrial cities designated by the government for industrial development. The project location was selected over a Greenfield location because of its proximity to feedstock resources and infrastructure facilities of JIC and JIC II. The site location assigned for RTIP in JIC II will be used for similar projects if the RTIP is not materialized. Development at alternative locations, such as Greenfield sites outside the industrial city, would require substantial development of infrastructure to provide captive utility and logistics support to RTIP.

- *Process Selection:* The details of the process unit technologies and alternatives to these technologies are not discussed in detail due to confidential licensing agreements. Process

control technologies were selected to use BAT to address potential impacts, and meet local and national regulatory requirements and international standards.

- *Wastewater pre-treatment and Waste Management alternatives:* An extensive analysis of various wastewater treatment and solid waste treatment alternatives was undertaken for this project. The alternatives analyses for wastewater included at-source reductions (within the proposed production units), design and construction of a centralized pre-treatment facility, and utilization of the existing Jubail Industrial City wastewater treatment infrastructure (Marafiq IWTP and SWTP). Similar to wastewater, the alternatives analyses for solid waste included at-source reductions (within the proposed production units), design and construction of dedicated centralized treatment facilities (internal kilns, etc.), and utilization of the existing Jubail Industrial City solid and hazardous waste treatment and disposal infrastructure (Bee'Ah and EDCO).

After evaluation of the alternatives from an economic and sustainability perspective, it was decided that a combination of various at-source reduction and treatment assets, combined with the existing infrastructure was the appropriate alternative for this project. The use of existing infrastructure lowers the overall environmental footprint for the project, Industrial City and region.

ES.8. Cumulative Impacts Assessment

The cumulative impacts assessment has assessed the cumulative impacts that are likely to result from the Project on all affected environmental and socioeconomic conditions at the RTIP site including other existing, approved and/or planned projects in the region that could reasonably be expected to have a combined effect.

The assessment was focused on key primary issues such as air quality, terrestrial and marine biological resources, noise, wastes, socio-economic aspects and community health.

Planned future projects for the region are generally related to oil products processing facilities (including petrochemicals facilities), steel and metal industries, chemical processing facilities, and chlorine products. Cumulative impacts may occur when a project's schedule overlaps with RTIP's schedule.

As the construction schedule for several large projects in the Jubail Industrial City is unknown, there is a possibility of overlap with RTIP occurring. However, availability of financing, manpower and logistical constraints is likely to prevent simultaneous construction of multiple industries. The peak construction period for RTIP alone is expected to bring approximately 55,000 project employees to the Industrial City (predominantly within a construction camp or camps).

Cumulative impacts on air quality and noise may result from the vehicle construction traffic if several projects were under construction in parallel. These impacts are expected to be of low significance since they are localised and temporary in nature. It is anticipated that habitat loss as a result of the Project even in combination with other planned projects is going to be of relatively low significance due to the limited ecological biodiversity of the area. Regarding the marine environment, the increase in the number of tankers and other vessels that will service RTIP through the KFIP, as well as other future planned projects in Jubail Industrial City, will increase the potential for a major spill directly into the Arabian Gulf, as well as increase the risk

of untreated or incompletely treated wastewater being discharged into the Gulf. The incremental waste that will be generated by the proposed project combined with other projects in Jubail Industrial City is considered negligible compared to the capacity and life expectancy of the various solid waste management facilities found in the area. The cumulative demand for wastewater management will have to be monitored carefully as Marafiq is the only provider of these services in the immediate surroundings. This is not however considered to prove problematic, as there are presently various expansion plans for the facility's two treatment plants being considered or in preparation. A significant cumulative impact is related to the demands on the current community health care infrastructure by the employees of RTIP and of the other future projects. Positive cumulative impacts identified are related to the overall increase in wealth and access to livelihood opportunities for the local community and the local employment and up-skilling/training by skilled non-Saudi workers.

During the operation phase of the proposed project, cumulative impacts on air quality are generally considered of low significance as all projects will be subject to RCJY permitting and emission requirements and RTIP is targeting to consume less than 25% of the increment available between the baseline and the applicable ambient air quality standards for criteria pollutants. However, as current baseline ambient air values for ozone exceed the RCJY ambient air quality standards, it would be prudent for the RCJY to consider undertaking a photochemical modelling study of the airshed to determine whether ozone formation may be an issue in relation to cumulative impacts.

Regarding cumulative noise impacts it is not expected that combined noise levels would pose a significant noise increase in the closest sensitive receptors and mixed used area. However, with regards to traffic the cumulative impact is expected to be similar to that described for construction, though during operation, part of the traffic for personnel transport will come/go from the JIC community area.

While this assessment has largely been qualitative in nature, identified cumulative impacts are considered to be either not significant, sufficiently mitigated by measures described in the EIA, or of a beneficial cumulative nature.

ES.9. Summary of Impacts

The assessment of all identified potential impacts was undertaken as discussed in the sections above for air quality and meteorology; onshore physical biological resources (terrestrial and marine); noise; waste management; socio-economic aspects, archaeological and cultural aspects. The impacts are summarised in a table [see Table 20-1 in Section 20 Summary of impacts] and include all the assessment results according to the criteria selected.

The table presents the impacts across each phase of the project, considering the frequency, likelihood, extent, duration and magnitude factors of the impact. The type (positive or negative) and potential significance of each impact are also included. Finally, the requirement for mitigation measure(s) is indicated, where appropriate or feasible, based on the impact assessment criteria defined for each environment.

ES.10. Summary of Mitigation

Where considered appropriate, mitigation measures have been identified that could minimise potential environmental impacts resulting from the construction, commissioning, operation and decommissioning of RTIP. The potential mitigation measures are summarised according to the impact in Table 21-1 in Section 21 Summary of Mitigation Measures. The significance of the impact is also indicated prior to and following implementation of the mitigation measure(s). Where possible the identified mitigation measures are presented as Good International Industry Practices (GIIP), according to World Bank Group Guidelines, 2007 and BAT to ensure that their adoption is technically and economically feasible.

ES.11. Monitoring Plan

A monitoring plan has been developed to monitor the implementation of the proposed mitigation measures during the life of the project. The monitoring plan will also enable the identification of actual environmental impacts. Point source or end-of-pipe emission monitoring should be undertaken by RTIP to ensure compliance with the relevant environmental standards (e.g., wastewater discharges, stack emissions, groundwater monitoring, etc.).

ES.12. Other Considerations

As part of this EIA, an EMP and a stakeholder engagement plan, are outlined and appended to this study.

ES.12.1. Stakeholder Engagement Plan

Identifying and classifying key stakeholders potentially affected by RTIP activities is an essential and initial element of consultation. To the extent possible, the RTIP project team will meet with key stakeholders at various stages of the project and solicit feedback on the key findings of this EIA study. The main stakeholder for this project is the RCJY. RCJY has been established by the government to manage industrial parks in Jubail, Yanbu and Ras Azzor to ensure that the sustainable development of these parks is maintained. RCJY is designated as the agency which represents both government and the residents of these parks. RCJY is engaged with both government and communities on the development of these parks.

Given the necessity to address and effectively plan for stakeholder consultation per World Bank/IFC standards and similarly accepted international standards (including the Equator Principles), RTIP has developed a stakeholder engagement plan that describes primary potential project stakeholders and methods to involve them. This plan, attached as Appendix F, considers the cultural context and the nature of JIC as an industrial park.

The stakeholder engagement plan has been prepared considering current practices in the country with regards to the consultation process. This means that the plan is focused only on the primary stakeholders of RTIP, which include local governmental agencies. The main objective of this plan is to inform stakeholders of activities involved in RTIP, and any potential affects from their activities.

ES.12.2. Environmental Management Plan (EMP)

The EMP addresses the environmental management of RTIP from an early stage. It will provide a detailed framework of specific management responses and references procedures required to manage the environmental impacts and issues identified during this EIA, to ensure compliance with recognised environmental management guidelines and other site management plans. An EMP to be used as a preliminary document to be updated as the project evolves has been prepared and attached as Appendix A.