1 INTRODUCTION

HERMES Airports Ltd has undertaken the task of building the new Larnaca International Airport (LIA). HERMES has appointed Bouygues Batiment International (BBI) to provide the design and construction of the LIA, including the design and the construction of a new complex of aviation fuel storage tanks (fuel farm, hereinafter cited as FF) under a separate Agreement with Olympic Fuel Company S.A. that designed, financed, built and operates the aircraft fueling facilities (fuel farm and hydrant system) at the new Athens International Airport.

1.1 Fuel Farm basic data

The occurrence of the FF construction falls in the same period of the construction of the LIA. The plot that was selected for the installation of the FF is located on the west-southern part of the new terminal (Figure 1.1). It consists of:

- three main Jet A-1 fuel storage tanks (a 4th one will be constructed during the expansion stage of the project) of 12,000 m³ total capacity
- loading and unloading facilities for road tankers
- supplementary systems (fire-fighting, maintenance, etc.)
- office buildings

The new FF will supply the Hydrant Refuelling system (HRS) that is also under construction and will serve the aircrafts stationed at the new terminal. The underground pipes of HRS will be connected to a pumping station fed by the abovementioned storage tanks.

Also the potential environmental impacts associated with the proposed construction of a FF that will operate in order to serve the new Larnaca International Airport terminal are examined later on this assessment. The assessment addresses on the main project activities. It is essential to note that the impact assessment is absolutely focused on the construction and operation of the specific part of the whole fuel distribution system of the new airport terminal. As it will be mentioned further down, the possible impacts and the corresponding mitigation measures that will be proposed are adjusted to the general condition of the space where the FF installation works will take place.
2 Project Owner - Construction Team

2.1 Project Owner
HERMES Airports Ltd

2.2 Construction Team

- Consultants:
  - Meinhardt
  - Hyperstatics
  - Olympic Fuel Company S.A.

- Main contractor:
  - BYBI CB

- Subcontractors
  - HTE
  - Chapo
  - Iacovou Bros (Constructions) Ltd.
1.2 Environmental Statement Structure

The present Environmental Statement Structure comprises of the following sections:

- Introduction

Provides basic information on the under design fuel farm.

- Project Description

This section describes the specific elements of the airport development project, including the design, construction and operation of facilities. In addition it provides the advantages of the hydrant refueling system compared to the current refueling system.

- Environmental and Socio-Economic Baseline

In this chapter the existing natural and socio-economic environment at the vicinity of the plot on which the FF will be constructed is described.

- Impacts and Mitigation Management

This section identifies whereas the construction and operational activities interact with the natural and socio-economic environments. In addition it discusses the probability of occurrence and consequence of potential environment and social impacts that may arise during construction and operation. At the end it delineates the measures for control and mitigation of impacts.

- Health & Safety Management

- Environmental Management Plan
Figure 1.1: FF site indicated on satellite picture of the LIA area.
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<td>Construction</td>
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<td>3.25.2</td>
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<td>33</td>
</tr>
<tr>
<td>3.25.2.1</td>
<td>Gas Emissions</td>
<td>Construction</td>
<td>33</td>
</tr>
<tr>
<td>3.25.2.2</td>
<td>Gas Emissions</td>
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<td>33</td>
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<td>3.25.3.1</td>
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<td>Construction</td>
<td>33</td>
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<tr>
<td>3.25.3.2</td>
<td>Solid Wastes</td>
<td>Operation</td>
<td>33</td>
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<td>3.25.4</td>
<td>Noise</td>
<td>Construction</td>
<td>34</td>
</tr>
<tr>
<td>3.25.4.1</td>
<td>Noise</td>
<td>Construction</td>
<td>34</td>
</tr>
<tr>
<td>3.25.4.2</td>
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3. PROJECT DESCRIPTION

3.1 Introduction

This chapter describes the under design Fuel Farm (FF) of the new Larnaka International Airport (LIA) and the construction works that will take place during the implementation of the project. The present part of the Environmental Impact Assessment study refers initially to the in detail description of all the main and ancillary installations and systems and the operational scheme of the unit. The construction procedure and the necessary staff, pieces of construction equipment and materials are reported in the second part of it.

The main scope of this comprehend description is the identification and evaluation of the potential sources of environmental impacts that may emerge due to the construction and operation of the new FF.

3.2 FF Design & Constructors

The companies that will participate to the design and construction FF are presented in the following list:

- Consultants:
  - Meinhardt
  - Hyperstatics
  - Olympic Fuel Company S.A.
- Main contractor:
  - BYBI CB
- Subcontractors
  - HTE
  - Chapo
  - Iacovou Bros (Constructions) Ltd.

3.3 General Description

The FF is a complex aviation and road traffic fuels reception and storage installation that will be connected and will feed the fuel distribution system that will operate after the implementation of the new LIA terminal (and also during the transitional period).
The main components of the FF are the following:

- 3 (above ground) fixed roof tanks for Jet A-1 fuel with a capacity of 4,000 m³ each (a supplementary tank of the same capacity -4,000 m³- will be constructed during the expansion phase of the project).
- 1 recovery tank of 100 m³ volume
- 1 off-specification tank with a capacity of 20 m³ volume
- 1 Diesel tank of 100 m³ volume
- 1 Diesel tank of 10 m³ volume for emergency power generator
- 1 pumping and filtering station with manifolds
- 4 road tanker offloading stations (plus 1 during expansion phase)
- 2 refueller loading stations
- 1 water tank of the fire fighting system (2,000 m³)
- 1 transfer-pipeline receiving station
- 3 office buildings
- 2 maintenance hangars for fuel trucks and dispensers
- 1 fire fighting building
- 1 technical building including power transforming station
- 2 underground pipelines connected to the fuel hydrant system of the LIA
- Fences and gateways
- Road network and walkways
- Parking lots

Most of these elements may be located on Figure 3.1 that presents the overview layout of the FF.

### 3.4 FF Site Position

The FF construction site lies at the South-Western part of the LIA site at Larnaka, Cyprus (Figures 3.3 & 3.4). Roughly, the site’s borderline is took in by the following coordinates:

<table>
<thead>
<tr>
<th></th>
<th>North</th>
<th>East</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern corner</td>
<td>34°52′07.83″</td>
<td>33°36′07.16″</td>
</tr>
<tr>
<td>Southern corner</td>
<td>34°51′53.66″</td>
<td>33°36′06.90″</td>
</tr>
<tr>
<td>Western corner</td>
<td>34°52′02.43″</td>
<td>33°36′00.80″</td>
</tr>
<tr>
<td>Eastern corner</td>
<td>34°52′00.13″</td>
<td>33°36′15.13″</td>
</tr>
</tbody>
</table>
The installations will be lying approximately 550 metres away from the main building of the new terminal (S-W).

The specific position was selected after an extensive optimization study that was based on the following parameters:

- Access from the public road for both road tank trucks and employees - landside.
- Quick access for the FF and Into-plane employees to the airside, so that all Fuelling will also provide timely access to Airport’s Fire Brigade use in case of emergency.
- Full coverage by all necessary utilities via the Airport.
- Area: 150x100 m approx.
- The location to be decided would also dictate the power demand for hydrant pump station and also operational flexibilities or restrictions.

### 3.5 Description of FF Operational Scheme

The operation scheme of the unit can be divided into three discrete procedures:

- Reception of fuels
- Storage
- Supply of the LIA fuel distribution system (FDS)

#### 3.5.1 Fuel Reception

Road fuel tankers will transport various types of aviation and road traffic fuels from several Marine Terminals of Larnaka Commercial Harbour to FF (Figure 3.3). According to the occupancy conditions of the available installations the road tankers may park temporally to the special parking spaces just outside the main gateway of the FF (items 5.4 on Figure 3.1). Whenever it is possible the tankers enter the site and head through the specially constructed internal road network to the four relevant offloading spaces. The vast part of this procedure refers to the offloading of Jet A-1 fuel to the relevant unloading facilities - Item 2.1 - and Diesel unloading installations.

The road tankers will then be connected through couplings and hoses to the pumping devices and transferred via underground pipes to the storage tanks.

#### 3.5.2 Fuel Storage

The fuels will be stored into the tanks (items 1.1 & 1.3) according to the current demanded storage capacity. Two supplementary tanks will be also installed by the Jet A-1 fuel tanks, a recovery/test rig tank (100 m³ - item 1.5) and off-specification
tank (20 m\(^3\) - item 1.6). These two tanks will be used during the quality tests of the fuel and the storage of unacceptable quantities.

3.5.3 FDS supply

The procedure of FDS supply will be divided in two parts regarding each fuel type that will be stored and distributed through the FF.

3.5.3.1 Jet A-1

As for the main fuel type handled at the installations it will be distributed through underground pipes two alternative points. The major part of the fuel quantities (∼95%) will be pumped to the Fuel Hydrant System (FHS) that will serve the apron aircraft spots.

Despite of the existence of the FHS, refueller trucks will be needed to refuel aircraft not parked at the FHS spots or the cargo area at the apron of the existing Airport and for defuelling, as well. Therefore the rest of the fuel quantities (∼5%) will be pumped to the refueller loading racks (items 2.2) through a pipe bridge (item 5.1).

3.5.3.2 Diesel

The Diesel fuel will be stored mainly for the feeding of the refueller trucks and later on (future operational scheme) for all the ground serving vehicles. The refuelling will be taking place at the Diesel station (item 2.3)

3.6 FF Tankage

3.6.1 Jet A-1

The total tankage of the 3 Jet A-1 depots is 12,000 m\(^3\) (3x4,000 m\(^3\))\(^1\). The selection of the number and capacity of these tanks was derived through an extensive study performed by Olympic Fuel Company S.A.. This study was based on a series of basic assumptions regarding technical and operational restrictions.

3.6.1.1 Fuel Demand

The main assumption referred to the fuel demand that was calculated based on the past years demands and predicted yearly increase rates. The data that were taken into account were the following:

\(^1\) It was assumed that the maximum level of product in tank will be 95% of the total tankage→3,800 m\(^3\)
Preliminary Environmental Impact Assessment
Construction & Operation of the Fuel Farm of LIA

Data

<table>
<thead>
<tr>
<th></th>
<th>Average annual demand</th>
<th>Average daily demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel demand in 2006</td>
<td>264,231 m³</td>
<td>724 m³</td>
</tr>
<tr>
<td>Yearly increase rate (until 2010)</td>
<td>7.127 %</td>
<td></td>
</tr>
<tr>
<td>Fuel demand in 2010</td>
<td>348,000 m³</td>
<td>953 m³</td>
</tr>
<tr>
<td>Yearly increase rate (until 2030)</td>
<td>2.543 %</td>
<td></td>
</tr>
<tr>
<td>Fuel demand in 2030</td>
<td>575,042 m³</td>
<td>1,575 m³</td>
</tr>
</tbody>
</table>

It is obvious that the time frame used for this study part was relatively extended just in order to avoid any future capacity deficiencies.

3.6.1.2 Refuelling Procedure

As for the refuelling fleet it was assumed that the average truck capacity is 60 m³, with a flow rate of 120 m³/hr and the refuelling procedure will take place 24 hrs./day.

3.6.1.3 Fuel Receipt

The main technical restriction imposed on the study was that a stock of 2,400 m³ has to be provided in a time period of 12 hours through bridgers with capacity of 33 m³.

3.6.1.4 Fuel Stocks

The assumed number of days for emergency stock is 5 and operational stock 2.

3.6.1.5 Distribution Schemes

The data concerning the distribution schemes are enlisted in the following table:

<table>
<thead>
<tr>
<th>Hydrant system</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of hydrant system utilization</td>
<td>95 %</td>
<td></td>
</tr>
<tr>
<td>Average flow rate (short distance)</td>
<td>1,000 lt/min</td>
<td></td>
</tr>
<tr>
<td>Average flow rate (medium distance)</td>
<td>2,000 lt/min</td>
<td></td>
</tr>
<tr>
<td>Average flow rate (long distance)</td>
<td>3,000 lt/min</td>
<td></td>
</tr>
<tr>
<td>Number of simultaneous fuellings (narrow body)</td>
<td>6.33</td>
<td></td>
</tr>
<tr>
<td>Number of simultaneous fuellings (wide body)</td>
<td>5.00</td>
<td></td>
</tr>
<tr>
<td>Target flow rate</td>
<td>21,333 lt/min</td>
<td></td>
</tr>
<tr>
<td>Hydrant pump flow rate</td>
<td>275 m³/h</td>
<td></td>
</tr>
<tr>
<td>Maximum flow rate of dispenser</td>
<td>3,600 lt/min</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Refuelling trucks</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of refueller utilization</td>
<td>5 %</td>
<td></td>
</tr>
<tr>
<td>Operating time fuel station</td>
<td>24 hrs.</td>
<td></td>
</tr>
<tr>
<td>Fueller capacity</td>
<td>60 m³</td>
<td></td>
</tr>
<tr>
<td>Fuelling rate of the fueller</td>
<td>120 m³/h</td>
<td></td>
</tr>
<tr>
<td>Fuellers handling time</td>
<td>15 min</td>
<td></td>
</tr>
</tbody>
</table>
3.6.2 Diesel

The capacity of the Diesel depot of the supply station will be 100 m$^3$ while the one of the tank for the emergency power generator 10 m$^3$.

3.7 Fuels Properties

3.7.1 Jet A-1

3.7.1.1 Main Data

Jet A-1 is a specialized type of petroleum-based fuel used to power aviation turbine engines and is a preparation manufactured from kerosenes derived from crude petroleum. It is a complex mixture of hydrocarbons consisting of paraffins, cycloparaffins, aromatic and olefinic hydrocarbons with carbon numbers predominantly in the C9 to C16 range. Total aromatic hydrocarbons present are typically in the range of 10-20% v/v. May also contain several additives at <0.1% v/v each. Indicative Jet A-1 additives are the followings:

- Antioxidants to prevent gumming
- Antistatic agents, to dissipate static electricity and prevent sparking
- Corrosion inhibitors
- Fuel System Icing Inhibitor (FSII) agents

Jet A-1 is stored under ambient temperatures and pressures. The materials recommended for storage and transfer equipment are mild steel, stainless steel or aluminium. In contrary, plastics and fiberglass must not be used.

3.7.1.2 Physical and Chemical Properties

The physical and chemical properties of the fuel are listed in the following table.

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour</td>
<td>Pale straw</td>
</tr>
<tr>
<td>Physical State</td>
<td>Liquid</td>
</tr>
<tr>
<td>Odour</td>
<td>Characteristic</td>
</tr>
<tr>
<td>Vapour Pressure</td>
<td>&lt;0.1 kPa at 20°C.</td>
</tr>
<tr>
<td>Initial Boiling Point</td>
<td>circa 150°C.</td>
</tr>
<tr>
<td>Final Boiling Point</td>
<td>circa 300°C.</td>
</tr>
<tr>
<td>Solubility in Water</td>
<td>Negligible</td>
</tr>
<tr>
<td>Density</td>
<td>775 to 840 kg/m$^3$ at 15°C.</td>
</tr>
<tr>
<td>Flash Point</td>
<td>38°C minimum</td>
</tr>
<tr>
<td>Flammable Limits - Upper</td>
<td>6%(V/V) maximum.</td>
</tr>
<tr>
<td>Flammable Limits - Lower</td>
<td>1%(V/V) minimum.</td>
</tr>
<tr>
<td>Auto-Ignition Temperature</td>
<td>&gt;220°C.</td>
</tr>
<tr>
<td>Vapour Density (Air=1)</td>
<td>Greater than 5</td>
</tr>
</tbody>
</table>
3.7.1.3 Hazards Identification

Jet A-1 is a hazardous substance and is enlisted as a dangerous product. It is harmful to human, may cause lung damage if swallowed. It is irritating to skin and aspiration into the lungs may cause chemical pneumonitis which can be fatal.

It is flammable and its liquid phase evaporates quickly and can ignite leading to a flash fire, or an explosion in a confined space. May ignite on surfaces at temperatures above auto-ignition temperature. Vapour in the headspace of tanks and containers may ignite and explode at temperatures exceeding auto-ignition temperature, where vapour concentrations are within the flammability range.

3.7.1.4 Fire Fighting Measures

Combustion is likely to give rise to a complex mixture of airborne solid and liquid particulates (smoke), and gases, including carbon monoxide, oxides of sulphur, and unidentified organic and inorganic compounds. The vapour is heavier than air, spreads along the ground and distant ignition is possible. Will float and may be reignited on surface water. Flammable vapours may be present even at temperatures below the flash point.

The extinguishing media that are proposed are:

- Foam,
- Fine water spray
- Dry chemical powder

Carbon dioxide, sand or earth may be used for small fires only and it is recommended not to use water in a jet.

3.7.1.5 Ecological Information

Jet A-1 floats on water and partly evaporates from water or soil surfaces, but a significant proportion will remain after one day. If it enters soil, it will adsorb to soil particles and will not be mobile. Large volumes may penetrate soil and could contaminate groundwater. It oxidises rapidly by photochemical reactions in air. Major components are inherently biodegradable. The volatile components oxidise rapidly by photochemical reactions in air. Contains components with the potential to bioaccumulate. May cause tainting of fish and shellfish. Jet A-1 forms poorly soluble mixtures and classified as toxic to aquatic organisms. Films formed on water may affect oxygen transfer and damage organisms.
3.7.2 Diesel

3.7.2.1 Main Data

Diesel is a specialized type of petroleum-based fuel used to power internal combustion engines. It is a complex mixture of hydrocarbons consisting of paraffins, cycloparaffins, aromatic and olefinic hydrocarbons with carbon numbers predominantly in the C9 to C25 range. May contain catalytically cracked oils in which polycyclic aromatic compounds, mainly 3-ring but some 4- to 6-ring species, are present. May also contain several additives at <0.1% v/v each. Dyes and markers can be used to indicate tax status and prevent fraud. May contain cetane improver (Ethyl Hexyl Nitrate) at <0.2% v/v.

Diesel is stored under ambient temperatures and pressures. The materials recommended for storage and transfer equipment are mild steel, stainless steel. Aluminium may also be used for applications where it does not present an unnecessary fire hazard. Examples of suitable materials are: high density polyethylene (HDPE), polypropylene (PP), and Viton (FKM), which have been specifically tested for compatibility with this product. In contrary, plastics and fiberglass must not be used.

3.7.2.2 Physical and Chemical Properties

The physical and chemical properties of the fuel are listed in the following table.

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour</td>
<td>Colourless/pale straw/yellow</td>
</tr>
<tr>
<td>Physical State</td>
<td>Liquid</td>
</tr>
<tr>
<td>Odour</td>
<td>Characteristic</td>
</tr>
<tr>
<td>Vapour Pressure</td>
<td>&lt;0.1 kPa at 20°C.</td>
</tr>
<tr>
<td>Initial Boiling Point</td>
<td>circa 170°C.</td>
</tr>
<tr>
<td>Final Boiling Point</td>
<td>circa 390°C.</td>
</tr>
<tr>
<td>Solubility in Water</td>
<td>Negligible</td>
</tr>
<tr>
<td>Density</td>
<td>815 to 870 kg/m³ at 15°C.</td>
</tr>
<tr>
<td>Flash Point</td>
<td>&gt;50°C</td>
</tr>
<tr>
<td>Flammable Limits - Upper</td>
<td>6%(V/V) maximum.</td>
</tr>
<tr>
<td>Flammable Limits - Lower</td>
<td>1%(V/V) minimum.</td>
</tr>
<tr>
<td>Auto-Ignition Temperature</td>
<td>&gt;220°C.</td>
</tr>
<tr>
<td>Vapour Density (Air=1)</td>
<td>Greater than 5</td>
</tr>
</tbody>
</table>
3.7.2.3 Hazards Identification

Diesel is enlisted as a dangerous product. Harmful, may cause lung damage if swallowed. Limited evidence of a carcinogenic effect. Aspiration into the lungs may cause chemical pneumonitis which can be fatal.

It is not classified as flammable, but will burn. May ignite on surfaces at temperatures above auto-ignition temperature. Vapour in the headspace of tanks and containers may ignite and explode at temperatures exceeding auto-ignition temperature, where vapour concentrations are within the flammability range.

3.7.2.4 Fire Fighting Measures

Combustion is likely to give rise to a complex mixture of airborne solid and liquid particulates (smoke), and gases, including carbon monoxide, oxides of sulphur, and unidentified organic and inorganic compounds. Flammable vapours may be present even at temperatures below the flash point. The extinguishing media that are proposed are:

- Foam,
- Fine water spray
- Dry chemical powder

Carbon dioxide, sand or earth may be used for small fires only and it is recommended not to use water in a jet.

3.7.2.5 Ecological Information

Diesel floats on water. Contains volatile components. Partly evaporates from water or soil surfaces, but a significant proportion will remain after one day. If it enters soil, it will adsorb to soil particles and will not be mobile. Large volumes may penetrate soil and could contaminate groundwater. The volatile components oxidise rapidly by photochemical reactions in air. Contains components with the potential to bioaccumulate. It is classified as toxic to aquatic organisms and films formed on water may affect oxygen transfer and damage organisms.
3.8 Detailed Description of FF Components

3.8.1 Jet A-1 Tanks

Three Jet A-1 tanks will be constructed in a specially shaped site of the FF. The capacity of these tanks will be 4,000 m$^3$. A supplementary tank of the same capacity will be constructed during the expansion phase of the project. A detailed layout of these tanks is presented on Figure 3.5. The technical specifications impose that the maximum loading rate will be 95% and hence the maximum stored volume is 3,800 m$^3$.

A double bottom will be constructed that will allow the inspection of the lower part of the tanks and the drainage of liquids.

3.8.1.1 Auxiliary Modules

Various modules are also presented on Figure 3.5 that will be formed and installed on each tank in order to serve the procedures of loading, off-loading and operational/safety control. In particular, these nozzles and pieces of equipment are divided in two parts, these that will be installed on the shell and the roof of the tanks.

- Shell nozzles and equipment:
  - The main inlet and outlet nozzles through which the loading and off-loading of the tanks will occur (items SN1 & SN2).
  - Sampling nozzle through which samples of the stored product will be taken (item SN3).
  - Floating suction control device with pressure gauge used for the product level control (item SN4).
  - Tank discharge nozzle through which the quantities of product that can not be extracted via pumping will be removed (item SN5).
  - Water drain nozzle that will be connected through a pipe with the tank sump forming a closed sampling system (items SN6 & S13).
  - Manhole for the access of the interior of the tank (item SN7).
  - Spare nozzle (item SN8).
  - Measuring and test nozzle for the double bottom of the tank (items SN9 & SN10).
  - Tank settlement marking (item S11).
  - Tank grounding connection (item S12).
  - Clamp for raceway (item S14).
- Fire fighting system’s foam nozzle (item SN15).

- Roof nozzles and equipment:
  - Roof manhole for the access of the interior of the tank from the roof (item RN1).
  - Nozzle for overfill protection (item RN2).
  - Nozzle for level gauge - radar - (item RN3).
  - Nozzle for temperature measurement (item RN4).
  - Nozzle for manual gauging and sampling (item RN5).
  - Nozzle for the ventilation of the free space between the roof and the product (item RN6).
  - Nozzle for floating suction test (item RN7).
  - Spare nozzle (item RN8).
  - Nozzle for measuring of tank bottom settlement (item RN9).
  - Interconnecting walkway with hand railing for the immediate access between the tank roofs (item R10).
  - Roof walkway with hand railing (item R11).
  - Stairs with hand railing (item R12).
  - Nozzle for emergency vent valve (item RN13).

As for the protection devices installed on the tanks these will be overpressure valves that will open for internal pressure of 2.5 psi and overfilling detection system that will be activated for High (90%) and High/High (95%) levels.

### 3.8.1.2 Construction Materials - Method

The depots will be constructed via the welding of carbon steel sheets that will form a vertical cylindrical tube (diameter: 22.8 m) and an elliptical fixed roof. This kind of tanks are designed as atmospheric tanks (free vented) and therefore are suitable for Jet A-1 fuel (storage under ambient pressure - §3.7.1.1).

All the inlets/outlets/manholes necessary for the efficient operation of the tanks will be constructed through the welding of steel pipes on the main body of the construction where special holes will be shaped.

### 3.8.1.3 Retention basin

All tanks, including the provision of the fourth tank, will be located inside retention tank basin (containment dyke - 70.1x65.6 m²) where the quantities of product will be collected in case of a major spill incident. The basin will be orientated by a dyke and
a security access road. The area where the pumping devices will be installed will be protected through a wall built between the pumping facilities and the tank area.

3.8.2 Diesel Tank

A Diesel tank with tankage of 100 m$^3$ will be installed at the FF site (item 1.3 on Figure 3.1) one of 10 m$^3$ at the technical building (item 1.8). The first one will be a horizontal cylindrical tank that will be installed under ground level. An indicative type of an underground diesel tank, just before it was covered, is presented in the adjacent picture. The emergency generator tank will be constructed over ground.

This type of tank tanks will be designed to be both liquid and vapour tight and the product will be stored under ambient pressure.

The tank will be equipped with all the necessary equipment for the loading and off-loading (pump) as well as the control and safety systems (level control gauge, pressure and temperature measurement devices, pressure relief valve, etc.). At the Figure 3.7 a layout of an underground horizontal storage tank is presented where the minimum (according to the relevant IPPC BREF document) auxiliary devices are mounted on the vessel.

The tank that will be installed in FF will be probably made of carbon steel and pre-constructed.

In addition, underground tank will be protected from corrosion on the outside, for example with cathodic corrosion protection or by insulation, e.g. bitumen. The tank can be double walled and equipped with a leakage detector, but can also be single walled in combination with containment.

It is important that the construction proceeds in such a way so as to prevent damage from aboveground activities. When containing combustible substances, the tank is normally completely surrounded by a layer of non-combustible substance that cannot damage the insulating layer, e.g. sand.

3.8.3 Fuel Distribution System

As it was already mentioned the fuel distribution will be implemented mainly through the Hydrant system (95% of the distributed quantities) and the refuellers fleet.

3.8.3.1 Hydrant System

The hydrant refuelling system consists of an under-surface pipeline infrastructure, through which Jet A-1 fuel will flow and it will be connected to the pumping station of the FF and end up to multiple nozzles at each aircraft parking stand of the apron.
The route of the underground pipelines is presented in Figure 3.8. The two pipes of the system are installed in parallel and end up to the valve vaults where the fuel is pressurized and pumped to the two pipe loops (Right and Left) along which the fuel nozzles are installed. The Hydrant system is currently under construction and the total length of the pipeline grid is 2.600 m.

The aircraft refuelling is performed by connecting a flexible hose to the hydrant supply nozzle and another hose to the aircraft refuelling nozzle. Both hoses are part of a specially made truck, named dispenser (Figure 3.9), which transfers the fuel from the hydrant to the aircraft. The fuel dispensers are simple trucks (not tankers) that carry the necessary for the final control and filtering of the fuel devices (there is no pumping device mounted on them).

The hydrant valve is installed inside an environmental friendly fuel pit, fully tight, capable to retain any operational fuel droplets and protect the ground (it can be seen on Figure 3.9).

It is important to notice that for maintenance reasons it is possible that the each one of the pipeline grid branches serve the fuel flow rate needs of the whole system. The hydraulic devices that will be installed in the valve chamber may deviate the flow in such a way that the two loops will be fed by one pipeline branch.

The aforementioned fuel dispensers will be owned and operated by two fuel distribution companies (different to the companies that will install and operate the Hydrant system and fuel farm). The dispensers, according to the current operation estimations, will be 2 to 4 in order to meet the refuelling needs of the airport.

The refuelling system will be assisted by the operation of a “defuelling” tanker truck which will pump and carry to a special storage tank the quantities of fuel that would already be stored to the fuel storages of the aircrafts and for specific reasons (passenger or cargo overload) and it is needed to be removed. The fuel that is stored in the storage tank can not be reused and it will have to be appropriately treated by the company that will operate the new fuel farm.

The refuelling system is fully distant operated via a control system that consists of a control room (hosting all the control-operation terminals) and an infrastructure of control valves and operation condition indicators. The subsystems of the control grid are connected to their terminals through under surface installed cables. These cables will be installed in sumps that will be constructed in parallel to the sumps that will host the main and secondary pipelines.

All the hydrant pipes and fittings will be fully coated internally and corrosion protected externally.
3.8.3.2 Refuellers

Despite the existence of the hydrant system, refueller will be needed to refuel aircraft not parked at the Hydrant or the cargo area at the apron of the existing Airport and for defuelling, as well. The calculations derived during design were based on the assumption that approximately 55 of the yearly demand will be covered by the refuellers.

The road tankers used for this procedure will be operated by the subcontractor companies, their capacity will be around 60 m³ and their number is currently unknown since this parameter depends on the abovementioned companies. In Figure 3.10 an indicative type of refueller truck is presented.

3.9 Buildings

The buildings that will be constructed are the complex building that will host the administration-control services of the companies that will operate the FF installations (items 3.1, 3.2 & 3.3 on Figure 3.1), the maintenance canopy (item 3.4), the technical building (item 3.5), fire fighting building (item 3.7) and guard house (item 3.6).

3.9.1 Office Building

The office building will be used by the three companies that will operate the FF and the fuel distribution companies (into-plane).

3.9.1.1 FF Operating Company

This will be a 2 storey building (ground and 1st floor - no basement) and the following uses will be hosted in its compartments:

- 1st Floor
  - Control room
  - Server & PLC room
  - Stairway to Control Room
- Ground Floor
  - Management offices 1
  - Administration office
  - Secretary-Reception office
  - Meeting and conference room
  - Laboratory
  - Kitchen & recreation room
The expected number of personnel working in this building is 16, including management staff, while the expected number of employees that will be present in the same time is 8 (in morning shift).

Overview layouts of the ground and 1st floor are presented in Figures 3.11 and 3.12 respectively. The levelling layout of the building is presented in Figure 3.13.

3.9.1.2 Into Plane Companies A & B

The two buildings that will be used by Into Plane Companies A & B will have one storey and the following uses will be hosted in their compartments:

- Ground Floor
  - Changing room, Lockers, Showers and toilets
  - Warehouse-Store
  - Workshop
  - Maintenance office
  - Laboratory - Server Room
  - Dispatching room
  - Kitchen & recreation room
  - Management Office 1
  - Management Office 2
  - Administration Office
  - Secretary-Reception
  - Meeting room
  - Toilets
  - Archive, file room
  - HVAC Room
The expected number of personnel working in these buildings is 12, including management staff, while the expected number of employees that will be present in the same time is 4 (in morning shift).

3.9.2 Technical Building

Several auxiliary systems will be installed in this building (approx. 240 m$^2$) such as:

- Emergency power generator
- Storage room of fire fighting equipment
- Control cabinets
- Pump cabinets
- Power supply panels
- Electric transformers

An overview and a side view layouts of this construction are presented in Figure 3.14.

3.10 Fire Fighting System

3.10.1 Introduction

The Fire Fighting System consists of a critical component of the FF since the volumes and flammability of the stored fuels may lead to extended damages in case of a fire explosion incident. The study prepared on the issue was extended and concluded to the design scheme that is described briefly.

3.10.2 Fire Fighting Means

The two means that will be used is water (water sprinkling) and fire retardant foam (foam jets)$^2$.

3.10.2.1 Water

Water will be stored in a water tank (item 1.4 on Figure 3.1), with a capacity 2,000 m$^3$, that will be supplied from the central water supply system of LIA. Water will be distributed to the following component of the FF:

---

$^2$ Fire Retardant Foam, or fire suppression foam, is foam used for fire suppression. Its role is to cool the fire and to coat the fuel, preventing its contact with oxygen, resulting in suppression of the combustion. The surfactants used produce foam in concentration of 3%. Other components of fire retardant foams are organic solvents (e.g. trimethyltrimethylene glycol and hexylene glycol. Foam stabilizers are also used, for example lauryl alcohol. Other chemicals are used as well, such as corrosion inhibitors.
• Pump station
• Jet A-1 tanks
• Recovery tank
• Off specification tank
• Office buildings (under design speculation)

This water flow stream serves as cooling agent of the components in case of a fire explosion incident and will be distributed through a water manifold and numerous sprinklers. A parallel water hydrant system will be also constructed that will be equipped with standpost hydrants and monitors.

The total water demand flow rate was calculated to 1,095 m³/h and the stored quantity suffices for a period of 2 hours of continuous use.

3.10.2.2 Foam

Foam will be stored in three foam tanks and will be distributed to the following components of the FF:
• Jet A-1 tanks
• Tank basin area
• Refueller loading sytem
• Truck off-loading system

The two alternative types of foam that will be used are FP (fluoroprotein) and AFFF (aqueous film forming foam), the final selection will be implemented with the support of Airport Fire Brigade. Foam will be distributed through a foam manifold, pouring nozzles, injection pipes and foam monitors.

3.10.3 Power Supply

The Fire Fighting System will be supplied by an emergency diesel generator with a power output of 800 KVA (presented also on Figure 3.14).

3.10.4 Diagrams

The flow diagram of the fire fighting means is presented in Figure 3.15. The diagram of the areas that will be under fire fighting protection is presented in Figure 3.16 and the hazardous areas in Figure 3.17.

3.11 Coalescence Separator

The coalescence separator (item 5.6 on Graph 3.1) comprises a tank which is used for the separation of the components of an oil-water liquid mixture. This device will be used for the substance separation of the liquid mixture that will be formed during
the FF drainage system operation (the various types of oils will arise from the accidental small quantity spills.

3.12 Operational Control System

FF will be fully automated by means of a central redundant control PLC (programmable logic controller) and SCADA (Supervisory, Control and Data Acquisition) System. The automation system will control all fuel related operations, fire fighting, electrical systems, etc. The connection between the field equipment will be provided by cables and fiber optics.

3.12.1 Emergency Control Systems

An emergency fuel shut-off system will be installed at the tank farm, Into-Plane and apron areas, where fuel is stored and/or transferred at. This system will be equipped with push buttons and specific sensors in critical areas.

All building and critical locations of the tank farm open areas will be covered with telephone system.

3.13 FF Power Supply

The electric power necessary for the operation of the FF will be supplied from the power network of the main terminal building. The layout of the power supply grid and an overview of the supply cable line (MV Supply) are presented in Figures 3.18 & 3.19.

The maximum power consumption that was calculated during the design of the total fuel delivery system is 1 MW. The calculations were based on the worse operational scenario which consists of the simultaneous operation of all the following installations/devices and the corresponding efficiency/concurrency factors (the complete list is present in Figure 3.20:}
3.14 FF Water Supply

The water quantities that will be necessary for the operation of the FF will be supplied from the water supply pipe grid of the main terminal building. The overview of the corresponding pipeline is presented in Figure 3.18.

Taking into account that approx. 40 people will work at the FF installations during its operation and that the necessary water quantity per person in such installations is 400 lt/day it can be estimated that the total daily consumption will be around 16,000 lt.

The necessary water quantities used by the fire fighting system are mentioned in the corresponding paragraph.

3.15 Cathodic Protection

The majority of the components that will be installed at the FF will be made of steel and so it is necessary that all this items to be protected from corrosion and erosion. One deep well anode will be placed to protect the entire system and this can be placed within the boundaries of the FF.

In order to allow the proper testing of the system, cathodic measuring points will be included in the construction.

3.16 FF Internal Road Network/Road Traffic

3.16.1 FF Internal Road Network

A dense internal road network will be constructed in order to serve the various vehicle movements that will take place during the operation of the FF. These roads are presented at the general layout of the FF (Figure 3.1) and will be covered with

| CSS pumps | Off- loading pumps |
| MOVs\(^1\) | Diesel pump |
| Sump pump | Buildings |
| Hydrant pump | Lighting |
| Transfer pump | Cathodic protection |
| Service pumps | |

\(^1\) Mechanically operated valve
asphalt. The design of these roads was based on the technical limitations due to every procedure (off-loading, loading, etc.) and vehicle types.

3.16.2 Road Traffic

The routes that will be ran by the operational and auxiliary vehicles are presented in Figure 3.21.

The need of replenishing a peak fuel consumption (2,400 m³) day within 12 hours period imposes that the maximum Jet A-1 off-loading frequency is 6-7 per hour. This frequency refers also to the maximum frequency of road tankers entrances to the FF installations through the local road network.

As it was already mentioned, the main part of the refuelling will be obtained via the hydrant system and consequently the refuelling traffic will be relatively minimal (5%).

3.17 Soil Protection

Apart from the passive (structure) and active (mechanical systems) counter leakage systems the soil above FF installations will be counter-leakage protected through the construction of relevant types of ground sheathings. In particular, the spatial distribution of these materials is presented in Figure 3.22. Liquid tight concrete and HDPE membrane covered by round gravel 8/3 are used at areas of the FF where there will be a higher frequency of accidental fuel/oil spills of larger possibility of massive leakages (e.g. tank basin and refuelling pits).

3.18 Drainage - Sewage Hydraulic Systems

Two pipeline grids will be constructed under the ground of the FF site that will collect and transfer the water streams that will be formed due to the rainwater flow and the aqueous mixtures that will emerge in cases of fluid substances spills. The diagrams that present the proposed designs of these grids are presented in Figures 3.23 and 3.25.

The drainage pipeline grid will be installed along the internal road paths and it will lead the water quantities to an oil separator (and only during a major spill incident it will be forwarded to a retention tank for further processing) that will be constructed in the FF site. The outlet of the retention tank ends up to the area adjacent to the FF site inside the LIA area. The major principles of the drainage system operation are presented in Figure 3.24.

The sewage pipeline has two branches that end up to a common pipe through which the sewage will be forwarded to the hydraulic network where all the sewage sources will be collected for further processing.
3.19 Lightning Protection

The lightning protection system that will be constructed/installed in order to protect the installations against lightning strikes and the consequent possibility of explosion emergence is still under design. Further detail will be submitted by the designer during a following design stage.

3.20 FF Site Security Measures

The substantially sensitive character of the under construction installations imposes the need of extended security measures implementation.

3.20.1 Fence

The most important component of the security system will be the special fence that will be constructed around the FF site in order to suspend any non authorized entrances. An indicative layout of that fence is presented in Figure 3.26. It will be a chain link fence with barbed wire on top (height : 2.9 m.) and its frame will be constructed through the assembly/welding of metal beams.

A ground dyke (height: 4m.) that will also serve as a noise and visual obstacle along a part of the total fence length will be constructed. The potential position of the dyke is presented in Figure 3.27.

Additionally, to these constructions the existing tree lines that will be supplemented by additional trees will also constitute visual obstacles. The supplementary tree line situated outside the ground dyke is proposed as a visual disturbance mitigation measure since there is a possibility of constructing a relatively high visual obstacle along private properties adjacent to the FF site.

3.20.2 Gate Check Points

At the site’s gateway a guard house will be constructed. It will be equipped search/screening equipment.

3.20.3 CCTV

All FF area will be surveyed by a CCTV(closed circuit television) system.

3.20.4 ACS

In every point that there is access to secure parts of the installations, an Access Control System (ACS) will be installed and incorporated with current airport system.
### 3.21 Maintenance Procedures

Briefly, the maintenance works that will take place during the operation of the FF are the following (frequency):

- Fuel Tests
- Filter Changes
- Fire Fighting Tests

### 3.22 FF Personnel

Approximately 40 people will work at the site specialized in FF Management and Fuel Delivery.

### 3.23 Short Description of Existing FF

LIA was built in 1976, including the FFs (Figure 3.3), due to closure of main Airport of Cyprus at Nicosia. At that time, the LIA facilities were considered as of temporarily use, striving for the re-opening of Nicosia Airport. This status has also been reflected to the FFs, which had not been designed to accommodate the future requirements. This is why additional small tanks have been added to the ones built in the beginning.

FFs are operated by different Oil companies, namely ExxonMobil, AirBP and PPT and consist of Jet A-1 tanks of different types and sizes:

- Vertical tanks: 2 (maximum tankage is 758 m$^3$)
- Horizontal tanks: 18 (from 70 to 267 m$^3$ of capacity each)
- Total Tankage: 3,339 m$^3$

In addition, one Oil company operates an Avgas tank of 30 m$^3$ capacity.

The fuel is received by means of road tank trucks via 2 off-loading bays per Oil company (6 in total). The maximum receiving flow rate of all 6 receiving facilities is 10.2 m$^3$/hr. Then, fuel is stored onto the abovementioned tanks of several types and sizes, so to be quality controlled before fuel is certified and tanks released for refueller trucks loading. There are 7 loading bays in all 3 companies with a maximum loading flow rate of 10.4 m$^3$/hr. Then the refuellers are ready to be used for aircraft refuellings.

### 3.24 FF Construction

The FF facilities construction will involve the following main activities:

- Site preparation activities, involving further cut and fill works, construction of an access road infrastructure and installation of security fencing and lighting.
- Construction of temporary facilities, drinking water stations, water supply and pipeline and filtration systems, guardhouses and security office.
- General services, to include generators to provide power for temporary site construction facilities, septic tank facilities for sewage system for site staff to use, during site preparations these will be temporary structures only.
- Construction of the principal elements of the FF including but not limited to storage tanks, pipe infrastructure, office buildings and road/ground cover works.
- Development of ancillary facilities including the development of supplementary tanks and safety & security systems.

3.24.1 Schedule

The worksite preparation activities are expected to commence in September 2008 with commissioning activities scheduled for November 2009. Detailed project scheduling is ongoing.

3.24.2 Site Preparation Activities

3.24.2.1 Cut and fill of the existing site

There is no need of significant decommissioning activities since a major part of the site is already prepared due to the new LIA terminal construction works. The rest of site is currently used as agricultural fields hence limited preparation works will take place. Additional attention will have to be paid on the decommissioning of the indicative pillars of the Larnaka desalination company pipeline. At this stage it is not considered that significant quantities of fill material will be required from any sources external to the site since there are significant quantities of removed soil from other sites of the overall LIA worksite near the FF construction site (Figure 3.28).

3.24.2.2 Installation of security fencing and lighting

A temporary perimeter fence will be installed during the initial site activities to provide a secure and safe operating zone for construction works. This fencing will eventually be replaced as part of the operational phase of the asset.

3.24.2.3 Construction of site buildings

A small number of buildings will be constructed on site, including owner and contractor offices, guardhouses, security office. These facilities will be of a temporary nature and water supply will be sourced from a daily tanker delivery and will provide for the requirements of onsite personal and equipment, cement batch plant water tank and onsite dust suppression operations. Power supply will be from temporary generator supply.
3.24.2.4 Concrete Batching Plant

The construction of the FF will require an ongoing source of concrete as part of activities that typically include piling for tanks, hard-standing areas and foundations for temporary and permanent buildings. In order to meet the scheduling requirements for the overall project the cement batch plant that is already established during the LIA terminal construction.

3.24.3 Road Access

The vehicles that will be commissioned for the site preparation and construction works may access the site through two alternative site’s sides. The one is from the existing worksite and the other from the road leading to the worksite entrance that is near the FF site. As for the first option there is no need for further road works since there is the possibility of using the currently used by heavy vehicles worksite roads. Respectively, the abovementioned road is also used by heavy vehicles that enter/exit the LIA worksite entrance (Figure 3.29).

3.24.4 Construction of Facilities

The general facilities provision for the onsite activities are to include generators, water and sewerage services for site staff to use whilst the main facilities are being constructed. The sewerage system will be a basic septic tank arrangement, which will be pumped on an as required basis. Waste will be transported to the local treatment plant.

The construction of the FF will include the following principal tasks:

- Site clearing, leveling and setting out
- Civil construction to include all bases and piling
- Mechanical erection of steelwork
- Jet A-1 tanks construction
- Building construction
- Pipe racking construction and piping installation
- Mechanical equipment installation
- Electrical and instrumentation installation
- Mechanical completion
- Commissioning

3.24.5 Construction Staff

During the construction works aprox. 150 workers specialized in all building trades will be engaged
### 3.24.6 Construction Equipment

The pieces of construction equipment (types and power level) and the estimated operational time that will be used during the FF construction are listed in the following table.

<table>
<thead>
<tr>
<th>Construction Stage</th>
<th>Pieces of equipment</th>
<th>Power (kW)</th>
<th>Operational time (hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site clearing, leveling and setting out</td>
<td>2 Loaders</td>
<td>200</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>2 Hydraulic excavators</td>
<td>186</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>1 Motor grader</td>
<td>200</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>4 Dump trucks</td>
<td>200</td>
<td>100</td>
</tr>
<tr>
<td>Civil construction</td>
<td>1 Loader</td>
<td>200</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td>1 Hydraulic excavator</td>
<td>186</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td>1 Motor grader</td>
<td>200</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>4 Dump trucks</td>
<td>200</td>
<td>600</td>
</tr>
<tr>
<td></td>
<td>1 Road roller</td>
<td>100</td>
<td>80</td>
</tr>
<tr>
<td>Mechanical erection of steelwork</td>
<td>2 trucks</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td>2 Cranes</td>
<td>200</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>3 HI-AB</td>
<td>200</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Scaffolds</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>2 Self-moving cranes</td>
<td>200</td>
<td>100</td>
</tr>
<tr>
<td>Jet A-1 tanks construction</td>
<td>2 trucks</td>
<td>200</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>3 Cranes</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td>Scaffolds</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>2 Self-moving cranes</td>
<td>200</td>
<td>300</td>
</tr>
<tr>
<td>Building construction</td>
<td>2 trucks</td>
<td>200</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td>1 Crane</td>
<td>200</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>2 Cement transit mixers</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>2 Cement pumps</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>3 HI-AB</td>
<td>200</td>
<td>400</td>
</tr>
<tr>
<td>Pipe racking construction and piping installation</td>
<td>1 Loader</td>
<td>200</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>2 Hydraulic excavators</td>
<td>186</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>1 Dump truck</td>
<td>200</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>1 Crane</td>
<td>40</td>
<td>80</td>
</tr>
<tr>
<td>Mechanical equipment installation</td>
<td>2 Cranes</td>
<td>200</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>4 HI-AB</td>
<td>200</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Scaffolds</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Electrical and instrumentation installation</td>
<td>2 HI-AB</td>
<td>200</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Scaffolds</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Mechanical completion</td>
<td>2 HI-AB</td>
<td>200</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>Scaffolds</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Commissioning</td>
<td>2 HI-AB</td>
<td>200</td>
<td>20</td>
</tr>
</tbody>
</table>
3.24.7 Water Supply

The estimation of the allocated water quantities needed during the construction works is presented in the following table, taking into account the following assumptions:

- Mean number of construction workers in the worksite during the entire construction period: 75.
- Construction duration: 14 months
- Pieces of equipment used: as listed in the previous Table.

<table>
<thead>
<tr>
<th>Activities</th>
<th>Consumption (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workers personal needs</td>
<td>525</td>
</tr>
<tr>
<td>Vehicle washing</td>
<td>70</td>
</tr>
<tr>
<td>Wheel washing</td>
<td>60</td>
</tr>
<tr>
<td>Dust production mitigation process</td>
<td>700</td>
</tr>
<tr>
<td>Various</td>
<td>300</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1655</strong></td>
</tr>
</tbody>
</table>

3.24.8 Energy Consumption

The estimation of fuel consumption (diesel) during the construction works was based on the construction equipment assumptions, as it was presented in the following Table, taking also into account the assumption according to which the Construction works mean duration will be 10 hours per day.

<table>
<thead>
<tr>
<th>Pieces of equipment</th>
<th>Operational duration (hrs)</th>
<th>Specific consumption (lt/hr)</th>
<th>Total consumption (lt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loader</td>
<td>600</td>
<td>25</td>
<td>15,000</td>
</tr>
<tr>
<td>Hydraulic excavator</td>
<td>640</td>
<td>30</td>
<td>19,200</td>
</tr>
<tr>
<td>Motor grader</td>
<td>360</td>
<td>40</td>
<td>14,400</td>
</tr>
<tr>
<td>Dump truck</td>
<td>2,840</td>
<td>20</td>
<td>56,800</td>
</tr>
<tr>
<td>Road roller</td>
<td>80</td>
<td>40</td>
<td>3,200</td>
</tr>
<tr>
<td>Truck</td>
<td>1,800</td>
<td>20</td>
<td>36,000</td>
</tr>
<tr>
<td>Crane</td>
<td>1,200</td>
<td>30</td>
<td>36,000</td>
</tr>
<tr>
<td>HI-AB</td>
<td>1,840</td>
<td>20</td>
<td>36,800</td>
</tr>
<tr>
<td>Self-moving crane</td>
<td>800</td>
<td>30</td>
<td>24,000</td>
</tr>
<tr>
<td>Cement transit mixer</td>
<td>200</td>
<td>30</td>
<td>6,000</td>
</tr>
<tr>
<td>Cement pump</td>
<td>200</td>
<td>20</td>
<td>4,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>251,400</strong></td>
</tr>
</tbody>
</table>
3.24.9 Construction Materials

It is necessary to refer to the provision of the constructor to use types of materials for the construction of the project that comply with the relevant specifications in order to avoid any impacts to the environment and the health and safety of the workers.

3.25 Environmental Aspects

The way by which the environment inside and around the FF construction site will be affected by the construction and operation of the FF will be expressed through specific types of environmental disturbances that may emerge. These types are the following:

- Production of Liquid Wastes
- Production of Gas Emissions
- Production of Solid Wastes
- Noise

3.25.1 Liquid Wastes

3.25.1.1 Construction phase

During the construction of the project the liquid wastes that will be produced are the following:

- Leakage of fuels and lubricants during the maintenance of the construction vehicles.

It is assumed that the quantities that may be spilled on the site’s ground will be minimal since the main part of the maintenance activities will take place at the maintenance pits of the main new LIA terminal worksite. The quantities of lubricants that will be removed from the construction vehicles during the maintenance procedure and the corresponding data are presented in the following table.
### Preliminary Environmental Impact Assessment

#### Construction & Operation of the Fuel Farm of LIA

**Prepared by:** Aeoliki Ltd.

<table>
<thead>
<tr>
<th>Pieces of equipment</th>
<th>Operational duration (hrs)</th>
<th>Lubricant volume per service (lt)</th>
<th>Service frequency (hr)</th>
<th>Produced lubricant quantities (lt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loader</td>
<td>600</td>
<td>25</td>
<td>200</td>
<td>75</td>
</tr>
<tr>
<td>Hydraulic excavator</td>
<td>640</td>
<td>22</td>
<td>200</td>
<td>70.4</td>
</tr>
<tr>
<td>Motor grader</td>
<td>360</td>
<td>40</td>
<td>200</td>
<td>72</td>
</tr>
<tr>
<td>Dump truck</td>
<td>2,840</td>
<td>20</td>
<td>200</td>
<td>284</td>
</tr>
<tr>
<td>Road roller</td>
<td>80</td>
<td>40</td>
<td>200</td>
<td>16</td>
</tr>
<tr>
<td>Truck</td>
<td>1,800</td>
<td>20</td>
<td>200</td>
<td>180</td>
</tr>
<tr>
<td>Crane</td>
<td>1,200</td>
<td>50</td>
<td>200</td>
<td>300</td>
</tr>
<tr>
<td>HI-AB</td>
<td>1,840</td>
<td>20</td>
<td>200</td>
<td>184</td>
</tr>
<tr>
<td>Self-moving crane</td>
<td>800</td>
<td>30</td>
<td>200</td>
<td>120</td>
</tr>
<tr>
<td>Cement transit mixer</td>
<td>200</td>
<td>35</td>
<td>200</td>
<td>35</td>
</tr>
<tr>
<td>Cement pump</td>
<td>200</td>
<td>45</td>
<td>200</td>
<td>45</td>
</tr>
</tbody>
</table>

|                           | **Total**                  | **1381.4**                        |

- **Sanitary wastes**
  The flow of the liquid wastes produced by the construction staff will be totally controlled under the management scheme that is already under elaboration in the main worksite and hence these quantities will be treated immediately and efficiently. Taking into account the worst case, that refers to the contemporary presence of approx. 150 workers at the site it is estimated that the flow the quantities of sanitary wastes will be 3 m³/day.

#### 3.25.1.2 Operation phase

During the operation of the FF the liquid wastes that will be produced are the following:
- **Leakage of fuels and lubricants during the maintenance of the refuellers.** The exact estimation of these quantities is currently impossible since the technical data concerning the refueling fleet will be obtained after the designation of the companies that will run this procedure. Preliminarily, it is possible to assume that these quantities will be disposed to the environment since the maintenance procedure will take place in a specially constructed site (maintenance canopy) and they will be adequately processed.
- **Leakage of fuels during the off-loading and loading procedures.** Likewise, these quantities will be minimal due to the counter-leakage systems that will be used during the operation of the FF.
3.25.2 Gas Emissions

3.25.2.1 Construction phase

During the construction of the project the only gas emissions that will be released are the combustion gases that will be produced by the construction pieces of equipment. Taking into account the technical data of the vehicles and the fuel consumption (that was calculated previously) it is calculated that the following quantities of gas emissions will be released during the 14 months of the FF construction.

<table>
<thead>
<tr>
<th>NOx (tn)</th>
<th>CO (tn)</th>
<th>VOC (tn)</th>
<th>PM (tn)</th>
<th>CO₂ (tn)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.93</td>
<td>2.22</td>
<td>1.22</td>
<td>0.61</td>
<td>239.15</td>
</tr>
</tbody>
</table>

Construction activities are also associated with the generation of dust, especially from:

- Earthworks including excavation, handling on site and deposition,
- Handling and storage of materials (including loading and unloading)
- Haulage roads and unsealed site surfaces (including vehicles traveling along them)
- Wind blow across disturbed site surfaces and materials,
- Mechanical operations such as crushing, drilling, concrete mixing and cutting.

3.25.2.2 Operation phase

The gas emissions produced during the operation phase will emerge from the escape of fuel vapors during the off-loading and loading procedures. The estimation of the emitted quantities was based on the refilling scheme that will be implemented during the operation (Chapter 5).

3.25.3 Solid Wastes

3.25.3.1 Construction phase

During the construction of the project the solid wastes that will be produced are the equipment packaging materials and the domestic solid wastes produced by the construction staff.

It is necessary to state that the quantities of soil that will be excavated are not considered as solid wastes.

3.25.3.2 Operation phase

During the operation of the FF the solid wastes that will be produced are the domestic solid wastes produced by the FF and Into-plane companies staff (40 workers)
3.25.4 Noise

3.25.4.1 Construction phase

During the construction stage noise disturbance will be caused due to the operation of heavy duty vehicles. The worst case that is taken into account is the contemporary operation of 9 construction vehicles during the civil construction works.

<table>
<thead>
<tr>
<th>Vehicle type</th>
<th>Number of vehicles</th>
<th>Noise level (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loader</td>
<td>1</td>
<td>85</td>
</tr>
<tr>
<td>Hydraulic excavator</td>
<td>1</td>
<td>87</td>
</tr>
<tr>
<td>Motor grader</td>
<td>1</td>
<td>82</td>
</tr>
<tr>
<td>Dump trucks</td>
<td>4</td>
<td>78</td>
</tr>
<tr>
<td>Road roller</td>
<td>1</td>
<td>80</td>
</tr>
</tbody>
</table>

The spatial distribution of the produced noise is presented in Figure 3.30.

3.25.4.2 Operation phase

Day time

During the operation of the FF noise disturbance will be caused mainly due to the operation of hydraulic devices (various types of fuel pumps). The worst case that is taken into account is the contemporary operation of the listed devices during the typical operation of the FF installations. The pieces of equipment that were taken into account are the following:

<table>
<thead>
<tr>
<th>Type of equipment</th>
<th>Number</th>
<th>Power (kW)</th>
<th>Noise level (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrant pump</td>
<td>5</td>
<td>110</td>
<td>70</td>
</tr>
<tr>
<td>Diesel pump</td>
<td>1</td>
<td>1.5</td>
<td>72</td>
</tr>
<tr>
<td>Off-loading pump</td>
<td>3</td>
<td>30</td>
<td>80</td>
</tr>
<tr>
<td>CSS pump</td>
<td>3</td>
<td>1.5</td>
<td>72</td>
</tr>
<tr>
<td>Service pump</td>
<td>1</td>
<td>5</td>
<td>75</td>
</tr>
<tr>
<td>Motor operated valve</td>
<td>6</td>
<td>2</td>
<td>72</td>
</tr>
</tbody>
</table>

Apart of the devises listed above it was assumed also that three road tankers are present in the fuel farm in various positions (entrance - inside road - offloading installations). The noise level produced during the operation of the road tanker it was assumed to 80 dB.

---

4 “Noise and Vibration control on construction and open sites – Part 1” British Standard 5228, 1997
The spatial distribution of the produced noise for day time operation is presented in Figure 3.31. (The potential positions of the tankers are also indicated on the figure - red circles).

**Additional tree line**

The option of shaping an additional tree line along the dyke was also modeled in order to examine the reduction of the noise disturbance due to the presence of this supplementary obstacle. It was noted that the relatively low density of the tree body caused minimal noise disturbance reduction and therefore this option was not recommended (as a noise obstacle) to the project designer.

**Night time**

The operation of the facilities during night time was also modeled taking into account that:

- the hydrant refueling system pumping devices will be under constant operation
- the refueling of the facilities through road tankers will be prohibited in order to decrease the produced noise levels.

The pieces of equipment that were taken into account during this modeling are the following:

<table>
<thead>
<tr>
<th>Type of equipment</th>
<th>Number</th>
<th>Power (kW)</th>
<th>Noise level (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrant pump</td>
<td>5</td>
<td>110</td>
<td>70</td>
</tr>
<tr>
<td>Diesel pump</td>
<td>1</td>
<td>1.5</td>
<td>72</td>
</tr>
<tr>
<td>Off-loading pump</td>
<td>3</td>
<td>30</td>
<td>80</td>
</tr>
<tr>
<td>CSS pump</td>
<td>3</td>
<td>1.5</td>
<td>72</td>
</tr>
<tr>
<td>Service pump</td>
<td>1</td>
<td>5</td>
<td>75</td>
</tr>
<tr>
<td>Motor operated valve</td>
<td>6</td>
<td>2</td>
<td>72</td>
</tr>
</tbody>
</table>

The spatial distribution of the produced noise for night time operation is presented in Figure 3.32.
Figure 3.1: FF Overview Layout
Figure 3.2: Legend of Figure 3.1
Figure 3.3: Map of FF broader area
Figure 3.4: FF satellite picture and corresponding layout
Figure 3.5: Detailed overview and side view of Jet A-1 tanks
Figure 3.6: Legend of Figure 3.4

Figure 3.7: Side view of horizontal underground fuel tank
Figure 3.8: Hydrant system pipeline diagram
Figure 3.9: Hydrant dispenser and fuel pit

Figure 3.10: Refueller
Figure 3.11: Office building ground level overview layout
Figure 3.12: Office building 1st level overview layout
Figure 3.13: Office building elevation layouts
Figure 3.14: Technical building overview layout
Figure 3.15: Fire fighting system flow diagram
Figure 3.16: Fire protected areas layout
Figure 3.17: Hazardous areas layout
Figure 3.18: Utility service lines layout
Figure 3.19: Power supply grid
Figure 3.20: Hydraulic devices technical data
Figure 3.21: Traffic routes diagram
Figure 3.22: Soil coverage layout
Figure 3.23: Drainage system diagram
Figure 3.24: Drainage system operation principles
Figure 3.25: Sewage system diagram
Figure 3.26: Fence

Figure 3.27: Ground dyke

Figure 3.28: Piles of excavated soil
Figure 3.29: Heavy duty vehicle
Figure 3.30: Spatial distribution of produced noise (FF construction)
Figure 3.31: Spatial distribution of produced noise (FF operation - day)
Figure 3.32: Spatial distribution of produced noise (FF operation - night)
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4 ENVIRONMENT DESCRIPTION

4.1 Natural environment - Introduction

The construction of a new complex of aviation fuel storage tanks (Fuel Farm) is currently under development. This construction will coincide with the ongoing construction of the new airport and it would also involve the decommissioning and demolition of the existing fuel farm, currently servicing the Larnaca International Airport. The new Fuel Farm will be situated south-west of the new terminal building, and it will consist of the following:

- three main Jet A-1 fuel storage tanks (a 4th one will be constructed during the expansion stage of the project) of 12,000 m³ total capacity
- loading and unloading facilities for road tankers
- supplementary systems (fire-fighting, maintenance, etc.)
- office buildings
Figure 4.1: Fuel Farm Layout
<table>
<thead>
<tr>
<th>Preliminary environmental Impact Assessment Construction &amp; Operation of the fuel farm of LIA</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepared by Aeoliki Ltd.</td>
<td>4-3</td>
</tr>
</tbody>
</table>
4.1.1 General description of the Fuel Farm area

The new Fuel Farm will be located 4 km west of the Meneou, and Kiti, communities 8 km from the city of Larnaca and 1 km from the Dromolaxia community.

The location of the existing fuel depot as well as the new terminal building and the proposed location of the new Fuel Farm is depicted in Figure 4.2.

The general overview of the fuel farm area is presented in Pictures 4.1-4.7. The area surrounding the proposed location for the construction of the fuel farm, is characterised by residential development (see Pictures 4.8, 4.11) along its north, west and south boundary, whereas a buffer zone is located to the north-east. Finally, the buildings of an old (and not operational) animal farm are located to the south (Pictures 4.15-4.16).

An underground pipe from the Desalination Plant goes through the Fuel Farm area; its routing marked with concrete pillars (as shown in Picture 4.14). There are 6 such pillars located in the fuel farm area (designated as P.I9, P.I10, P.I11, P.I12, P.I13, and P.I14), and an airing point (see Picture 4.13). The pipe is buried at a depth of 2 meters (highest point of the pipe).
Figure 4.2 General overview of the Larnaca International Airport
Picture 4.1 Satellite picture of the wider project area

Picture 4.2: The north-west part of the area in which the fuel farm will be constructed

Picture 4.3 The north east border of the fuel farm

Picture 4.4 Satellite picture of the closest house

Picture 4.5 North east boundary of the fuel farm area

Picture 4.6 West border of the fuel farm

Picture 4.7 North West border of the fuel farm

Picture 4.8: The closest house to the fuel farm

Picture 4.9: General overview of the area where the fuel farm will be constructed

Picture 4.10 House in the vicinity of the study area

Picture 4.11 Houses under construction near the study area
Picture 4.12 Desalination Plant Pipe Routing
**Picture 4.13** Point of airing of the Desalination Plant pipes

**Figure 4.3** Desalination Plant pipe graph

**Picture 4.14** Concrete pillar

**Picture 4.15** Old Farm Buildings

**Picture 4.16** Old Farm Entrance
4.1.2 Geomorphology, Geology and Hydrogeology

4.1.2.1 Regional Features

The geomorphology of Cyprus (Figure 4.4) is dominated by two mountain massifs: the Troodos range in the central, southern and western parts of the island, and the Pentadaktylos range which runs parallel with the northern coastline. Situated between the two mountain ranges is the Mesaoria Plain. The coastline is comprised of a mixture of low hills, rocky areas, cliffs and narrow plains. Wider plains exist around river estuaries.

Source: Geological Department Cyprus

Figure 4.4 Geological map of Cyprus

The central part of the Troodos Massif consists of igneous rocks (Troodos Ophiolite Complex), while the southern and southwestern fringes, is composed of autochthonous sedimentary rocks. The central and highest part of the ophiolite complex consists of ultramafic rocks (harzburgites, serpentinites) and plutonic rocks (dunites, wehrlites, pyroxenites, gabbros and plagiogranites). Bordering this is the Sheeted Dyke Complex and, lower down, the volcanic rocks (pillow lavas). Autochthonous sedimentary rocks dominate the southern and southwestern periphery with alternating layers of chalks and marls (Lefkara, Pachna and Kalavassos Formations).

The Pentadaktylos Mountain Range has retained its limestone covering over the ages. The two mountain ranges were originally separated by a shallow sea, the bed of which is now the Mesaoria (or middle)plain - a fertile agricultural region with the capital city of Nicosia situated at its centre.
The highest peak within the Pentadaktylos Mountain Range is Kyparissovouno (1024 metres (m)), followed by Boufavento (955m) and Gialas (935m). These mountains consist mostly of allochthonous recrystallized limestones, dolomites and marble.

The Mesaoria Plain sits between the two mountain ranges and extends from Morfou Bay to Ammochostos Bay. The topography is dominated by flat or softly undulating areas and scattered, characteristically flat-topped or conical-shaped hills. The altitude reaches up to 300m. The plain consists mainly of marls, calcarenites, sands and gravels (Lefkosia, Athalassa, Kakkaristra and Apalos Formations) as well as alluvial deposits.

4.1.2.2 Local Features

Larnaca Airport is located in an area of relatively gentle topography, lying within the shallow basins that comprise the salt lake systems. To the east of the airport, Larnaca town lies on relatively flat ground around the edge of Larnaca Bay. Topography gently increases in elevation towards the north and west, with small hills up to 20m high and occasional small cliff features formed from relic terraces around the northern edge of the main Larnaca Salt Lake (Aliki). Approximately 5 kilometres (km) to the west of Larnaca, where the Kiti Dam is located, the elevation of the ground is around 50m above sea level.

Published geological maps indicate that Larnaca airport is directly underlain by Quaternary Holocene deposits of sands, silts, clays and gravel (Alluvium-Colluvium) and/or Quaternary Pleistocene Terrace deposits of Limestones, Sands and Gravel. The higher ground surrounding the airport and the salt lakes tends to consist of the Terrace deposits, with outcrops immediately to the north of the airport along the edge of the road into Larnaca and around the northern edge of Aliki. The Peninsula jutting out into the main Larnaca Salt Lake is also part of this stratum. The Alluvium-Colluvium is generally confined to the slightly lower, basin like areas containing the salt lakes.

The recent Contaminated Land Assessment at the airport indicates that the underlying geology comprises mainly fine to medium sands to a depth of at least 5m below ground level (bgl).
### Table 4.1: Shallow geology encountered during site investigation

<table>
<thead>
<tr>
<th>Depth (m bgl)</th>
<th>Soil Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 3.5m bgl</td>
<td><strong>MADE GROUND</strong></td>
</tr>
<tr>
<td></td>
<td>Consisting variously of Tarmac, Tarmac like gravels, hardcore gravels and sands.</td>
</tr>
<tr>
<td>0 - 5.0m bgl</td>
<td><strong>ALLUVIAL DEPOSITS</strong></td>
</tr>
<tr>
<td></td>
<td>Consisting of brown sands, silts and clays</td>
</tr>
<tr>
<td>0.2 - 7.5m bgl</td>
<td><strong>TERRACE DEPOSITS</strong></td>
</tr>
<tr>
<td>Near by the Salt Lake Orhpani</td>
<td>Consisting of hard, red/brown clays with fine to coarse, rounded mudstone and flint gravels.</td>
</tr>
<tr>
<td>2.0 - 5.5m bgl</td>
<td><strong>ALLUVIAL DEPOSITS</strong></td>
</tr>
<tr>
<td></td>
<td>Dark grey/green sands and silts occasionally containing shell fragments.</td>
</tr>
</tbody>
</table>

Source: URS - LARNACA Airport Contaminated Land Assessment (2005)

In the salt lake area groundwater lies at a depth of around 2m bgl. Piezometric maps (*Milnes & Renard, 2002*) show a steep head gradient between the groundwater within the bedrock in the Kiti Dam area, where groundwater levels lie at a high of around 30m AOD, and the groundwater in the alluvial sediments surrounding Orphani Salt Lake, where groundwater levels are around 2mbgl. Groundwater flow is therefore inferred to be in an easterly direction towards the salt lakes from the dam. The recent contaminated land assessment of the airport indicates that groundwater levels within the boundary of the airport lie between approximately 1m and 2.5m bgl and with a groundwater flow direction inferred to be from the coast towards the southern end of the Airport Salt Lake.
Figure 4.5. Geological map of Larnaca Saltmarshes

4.1.2.2.1 Seismicity

The seismic behavior of Cyprus is directly related to the plate tectonic movements in the region. The Cyprus tectonic trough some 60 km south of Cyprus marks, the collision line between the African shield to the south with the Eurasian shield to north and is a continuous source of earthquake activity. Epicenters (see Figure 4.8) have been recorded over the whole island and current studies at the Cyprus Geological Survey aim to determine the neotectonic behavior of the island and the determination of faults that could be considered as active.

Cyprus is separated in five areas (Figure 4.7) based on the seismic intensities expected in each region. For each area, the limits of calculation for the largest acceleration of ground Amax are given in the following Table 4.6 as percentage of acceleration of gravity (g).

Table 4.6: Largest acceleration of ground per area

<table>
<thead>
<tr>
<th>Area</th>
<th>Amax (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I,II,III</td>
<td>0.075</td>
</tr>
<tr>
<td>IV</td>
<td>0.10</td>
</tr>
<tr>
<td>V</td>
<td>0.15</td>
</tr>
</tbody>
</table>

Source: Department of Geology

Figure 4.6. Seismic Zoning map of Cyprus
The new Fuel Farm is situated in an Area [III] region, and consequently, all construction works have to comply with the relevant provisions of the local legislation.

Source: Department of Geology

Figure 4.7. Earthquakes in Cyprus (1904-1995)

4.1.3 Climate and meteorology

4.1.3.1 Regional characteristics

Cyprus has a typical Mediterranean climate with hot dry summers and mild wet winters with rainfall occurring mainly between November and March while altitude tends to govern internal temperature and rainfall variations. The average annual precipitation for the island as a whole is 500 mm with an average of 300 to 400 mm in the central plain to nearly 1,200 mm at the highest point of the Troodos Massif. Average temperature ranges in Nicosia are from 5 to 15 degrees Celsius in January to 21 to 37 degrees Celsius (°C) in July.

Snow is rare on the Mesaoria Plains and on the Pentadaktylos Mountain Range. In areas of the Troodos massif with an altitude greater than 1000m, it snows periodically from December to the middle of April. At altitudes lower than 1700m snow rarely persists for more than one or two days; only on the higher peaks is there snow-cover for a longer period of time.
4.1.3.2 Local characteristics

The following data is provided from meteorological stations in the Larnaca district in particular the station within the airport boundary. Data is provided for the following parameters:

- Air Temperature;
- Precipitation and Evaporation;
- Air Humidity;
- Sunlight; and
- Wind.

4.1.3.2.1 Temperature

**Table 4.2** details the mean daily and mean monthly air temperature at Larnaca. In addition, the extreme temperature minimums and maximums are detailed. Data is recorded from 1991 to 2000.

**Table 4.2** Medium Temperature of air in the Meteorological Station of Larnaca Airport 1991-2000

<table>
<thead>
<tr>
<th>Air Temperature 1991-2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
</tr>
<tr>
<td>Mean Daily Max.</td>
</tr>
<tr>
<td>Mean Daily Min.</td>
</tr>
<tr>
<td>Mean Daily</td>
</tr>
<tr>
<td>Mean Monthly Max</td>
</tr>
<tr>
<td>Mean Monthly Min</td>
</tr>
<tr>
<td>Mean Monthly</td>
</tr>
<tr>
<td>Extreme Max.</td>
</tr>
<tr>
<td>Extreme Min.</td>
</tr>
</tbody>
</table>
4.1.3.2.2 Precipitation/Evaporation

Average monthly rainfall (1901-1975) from a meteorological station within Larnaca is available within the study by Kypris¹ into salt production at the Larnaca salt lakes. Also presented in this report are average monthly evaporation rates from between 1933 and 1973 and monthly evaporation from a Class A evaporation pan located near the salt lakes during the period May 1975 - April 1976. Table 5-2 below presents this data and as can be seen, evaporation is generally greater than evaporation.

Table 4-3 and Table 4-4 details the mean monthly rainfall the number of days with rainfall at Larnaca.

Table 4.3 Precipitation and evaporation within Larnaca

<table>
<thead>
<tr>
<th>Month</th>
<th>Average Monthly Rainfall (mm)</th>
<th>Average Monthly Evaporation</th>
<th>Monthly Evaporation from Class A Evaporation Pan</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>79</td>
<td>22</td>
<td>80</td>
</tr>
<tr>
<td>February</td>
<td>47</td>
<td>24</td>
<td>86</td>
</tr>
<tr>
<td>March</td>
<td>42</td>
<td>36</td>
<td>126</td>
</tr>
<tr>
<td>April</td>
<td>18</td>
<td>58</td>
<td>156</td>
</tr>
<tr>
<td>May</td>
<td>10</td>
<td>100</td>
<td>230</td>
</tr>
<tr>
<td>June</td>
<td>1</td>
<td>144</td>
<td>302</td>
</tr>
<tr>
<td>July</td>
<td></td>
<td>172</td>
<td>330</td>
</tr>
<tr>
<td>August</td>
<td></td>
<td>166</td>
<td>308</td>
</tr>
<tr>
<td>September</td>
<td>4</td>
<td>124</td>
<td>276</td>
</tr>
<tr>
<td>October</td>
<td>27</td>
<td>86</td>
<td>194</td>
</tr>
<tr>
<td>November</td>
<td>39</td>
<td>48</td>
<td>116</td>
</tr>
<tr>
<td>December</td>
<td>102</td>
<td>29</td>
<td>87</td>
</tr>
</tbody>
</table>

### Table 4.4 Mean monthly rainfall

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>75,9</td>
<td>76,7</td>
<td>62,9</td>
</tr>
<tr>
<td>February</td>
<td>57,4</td>
<td>59,8</td>
<td>48,7</td>
</tr>
<tr>
<td>March</td>
<td>41,2</td>
<td>43,5</td>
<td>43,4</td>
</tr>
<tr>
<td>April</td>
<td>14,9</td>
<td>16,2</td>
<td>12,1</td>
</tr>
<tr>
<td>May</td>
<td>9,3</td>
<td>7</td>
<td>10,4</td>
</tr>
<tr>
<td>June</td>
<td>2,3</td>
<td>2,9</td>
<td>2,5</td>
</tr>
<tr>
<td>July</td>
<td>0,6</td>
<td>0,1</td>
<td>0,3</td>
</tr>
<tr>
<td>August</td>
<td>0,6</td>
<td>0,4</td>
<td>0,2</td>
</tr>
<tr>
<td>September</td>
<td>0,1</td>
<td>0,2</td>
<td>0,9</td>
</tr>
<tr>
<td>October</td>
<td>13,6</td>
<td>17</td>
<td>17,2</td>
</tr>
<tr>
<td>November</td>
<td>43,3</td>
<td>43,2</td>
<td>53,7</td>
</tr>
<tr>
<td>December</td>
<td>84,8</td>
<td>81,7</td>
<td>89</td>
</tr>
<tr>
<td>Annual</td>
<td>343,9</td>
<td>348,7</td>
<td>341,2</td>
</tr>
</tbody>
</table>
4.1.3.2.3 Solar radiation

Table 4.5 details average monthly solar radiation (Wh/m²) at Larnaca Meteorological Station between 1985 - 1994.

Table 4.5 Medium monthly solar radiation (Wh/m²)

<table>
<thead>
<tr>
<th>Days</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
</table>

4.1.3.2.4 Wind

Figure 4.1.7 illustrates the prevailing wind direction at Larnaca Airport.

Figure 4.6 Annual Direction Windrose
4.1.4 Water Resources and Usage

A Hydrological Assessment was prepared (URS, September 2005) in order to determine the quantity and quality of flows to the Salt Lake system from the airport and other areas. The assessment developed an understanding of how the airport currently impacts on the hydrology of the system and how this impact compares to that from the other parts of the catchment. An initial water balance model for the Lake system as a whole was also developed.

The interconnected Salt Lake system which surrounds and lies within the boundary of the airport is important for their ecological status and are designated as a Special Protection Area under the EC Wild Birds Directive and the northern lakes are also designated as Wetlands of International Importance under the RAMSAR Convention.

Larnaca Salt Lakes are a complex hydrological system comprising four main salt lakes, three pools and an adjacent wetland. The cover of the total system is approximately 1800 hectares (ha) of which 670ha are water (when fully flooded) and nearly 300ha are related natural halophytic habitats. The four lakes are as follows:

- Lake Soros ~ 40 ha, low salinity regime;
- Lake Orphanie ~ 140 ha, low salinity regime;
- The Small Lake “Airport Lake” ~ 39 ha, medium salt regime; and
- The Great Lake or “Lake Alki”~ 449 ha, high salinity regime.

The Salt Lakes, especially Aliki, are the ultimate receptor for almost all the water and therefore contamination that enters the catchment. Human influences have shaped the hydrology of the catchment significantly, first by reducing the catchment area and then be restoring it to almost the same size but with a slightly different flow regime. Fortunately, the connections between the largest lake in the south, Orphanie and Aliki remain with culverts and pipes beneath the airport’s existing runway and taxiway directing water via the Airport Lake when water levels are high enough.

Direct rainfall was found to be the greatest contributor to water within the salt lakes, with runoff from a developed part of the catchment estimated to be the next largest contributor followed by groundwater and seawater intrusion. Runoff from the remainder of the catchments and direct discharges to the Lakes play a much smaller role.
Previous investigations of the Salt Lakes have identified contamination from a number of sources but mainly relating to the past uses of the Lake and its catchment. Arsenic and lead contamination from a former shooting range within the Lake and persistent pesticide contamination (DDT) from agricultural sources within the catchment are particularly notable. The studies also confirmed the existence of organic contamination, attributed to land-uses immediately surrounding the Lakes.

The Hydrological Assessment found the volume of runoff from the airport into the Lakes to be approximately 0.2% of the estimated total input (4.75 hm$^3$/year) which is relatively insignificant in terms of maintaining or changing the salinity of the Lakes. The airport is however, likely to be the main source of organic contaminants including hydrocarbon pollution, within the Airport and Small Airport Salt Lakes and therefore, is a contributor to pollution within Aliki. Existing contamination is also present, though not widespread, with hydrocarbon contamination near the bulk fuel storage areas along the eastern boundary of the Airport Salt Lake.

The location of the fuel farm as indicated in the Figure 4.8 lies in the southwest part of the Lake Aliki, and in the northwest part of the Orphani Lake, although it not in its close vicinity.

Finally, it must be noted that a drainage pipe line, with a routing which is parallel to the road, ends up in the Fuel Farm area, as depicted in Picture 4.17
4.1.5 Soil Quality and Contaminated Land

A Contaminated Land Assessment was undertaken at Larnaca International Airport in September 2005. The investigation involved the drilling of eight boreholes and the sampling of sediments in four locations within the Salt Lakes adjacent to the Airport and confirmed the underlying geology to
comprise mainly fine to medium sands. No significant soil or groundwater contamination sources were identified and no noticeable contamination, either visual or olfactory, was encountered in any of the boreholes or sample locations. Only one of the soil samples recorded a concentration higher than average of organic chlorinated pesticides and was evident in a sample located within the main Larnaca Salt Lake, outside of the airport boundary. Cadmium and chromium were found present in groundwater at elevations exceeding intervention values in a number of locations, however, Cadmium was not found within soil samples suggesting that the source of this contaminant was external. Chromium was found in all soil samples taken although at concentrations below intervention values.

In addition to the fuel depots, several other activities and incidents which could have potentially impacted soil and groundwater quality at the airport have been identified, near by the proposed position of the hydrant system such us the historical disposal of unknown wastes along the eastern boundary of the airport between 1960s and 1975; (Figure 4.10)

According to the Contaminated Land Assessment September 2005 as part of this ESIA process, no significant soil or groundwater contamination sources were identified within Larnacas Airport as well as no noticeable contamination, either visual or olfactory, was encountered in any of the boreholes or sample locations.

However none of the boreholes or sample locations lies in the boundaries of the fuel farm proposed location (Figure 4.10) but it is possible, although unlikely, that additional areas of contamination not identified by the intrusive site investigation exist within the proposed airport development footprint / construction areas.

As far as the current place of the fuel farms, TPH was not recorded near by the bulk fuel storage depot, however previous investigations indicate that TPH contamination beneath the older fuel storage areas is present. It is noted that some areas of the site were not sampled because of access and safety issues and it is feasible that contamination may exist in these areas. In particular there is expected to residual hydrocarbon contamination in the bulk fuel storage areas;
Figure 4.8  Location of the Contamination of ground water and soil observation boreholes
4.1.6 Ecology and Nature Conservation

The Larnaca Salt Lakes are protected under a number of International and National Conventions and Directives. Table 4.7 below provides detail on these Conventions and Directives.

Table 4.7 Larnaca Salt Lake System – Protection Status

<table>
<thead>
<tr>
<th>Protection Status (International Level)</th>
<th>Area (ha)</th>
<th>Convention/Directive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wetland of International Importance</td>
<td>1585</td>
<td>Ramsar Convention</td>
</tr>
<tr>
<td>Proposed Important Bird Area</td>
<td>1814</td>
<td>Bird Life International</td>
</tr>
<tr>
<td>Special Protected Area (UNEP Directory)</td>
<td>668</td>
<td>Barcelona Convention</td>
</tr>
<tr>
<td>Special Protection Area</td>
<td>1712</td>
<td>EU Wild Birds Directive (79/409/EEC)</td>
</tr>
<tr>
<td>Proposed Special Area of Conservation</td>
<td>1712</td>
<td>EU Habitats Directive (79/409/EEC)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Protection Status (National Level)</th>
<th>Area (ha)</th>
<th>National Law</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permanent Game Reserve (no hunting)</td>
<td>702</td>
<td>Games and Wildlife Law (39/974)</td>
</tr>
<tr>
<td>Temporary Game Reserve (no hunting)</td>
<td>873</td>
<td>Games and Wildlife Law (39/974)</td>
</tr>
<tr>
<td>Coasts and Areas for Nature Protection</td>
<td>1712</td>
<td>Fisheries Regulation (273/90)</td>
</tr>
</tbody>
</table>

4.1.7 Habitats and Flora

An ecological baseline assessment was undertaken in November 2005 within the airport boundary, in order to describe and evaluate the ecological characteristics of the area.

The Assessment included habitat mapping which listed flora species and provided target notes on features of special value or interest within the airport boundary. Figure 4.11 shows the habitat mapping of the airport.

The habitats found within the Larnaca Salt Lake System are summarised in the Table 4.8 below. The habitats are listed according to their classification.
under the EU Habitats Directive (92/43/EEC). Coastal lagoons and pseudo-
steppe with grasses and annuals are also classified as priority habitats under
the Habitats Directive.

Table 4.8  Larnaca Salt Lakes System - IBA Habitat Classification

<table>
<thead>
<tr>
<th>Description: Annex I Habitats</th>
<th>% Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coastal Lagoon</td>
<td>37</td>
</tr>
<tr>
<td>Mediterranean and thermo-Altantic halophilous scrubs</td>
<td>22</td>
</tr>
<tr>
<td>Annual Vegetation of drift limes</td>
<td>1</td>
</tr>
<tr>
<td><em>Salicornia</em> and other annuals colonizing mud and sand</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Mediterranean salt meadows (<em>Juncetalia maritimi</em>)</td>
<td>1</td>
</tr>
<tr>
<td>Ebryonic shifting dunes</td>
<td>&lt;1</td>
</tr>
<tr>
<td><em>Sarcopoterium phygranas</em> (<em>cisto-Micromerietea</em>)</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Pseudo-steppe with grasses and annuals (<em>Thero-Brachypodietea</em>)</td>
<td>1</td>
</tr>
<tr>
<td>Reed beds and sedge beds (<em>Phragmition australis, Scirpion maritimi</em>)</td>
<td>&lt;1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description: Non-Annex I Habitats</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Artificial Forest Monoculture (e.g. plantations)</td>
<td>2</td>
</tr>
<tr>
<td>Arable Land</td>
<td>12</td>
</tr>
<tr>
<td>Other Land (towns, villages, roads, waste places, mines, industrial)</td>
<td>24</td>
</tr>
</tbody>
</table>

The new Fuel Farm is located in the North West of the new proposed
terminal, and the area is covered mainly by cultivations of tree crops (citrus
trees and olive trees) as well as seasonal cultivations (cereals); however the
area cannot be classified in any Annex I habitat type.

**Picture 4.18 Opuntia trees**
Picture 4.19 Citrus trees

Picture 4.20 Lemon trees

Picture 4.21 Olive trees

Picture 4.22 Pine trees

Picture 4.23 Palm trees

Picture 4.24 Cultivated area

Figure 4.9 Habitat map of Larnaca Airport
4.1.8 Fauna

The ecological assessment identified 53 bird species with the number of individuals exceeding 1500. The majority of these birds were recorded at the Larnaka Sewage Treatment Plant where the birds were noted using the settling pools as a water resource given the scarcity of water within the Salt lakes during October/November.

A survey of the major and secondary fly routes of the avifauna were studied and are summarise shown in Figure 4.12

It is apparent that their direction doesn’t meet the proposed fuel farm. However the following species of conservation concern were noted in the cultivated areas, part of which will be occupied by the new airport buildings, apron and taxiway as well as a minute part of the fuel farm’s position (Figure 4.13):

- Hen Harrier - Circus cyaneus;
- March Harrier - Circus aeruginosus; and
- Stone Curlew - Burhinus oedicnemus.

Figure 4.10 Fly routes of Avifauna
4.2 Human Environment

4.2.1 Land use and urban planning

The location of the fuel farm is within the boundaries of the special airport zone (EA). The area surrounding the new Fuel Farm is characterised as Zone Ka6 (west) and Zone Δα2 (north).
Figure 4.13  Urban Zones
Table 4.9 Urban Zone characteristics

<table>
<thead>
<tr>
<th>Zone</th>
<th>Description</th>
<th>Maximum factor of layout</th>
<th>Maximum number of floors</th>
<th>Maximum altimeter (meters)</th>
<th>Maximum cover percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Πα9</td>
<td>Historical region</td>
<td>1,20:1</td>
<td>2</td>
<td>7</td>
<td>0,70:1</td>
</tr>
<tr>
<td>Κα6</td>
<td>Build up areas</td>
<td>0,90:1</td>
<td>2</td>
<td>8,30</td>
<td>0,50:1</td>
</tr>
<tr>
<td>Γα2</td>
<td>Agriculture Area/Countryside</td>
<td>0,06:1</td>
<td>2</td>
<td>7</td>
<td>0,06:1</td>
</tr>
<tr>
<td>Γα4</td>
<td>Agriculture Area/Countryside</td>
<td>0,10:1</td>
<td>2</td>
<td>7</td>
<td>0,10:1</td>
</tr>
<tr>
<td>Γγ1</td>
<td>Range</td>
<td>0,30:1</td>
<td>2</td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td>Δα2</td>
<td>Protection zone</td>
<td>0,01:1</td>
<td>2</td>
<td>7</td>
<td>0,01:1</td>
</tr>
<tr>
<td>Δα1</td>
<td>Protection zone</td>
<td>0,005:1</td>
<td>2</td>
<td>7</td>
<td>0,005:1</td>
</tr>
<tr>
<td>Δα3</td>
<td>Protection zone</td>
<td>0,05:1</td>
<td>2</td>
<td>7</td>
<td>0,05:1</td>
</tr>
<tr>
<td>Εβ7α</td>
<td>Commercial zone and other Central Operations</td>
<td>0,90:1</td>
<td>2/3</td>
<td>8,30/11,30</td>
<td>0,50:1</td>
</tr>
<tr>
<td>Εβ</td>
<td>Commercial zone and other Central Operations in effect of the factors of growth of residence of bordering Built-up Area</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Βα4</td>
<td>Industrial zone -Category B</td>
<td>0,90:1</td>
<td>2</td>
<td>-</td>
<td>0,50:1</td>
</tr>
<tr>
<td>Ββ1</td>
<td>Industrial zone -Category B</td>
<td>1,00:1</td>
<td>2</td>
<td>-</td>
<td>0,60:1</td>
</tr>
<tr>
<td>Βδ3</td>
<td>Craft-based Area -Category B</td>
<td>0,90:1</td>
<td>2</td>
<td>-</td>
<td>0,50:1</td>
</tr>
<tr>
<td>Αα1</td>
<td>Public uses</td>
<td>0,20:1</td>
<td>3</td>
<td>-</td>
<td>0,20:1</td>
</tr>
<tr>
<td>Αα4</td>
<td>Public uses</td>
<td>0,50:1</td>
<td>3</td>
<td>-</td>
<td>0,30:1</td>
</tr>
</tbody>
</table>
4.2.2 Demographic Data

According to the 2001 census of population, the population of the area is 9544 citizens, as presented in the Table 4.2.2 below.

Table 4.10 Area Population

<table>
<thead>
<tr>
<th>MUNICIPALITIES / COMMUNITIES</th>
<th>POPULATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dromolaxia</td>
<td>4.494</td>
</tr>
<tr>
<td>Meneou</td>
<td>3.354</td>
</tr>
<tr>
<td>Kiti</td>
<td>1.196</td>
</tr>
<tr>
<td>Total</td>
<td>9.544</td>
</tr>
</tbody>
</table>

4.2.3 Infrastructure

The new Fuel Farm will be accessed from the roundabout by the flyover (connecting the new Terminal Building access road to the Nicosia motorway), taking the detour to the southwest, towards the Meneou - Kiti communities (see Figure 4.16).
Figure 4.14  Road Network
4.2.4 Tourist infrastructure

The is no tourist infrastructure in the area.

4.2.5 Archaeological sites

Larnaca Salt Lake is near Larnaka International Airport. It fills with water during the winter and is visited by flocks of flamingoes who stay here from November till the end of March. It dries up in the summer. It used to yield a good quality of salt which was is scraped from its dried up surface. The salt from this lake is now considered unfit for human consumption.

At Kiti, a village 7 miles south of Larnaka, is also worth seeing. The Byzantine mosaic of the Blessed Virgin Mary in the central apse of the church of “Panagia Ageloktisti” is the best in Cyprus. Some of the icons are also magnificent.

“Hala Sultan Tekke”, is about 5 kilometers west of Larnaka, on the banks of the Salt Lake. It is equivalent to the Christian “monastery”. Within the precincts of this Tekke is the tomb of Umm Haram, said to be the foster mother of Mohammed. According to Moslem tradition Umm Haram died on this spot in 647 A.D. while accompanying the Arab invaders. She was buried here and later the Ottomans built the present mosque in her honour.

The earliest architectural remains at the “ancient city of Kition” date back to the 13th century B.C. the area was rebuilt by Archaean Greeks. The remains of the Cyclopean Walls, made of giant blocks and the complex of the five temples, are particularly interesting.

The “Old Aqueduct”, known as “The Kamares”, stands outside the town on the way to Limassol. It was built in Roman style in 1745 to carry water from a source about 6 miles south of Larnaka into the town. The aqueduct is illuminated at night.

This magnificent Orthodox Church of “St. Lazarus” was built in the town over the tomb of St. Lazarus, the brother of Mary and Martha. He died here and was buried in the church named after him. In 890 A.D. his tomb was found bearing the inscription “Lazarus the friend of Christ”. The marble sarcophagus can be seen inside the church under the Holy of Holies.

The “old Fort of Larnaca”, was erected by the Turks in 1625. This fort is now a museum and its inner courtyard is used as an open air garden - theatre during the summer months, by kind permission of the director of antiquities.
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5. IMPACTS AND MITIGATION MANAGEMENT AND MONITORING

5.1 Introduction

This Chapter examines the potential environmental and socio-economic impacts associated with the proposed development works. The assessment addresses the main project activities as defined in Chapter 3.

Overall, the proposed fuel farm development is not considered to constitute a significant risk to either environmental or social and community receptors. The construction phase will be executed and managed by a reputable international construction firm, Bouygues Batiment International (Bouygues) a member of the Hermes Airports Limited (Hermes) consortia.

Environmental and social management of the fuel farm construction and operation will have several aspects as follows:

- Construction programme management; and
- Ongoing fuel farm operations management upon completion of the construction.

Responsibility for delivery of the environmental and social management provisions outlined in this chapter will be as follows:

- Bouygues and its subcontractors - construction programme; and
- Hermes - airport operations.

Bouygues will develop a Construction Programme Environmental and Social Management Plan (ESMP). This ESMP will interface with Hermes’ operational ESMP and indeed will share some common elements such as management of air emissions, noise, land. Once the construction programme is finished the Construction Programme ESMP will no longer be maintained.

Hermes will develop an Airport Operations Environmental and Social Management Plan (ESMP) in accordance with the provisions of ISO14001:2004 - Environmental Management System, and it is expected that the construction and operation of the fuel farm will comply with the EMS requirements. Hermes may elect to gain accreditation for its management system some time in the future but it is not proposed to pursue this in the short term rather the principles of the standard will be applied including regular monitoring and auditing of the performance of the management provisions and implementation of corrective actions if and as required.
In the following sections, recommendations are made with respect to minimum requirements of a number of issue-specific control plans for both the construction and operation phases of the Larnaka International Airport new fuel farm development project. These issue-specific control plans will be ‘rolled-up’ under the auspices of the overarching Airport Operations and Construction Programme ESMP.

It should be noted that at the time of writing, details in respect to some aspects of the project design were not available and therefore, it has not been possible to complete a quantitative impact assessment. In such instances, a qualitative assessment has been made of the potential for impacts and their likely significance and recommendations are made in regards to future work programmes that should be undertaken by Bouygues to address the information gap.

5.1.1 Construction Phase

As discussed in Chapter 3, Section 3.24, development works at Larnaka International Airport fuel farm will last approximately 14 months. In summary, the construction programme will include:

- Site clearing and levelling;
- Civil construction works;
- Mechanical erection of steelwork;
- Jet A-1 tanks construction;
- Building construction;
- Pipe racking construction and piping installation;
- Mechanical equipment installation;
- Electrical and instrumentation installation; and
- Fuel farm handover.

At any one time, an average of 75 construction workers are anticipated to be on site. During the peak construction period, 150 construction workers are anticipated to be on site.

The construction phase is considered to have a potential to interact with the following environmental and social / community receptors:

- Environmental:
- Air quality;
- Water resources (surface and groundwater);
- Soils and land;
- Habitat (flora and fauna (birds)); and
- Construction waste.

- Socio-Economic & Community:
  - Local community (noise);
  - Local traffic and infrastructure;
  - Public health and safety; and
  - Construction workforce health and safety.

The following sections elaborate on the nature of the anticipated construction phase activity-receptor interactions, the mitigation measures that will be employed to address and reduce impacts to an acceptable level and the management and monitoring activities that will be conducted in order to demonstrate that the mitigation measure are effective.

A Construction Programme Environment Officer will be appointed to manage all environment and social monitoring requirements for the construction programme. Monitoring, recording, reporting and corrective action development and implementation will be conducted in accordance with the Construction Programme ESMP as developed by Bouygues.

5.1.2 Operational Phase

Operation of Larnaka International Airport fuel farm is considered to have a potential to interact with the following environmental and socio-economic / community receptors:

- Environmental:
  - Air quality;
  - Water resources (surface and groundwater);
  - Soils and land;
  - Fauna (birds); and
  - Waste.
• Socio-Economic & Community:
  - Local community (noise);
  - Local traffic and transport infrastructure;
  - Employee health and Safety; and
  - Public health and safety.

The following sections elaborate on the nature of the anticipated operation phase activity-receptor interactions, the mitigation measures that will be employed to address and reduce impacts to an acceptable level and the management and monitoring activities that will be conducted in order to demonstrate that the mitigation measure are effective.

A Fuel Farm Operations Environmental Programme will be appointed to manage all environment and social monitoring requirements during the fuel farm operations. Monitoring, recording, reporting and corrective action development and implementation will be conducted in accordance with an overarching Airport Operations Environmental and Social Management Plan (ESMP). The ESMP will be developed by Hermes.
5.2 Ambient Air Quality

5.2.1 Introduction

The aim of this section is to describe the existing air quality in the vicinity of the proposed Larnaka International Airport fuel farm, and to assess the potential impacts of the construction and operation of the fuel farm on air quality. The assessment considers potential changes to local air quality in relation to EU Limit Values for the protection of human health and ecosystems, and the potential generation of nuisance dust and odours.

No air emissions monitoring has been undertaken within the boundaries of the airport to date. The Municipality of Larnaca has however, undertaken air quality monitoring at a number of locations within Larnaca town including five sites at the airport site boundary. Levels of nitrogen oxides, sulphur dioxide, benzene, and ozone concentrations have been found to comply with available World Health Organisation and EU ambient air quality standards at all the sampling locations and concentrations near the airport are comparable to those in town centre.

During the construction phase, the fuel farm has the potential to generate adverse, but temporary, impacts on local air quality as a result of construction traffic and plant exhaust emissions, and also nuisance dust from construction activities. A quantitative and qualitative assessment of the impacts during the construction phase has been undertaken in this study.

During the operation phase, the fuel farm has the potential to affect both local and regional pollution as a result of emissions to air from a variety of stationary and mobile sources including tank losses, diesel engines and road tankers. The potential contribution of the fuel farm to pollutant emissions has been assessed quantitatively, and their impact on local air quality has been assessed using computerised modelling.

Existing air quality in the region has been assessed using the data from the “Larnaka International Airport Development Project Environmental and Socio-Economic Impact Assessment” prepared by URS and AEOLIKI in 2006.

The pollutants considered in this study were chosen by reference to relevant EU legislation and considering the principal types of emissions at petroleum products storage depots (Table 5.1).
The pollutants considered are:

**Operational Impacts**

- Nitrogen Dioxide (NO₂);
- Particulates with aerodynamic diameters less than 10 μm (PM₁₀);
- Volatile Organic Compounds (VOC);
- Benzene;
- Sulphur Dioxide (SO₂);
- Carbon Monoxide (CO);

**Construction Impacts**

- Dust;
- Nitrogen Dioxide (NO₂);
- Sulphur Dioxide (SO₂);
- Carbon Monoxide (CO);

All pollutants except VOCs and dust are covered by EU legislation for managing local air quality, and have human health impacts. VOCs are included to assess the contribution made by the fuel farm to the regional emissions of ozone precursors and also as a measure of the odour creation potential of the storage facility.
## Table 5.1 Pollutants - Sources and effects

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Main Sources</th>
<th>Impacts</th>
<th>Assess</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzene &amp; VOCs</td>
<td>Fuel vapours; Incomplete combustion of fuel</td>
<td>Carcinogenic (Benzene)</td>
<td>YES</td>
<td>Fuel farm tank emissions and combustion are potential sources</td>
</tr>
<tr>
<td>CO</td>
<td>Incomplete combustion of fuel</td>
<td>Reduces capacity of blood to carry oxygen</td>
<td>YES</td>
<td>Combustion/transport sources at fuel farm</td>
</tr>
<tr>
<td>Oxides of Nitrogen</td>
<td>NO formed during combustion in air. NO2 formed by oxidation of NO</td>
<td>Impaired lung function; acidification and eutrophication of soils</td>
<td>YES</td>
<td>Combustion / transport sources present at fuel farm</td>
</tr>
<tr>
<td>Ozone (O₃)</td>
<td>No man-made sources. Formed through chemical reactions in presence of sunlight</td>
<td>Eye, nose and throat irritation, chest infection; affects crop growth</td>
<td>NO</td>
<td>No assessment required in relation to local air quality due to lack of sources</td>
</tr>
<tr>
<td>PM₁₀</td>
<td>Industrial processes, especially mineral and ferrous metals. Combustion processes. Chemical reaction in air</td>
<td>Affects the respiratory and cardiovascular systems, asthma and mortality</td>
<td>YES</td>
<td>Combustion/transport sources present at fuel farm</td>
</tr>
<tr>
<td>SO₂</td>
<td>Predominant source is combustion of sulphur-containing fossil fuels, principally coal and heavy oils. Some industrial processes</td>
<td>Constriction of airways by stimulating nerves in the lining of the nose, throat and lungs</td>
<td>YES</td>
<td>Diesel engines are potential source</td>
</tr>
<tr>
<td>Lead</td>
<td>Road traffic was main contributor before general sale of leaded petrol was banned on 1 January 2000. Industry contributes to lead emissions but to a lesser extent</td>
<td>Affects the synthesis of haemoglobin, kidneys, joints and the reproductive system. Can cause damage to the nervous system</td>
<td>NO</td>
<td>No significant sources of lead associated with this project</td>
</tr>
<tr>
<td>Dust</td>
<td>Natural sources, industrial processes, construction activities</td>
<td>Nuisance dust soiling of surface. Corrosion of artifacts leading to faults or abrasion or contamination. Can affect growth of vegetation</td>
<td>YES</td>
<td>Construction activities are a potential source</td>
</tr>
</tbody>
</table>

### 5.2.2 Assessment methodology

The area of interest is broadly defined as the region within a 10 km radius of the proposed facility. This includes the residential areas of Dromolaxia at approx. 1 km to the northwest, Meneou at approx. 4 km to the west, Kiti at approx. 5km to the northwest, Klavdia at approx. 6km to the northwest, Perivolia at approx. 6 km to ther north, Tersefanou at approx. 7km to the wets, Kalo Chorio at approx. 9km the northwest, and Aradippou at approx. 10km to the north. Outside of the area, the contribution from the fuel farm is expected to be relatively small.
The assessment of construction impacts involves the identification of those activities which are likely to result in the generation of dust and other air emissions, and the identification of potential receptors in the vicinity of those activities.

The assessment of local air quality impacts during the operation of the fuel farm requires the calculation of ground level pollutant concentrations, both prior to and subsequent to the proposed development. The calculation of ground level concentrations requires that pollutant emission sources be identified and quantified.

Ground level pollutant concentrations in the study area are considered to have two contributions:

- Contributions from emission sources on the proposed fuel farm;
- Contributions from all other emissions sources.

Of these contributions, the former are explicitly included in the modelling exercise, the latter are implicitly included via the estimation of background pollutant concentrations.

Emissions sources considered for this assessment include:

- Storage tanks related emissions (VOC)
  - Including working losses, breathing losses, seal losses
- Product transportation related emissions (VOC)
  - Losses from mobile container loading
  - Vapour return unit exhausts
- Diesel generators (NOx, PM10, CO, SO2)
  - Emergency - routine testing only
- Traffic Emissions (NOx, PM10, Benzene)

The quantities of pollutants emitted from the above sources depend on the level of activity at the fuel farm. The steps required to calculate their contribution to ground level concentrations in the study area include:

- Estimation of emissions of the relevant pollutants for each scenario based on operational data;
- Representation of the spatial distribution of the emissions to an appropriate level of detail;
Atmospheric modelling using the Short Term Critical Impact Analysis Model (1) model together with appropriate meteorological data; and

Comparison of model results with relevant assessment criteria.

For the atmospheric modelling, information is required on both the quantities of pollutants released and their release location and characterisation.

For VOC releases from the storage tanks, the TANKS Software (of the US Environmental Protection Agency) has been chosen for the calculation of their emissions rates.

For the VOC emissions, it is the total amount released in a year that is of concern for both regional and local impacts. Therefore, its distribution throughout the year is of secondary importance. Emissions of VOC (and by definition benzene) are therefore modelled at their annual average.

For the diesel generators, their sporadic operation means that it is not possible to predict the diurnal profile or seasonality. However, it has been assumed that testing of the engines will take place during the daytime.

The atmospheric modelling was carried out using 10 years of hourly sequential meteorological data collected at Larnaka Airport for 1995 to 2005.

The wind roses for Larnaka show that north-westerly and south-south-westerly winds are dominant (Figure 4.6). There is a strong diurnal signal in the data, which is linked to the development of sea and land breezes. During the morning, wind speeds increase as a strong onshore breeze develops, with initially south-easterly winds veering towards south-south-westerly as the circulation develops. During the evening, the wind speed falls and the wind veers further to north-westerly. The sea breeze circulation is most marked during the summer period (May to September).

NO₂ is not emitted from combustion sources in significant quantities. Typically less than 5% of NOx emissions are NO₂ and 95% are NO. NO₂ is formed by oxidation of NOx in the atmosphere, primarily by reaction with ozone. EU Limit Values for the protection of human health relate to NO₂ rather than NO. For the purposes of this study it is assumed that 50% of the emitted NOx is converted to NO₂. This is considered to be a conservative estimate for the points of maximum NOx impacts, which lie within 2 km of the site.

The air quality assessment criteria used in this study are based on the air quality limit values or assessment criteria for the concentration of pollutants in ambient air or the relevant emissions ceilings. There is no generally accepted guidance available on the

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significance of air quality impacts and the judgment of significance is usually based on the expertise of the air quality specialist.

For this study, the assessment of significance will be made on a pollutant specific basis, which will take into account:

- the level of background concentration or emissions (except odours, where background concentrations are considered negligible);
- the process contribution (PC) as a percentage of the relevant limit value or ceiling i.e. the contribution of the fuel farm alone;
- the predicted environment contribution (PEC) as a percentage of the relevant standard or ceiling i.e. the total concentration in ambient air, taking into account the process contribution and the background concentrations; and
- for local air quality, whether the pollutant is a threshold pollutant i.e. there is a defined level below which effects are not seen - this is true for NO₂, but not true for particulates or carcinogenic substances such as benzene.

For annual average measures, where the process contribution is less than 1% of the relevant standard, the significance of the impact of the process will be considered to be negligible whether background concentrations exceed the standard or not. For short term measures, including odours, where the process contribution is less than 10% of the relevant standard or ceiling, the significance is considered negligible.

**Table 5.2 Significance criteria**

<table>
<thead>
<tr>
<th>Factor</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Major</strong></td>
</tr>
<tr>
<td></td>
<td>PEC&gt;70% of limit value and PC&gt;10% or PC&gt;50%</td>
</tr>
<tr>
<td>Local air quality; long term averages</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PEC&gt;70% of limit value and PC&gt;25% or PC&gt;50%</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Regional air quality</td>
<td>PEC&gt;70% of limit value and PC&gt;10%</td>
</tr>
<tr>
<td>Odours</td>
<td>PEC=50% of indicative criterion</td>
</tr>
</tbody>
</table>
5.2.3 Emission sources

Fixed roof tanks

Fixed roof tanks are proposed for the storage of Jet A-1 fuel. All tank storage is at ambient pressure and unheated.

Losses from the fixed roof tanks proposed for the storage of petroleum products were estimated using the emission factors in AP-42(2), Chapter 7, applying the TANKS Software of US-EPA. The losses considered were breathing losses and working losses. Breathing losses occur as a result of the expulsion of vapours due to the expansion and contraction of tank vapours due to diurnal temperature and barometric pressure variations. Working losses occur as a result of the loading and unloading operations changing the tank liquid level. For instance, during loading, as the liquid level rises, the pressure level within the tank increases and exceeds the relief pressure and vapours are expelled. Table 5.3 shows the emission estimates for fixed roof tanks.

Table 5.3: VOC Emissions from Fixed Roof Tanks Storing Jet A-1 fuel

<table>
<thead>
<tr>
<th>Year</th>
<th>Annual Throughput (tonnes)</th>
<th>No of Tanks</th>
<th>Loss per Tank per year (tonnes)</th>
<th>Total Losses per year (tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>264,231</td>
<td>3</td>
<td>0.66</td>
<td>2.0</td>
</tr>
<tr>
<td>2010</td>
<td>348,000</td>
<td>3</td>
<td>0.80</td>
<td>2.4</td>
</tr>
<tr>
<td>2015</td>
<td>394,557</td>
<td>4</td>
<td>0.95</td>
<td>2.85</td>
</tr>
<tr>
<td>2020</td>
<td>447,342</td>
<td>4</td>
<td>0.96</td>
<td>2.88</td>
</tr>
<tr>
<td>2025</td>
<td>507,189</td>
<td>4</td>
<td>0.98</td>
<td>2.94</td>
</tr>
<tr>
<td>2030</td>
<td>575,042</td>
<td>4</td>
<td>0.99</td>
<td>2.96</td>
</tr>
</tbody>
</table>

Product Loading onto Mobile Containers

The loading of Jet A-1 fuel at the fuel farm is regulated by EC Directive 94/63/EC on the control of volatile organic compound emissions resulting from the storage of petrol and its distribution from terminals to service stations. The provisions of the directive are intended to reduce the losses from loading and unloading of mobile containers at terminals (storage sites) to less than 0.005 w/w%.

Vapour losses from Jet A-1 loading were, therefore, estimated by setting the total loss to 0.005 w/w% of the total annual throughput of aviation fuel at the fuel farm. Table 5.4 shows the estimated emissions. The VOC directive requires the installation of vapour recovery systems and limits the concentration of vapours in the recovery unit exhaust to less than 35 g/m³. Typical exhaust concentrations for recovery units are in the region of 1 g/m³. Therefore, the above estimate of vapour losses are considered to be conservative.

Road tanker loading losses of aviation fuels were estimated using the Emission Factors provided in AP-42(1), Chapter 5. Table 5.4 shows the estimated losses.
### Traffic Emissions

The calculation of emissions from traffic requires knowledge of traffic volumes, speeds and fleet mix, including data on the types and ages of vehicles. The Larnaka International Airport Development Project Environmental and Socio-Economic Impact Assessment Study has provided information on the volume of cars, light goods vehicles (LGV), heavy goods vehicles (HGV) and buses on a number of roads for 2005. However, information on vehicle speeds, fuel types and ages is, at present, unavailable, for either the present or future Cyprus fleets.

Therefore, as a first approximation, the assessment of the impact of traffic emissions has simply considered the potential changes in emissions that would result from the addition of HGVs, associated with the transport of products to the fuel farm, onto the existing traffic levels. Since the level of traffic on Cyprus’ roads is likely to increase in the future, this will provide an upper bound on the percentage change in emissions.

The assessment has considered the increase in traffic movements along the Larnaka-Limassol highway and the Larnaka-Airpoport connection road, as shown in Table 5.5. For the highway, traffic speeds of 70 kph were assumed, whilst for the old road, traffic speeds of 50 kph were assumed.

### Table 5.4: VOC Emissions From Mobile Container Loading (tonnes per year)

<table>
<thead>
<tr>
<th>Year</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Aviation Fuel</td>
</tr>
<tr>
<td>2006</td>
<td>0.52</td>
</tr>
<tr>
<td>2010</td>
<td>0.68</td>
</tr>
<tr>
<td>2015</td>
<td>0.78</td>
</tr>
<tr>
<td>2020</td>
<td>0.84</td>
</tr>
<tr>
<td>2025</td>
<td>1.0</td>
</tr>
<tr>
<td>2030</td>
<td>1.1</td>
</tr>
</tbody>
</table>

### Table 5.5: Traffic flows

<table>
<thead>
<tr>
<th>Traffic type</th>
<th>Limassol to Larnaka Highway (Annual Daily Average)</th>
<th>Larnaka to Airport (Annual Daily Average)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cars</td>
<td>19,324</td>
<td>19,324</td>
</tr>
<tr>
<td>LGV</td>
<td>833</td>
<td>833</td>
</tr>
<tr>
<td>HGV</td>
<td>543</td>
<td>543</td>
</tr>
<tr>
<td>Buses</td>
<td>262</td>
<td>262</td>
</tr>
</tbody>
</table>
Emergency generator

The power rating of the emergency generator is 0.8 MW. As it will be seen in Section 5.2.5 the impacts of the sequential testing is small or negligible, and, therefore testing of the single backup generator is considered to have a negligible impact.

5.2.4 Construction impacts, mitigation and residual impacts

Potential impacts

Dust is generally considered to refer to particulate matter in the size range 1 to 75 μm in diameter, and is produced through the action of abrasive forces on materials. Fine dust particles (PM$_{10}$) are defined as particles less than 10 μm in diameter, and are of the most concern regarding health effects. In general, the majority of construction dust is larger in diameter than 10 μm. Particles larger than 10 μm are not associated with adverse effects on human health but can cause nuisance to local residents and are potentially damaging to sensitive ecosystems.

Research has shown that whilst small particles (<10 μm) can travel distances in excess of 1 km, the majority of large dust particles (greater than 30 μm) are deposited within 100 m of sources; intermediate sized particles (10 to 30 μm) are likely to travel up to 200 to -500 m. Therefore, it is considered that the potential for dust to cause impacts is likely to be limited to around 100 m from construction works with dust generation potential.

The potential for the generation of dust, and its transport offsite, is greatest during dry, windy weather. Therefore, taking into consideration the climate of Cyprus, a conservative approach has been adopted in this study, and receptors for dust impacts are considered to be properties within 500 m of dust generating activities. Using this criterion, the residential properties which are adjacent to the fuel farm boundaries are potential receptors.

In general, construction activities associated with the greatest potential for dust generation are:

- Earthworks including excavation, handling on site and deposition;
- Handling and storage of materials (including loading and unloading);
- Haulage roads and unsealed site surfaces (including vehicles travelling along them);
- Wind blow across disturbed site surfaces and materials;
- Mechanical operations such as crushing, drilling, concrete mixing and cutting.
The potential for fugitive dust from the proposed construction works depends fundamentally on the effectiveness of control measures. It is considered that by applying appropriate control measures, combined with on-site management and monitoring of site operation activities, the potential for dust generation and therefore the potential for dust effects would be minimised.

**Mitigation Measures**

Good site management practices during the construction works will help to prevent the generation of airborne dust. It should be the responsibility of the nominated contractor to ensure that sufficient precautionary measures to limit dust generation are in fact taken.

To ensure that atmospheric dust, contaminants or dust deposits generated by the construction work do not exceed levels which could constitute a nuisance to local residents or damage to equipment, it is proposed that visual inspections of site boundary levels of dust (and odours) be undertaken. A trained and competent person should carry out monitoring on a weekly basis. However, if dry windy weather prevails then the rate of monitoring should be increased to daily initially, and 4 times per day if levels remain high.

The mitigation measures described below should be implemented as necessary. If, despite the implementation of best practicable means of dust/odour mitigation, levels of dust soiling remain unacceptable, the site manager should ensure the cessation of dust generating construction activities.

The prolonged storage of debris on site, in temporary stockpiles should be avoided. Vehicles removing demolition or site clearance materials must have their loads effectively sheeted on all sides. Crushing of material for reuse, transportation or disposal should be undertaken as far away as possible from sensitive receptors. Excavation faces, when not being worked, should be sheeted.

The number of handling operations should be minimised, ensuring that dusty material is not moved or handled unnecessarily. Fine material should be delivered to site in bags. Drop height must be kept to a minimum.

Stockpiles should be located away from potential receptors, with slopes at angles less than the natural angle of repose of the material. Stockpiles should be sheeted, contained within wind barriers or potentially damped down. However, since water is a relatively scarce resource on Cyprus, watering of dusty materials should only be used sparingly. If long term stockpiles are required, consideration should be given to the use of chemical bonding agents.
Hardstanding areas for vehicles entering, parking and leaving the site should be provided, with wheel washing facilities at access points. Site roads should be cleaned regularly, and damped down if necessary. Site vehicle movements should be kept to a minimum and, where possible, restricted to paved haulage routes. Vehicle speeds should be limited to 20 km/h or less on surfaced roads, and 10 km/h on unpaved surfaces.

If required, cleaning of public roads used for transport of materials should be undertaken.

Residual Impacts

With the implementation of appropriate dust mitigation measures, it is concluded that the potential for dust impacts is low.
5.2.5 Operational impacts, mitigation and residual impacts

*Petroleum Product Storage Tanks and Loading Operations*

Table 5.6 shows the model predicted maximum annual average concentrations of volatile organic compounds resulting from the operation of the petroleum product storage tanks at the fuel farm. All tank and loading operation emissions are included in the assessment. The data are presented as the maximum over all 10 years of meteorological data.

<table>
<thead>
<tr>
<th>Receptor/Source</th>
<th>2010 VOCs Concentrations (μg/m³)</th>
<th>2030 VOCs Concentrations (μg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>0.075</td>
<td>0.025</td>
</tr>
<tr>
<td>H2</td>
<td>0.075</td>
<td>0.025</td>
</tr>
<tr>
<td>H3</td>
<td>0.074</td>
<td>0.025</td>
</tr>
<tr>
<td>H4</td>
<td>0.065</td>
<td>0.018</td>
</tr>
<tr>
<td>M1</td>
<td>0.032</td>
<td>0.0094</td>
</tr>
<tr>
<td>C1</td>
<td>0.061</td>
<td>0.021</td>
</tr>
<tr>
<td>C2</td>
<td>0.041</td>
<td>0.013</td>
</tr>
<tr>
<td>C3</td>
<td>0.032</td>
<td>0.011</td>
</tr>
</tbody>
</table>

The vapour emission rates, and hence the ground level concentrations resulting from these emissions, are dominated by the releases of JET A-1 tanks, from loading operations. These are considered to be a potentially minor adverse impact to air quality.

*Benzene*

There are no EU Limit Values for total VOC concentrations in ambient air. Therefore, the concentrations of VOCs have been used to estimate the concentration of benzene in ambient air, for which the EU Limit Value is 5 μg/m³ to be achieved by 2010.

Benzene is present in small quantities in gasoline and jet fuel, but in negligible quantities in distillate fuel oils. The maximum quantity of benzene in petrol in Cyprus is 1 % v/v, in line with EU policy. This gives a benzene concentration of less than 1.5 % w/w in aviation fuels. It is, therefore, possible to estimate benzene...
concentrations in air by assuming that there is also 1.5 % w/w of benzene in the VOC vapour emissions from the fuel farm.

Assuming 1.5% of the vapours are benzene gives maximum concentrations of benzene at residential properties of 0.018 μg/m³, less than 0.4% of the EU Limit Value. In the presence of low background concentrations, this is considered to be a potentially minor adverse impact on air quality.

Given this minor impact, no mitigation measures are required for VOC emissions from storage and loading operations beyond those included in the preliminary design, most importantly the use of fixed roof tanks for aviation fuel storage and vapour recovery units for loading operations.

Fugitive emissions of vapours, e.g. from pipework and spillages on site, have not been quantified for this assessment. The site environment manager should have responsibility for ensuring that good working practices are enforced on site. Spillages should be minimised and recovered as soon as possible to prevent evaporative losses. Pipework and associated fittings, valves and flanges etc, should be inspected for leaks on a regular basis and maintained in good condition. Replacement of faulty fittings should be made promptly.

Traffic

Table 5.7 shows the percentage increase in emissions from traffic on roads in the vicinity of the fuel farm. The assessment was based on two scenario:

Scenario 1 : All site traffic travels from the Fuel Storage Area located at the old Larnaca Refinery at Larnaka, using initially the Paralimni - Larnaka Highway (up to the Risoelia junction) and the the Larnaka bypass road towards the Larnaka Airport, and

Scenario 2 : All site traffic travels from the Vassilikos Energy Center, using the Limassol highway. It also assumes zero growth for traffic in the Do Nothing option. This provides an upper bound on the percentage increase in emissions resulting from the fuel farm HGV traffic.

As noted above, information on the Cyprus fleet was available from the Department of Road Transport. The assessment looked at the percentage increase in emissions that would result from the traffic increases, predicted for 2010 and 2030 at fuel farm individually. The data presented provide the maximum increase in emissions over all fleet mixes.

On the main highway, traffic emissions of NOx and PM₁₀ are predicted to increase as a result of the increased levels of HGV traffic by less than 15% of the existing levels by
2030, assuming zero growth in baseline traffic. Percentage increases in emissions on the old road (towards Kiti) are greater due to the lower existing traffic emissions. However, in both cases, the increase in emissions equates to an increase in roadside NO₂ concentrations of less than 1 μg/m³ within 20 m of the centre of the road, and an increase of less than 0.2 μg/m³ at 50 m. These increases are considered to be of minor adverse significance.

The increase in emissions of CO and benzene are less than 1% of the baseline levels and are, therefore, considered to be of negligible impact.

**Table 5.7 Maximum Predicted Increase in Annual Average Emissions of NO₂, PM₁₀, CO and Benzene from Traffic due to the Operation of the fuel farm (%)**

<table>
<thead>
<tr>
<th>Road</th>
<th>Nitrogen Oxide</th>
<th>PM₁₀</th>
<th>CO</th>
<th>Benzene</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2010</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limassol to Larnaka Highway</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Larnaka to Airport</td>
<td>2.0</td>
<td>1.3</td>
<td>0.4</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>Old Kiti Road</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2030</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limassol to Larnaka Highway</td>
<td>2.5</td>
<td>1.5</td>
<td>0.5</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>Larnaka to Airport</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Given the low level of impact of traffic emissions, there are no mitigation measures required for their abatement. However, to reduce the potential impact on nearby properties, haulage routes should be planned to take the majority of traffic away from population centres.

**Regional Air Quality**

The Cyprus Emissions Inventory, supplied by the Ministry of Labour and Social Insurance of Cyprus, provides total emissions of certain pollutants for Cyprus.

Emissions of sulphur dioxide and VOCs currently exceed the emission ceilings. Road transport emissions dominate the VOC emissions total; electricity generation dominates the sulphur dioxide emissions. The storage and distribution of petroleum products account for less than 5% of the total VOC emissions.

The total emissions of organic compounds from the fuel farm are predicted to be less than 1% of the annual ceiling limit for VOCs in both 2010 and 2030 (**Table 5.8**). It is therefore concluded that the impact of the operation of the plant on VOC emissions, and hence its ozone generation potential, is negligible.
Table 5.8 Cyprus Annual Emissions

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Emission Ceiling kT/year</th>
<th>2010 kT/year</th>
<th>2010 % of Ceiling</th>
<th>2030 kT/year</th>
<th>2030 % of Ceiling</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOCs</td>
<td>14</td>
<td>0.003</td>
<td>0.02</td>
<td>0.004</td>
<td>0.029</td>
</tr>
</tbody>
</table>

5.2.6 De-commissioning impacts, mitigation and residual impacts

The impacts of the de-commissioning of the fuel farm on local air quality are anticipated to be low.

Potential dust impacts are predicted to be of the same level as the construction impacts and, therefore, with the application of best practicable means, are not anticipated to be of significance.

There is the potential for the release of VOCs during tank de-commissioning. However, any residual material in the tanks is likely to be of low volatility. Therefore, the impacts on local air quality are anticipated to be no greater than the operational impacts and are considered to be of negligible or minor significance.

5.2.7 Summary

Uncertainties

The assessment of the impacts of the fuel farm on local and regional air quality has been based, to a large degree, on assumptions regarding emission levels. However, for the majority of emissions, the predicted impact is sufficiently low to provide a level of confidence in the robustness of the conclusion i.e. where the impact is less than 1% of the standard, even a 100% uncertainty level in the emission estimate has no significant impact on the conclusion regarding its impact on receptors.

In addition to emission estimate uncertainties, there are uncertainties associated with the modelling of the dispersion of pollutants in regions of complex terrain and coastal meteorological effects.

However, wherever possible, the assessment has been based on conservative assumptions i.e. those considered most likely to overestimate air quality impacts. The overall conclusion of the air quality impact assessment is that, the land based operations of the Energy Centre are unlikely to impact on air quality at relevant receptor locations, but that shipping emissions require further assessment.
Construction

A qualitative dust impact assessment has identified potential dust generating activities during the fuel farm construction and potential receptors for offsite dust impacts.

Potential receptors for dust include residential properties in the vicinity of the fuel farm and the adjacent agricultural land. Background dust deposition levels are expected to be elevated due to the dry climate of Cyprus and, as a result, the sensitivity of human receptors to dust nuisance is predicted to be low.

The overall assessment conclusion is that, with the application of best practicable means, adverse impacts due to construction dust or nuisance effects are unlikely to occur.

Emissions from Storage and Loading Operations

A quantitative assessment of the impacts of VOC emissions from the storage and loading operations at the fuel farm has been undertaken. The assessment has considered the magnitude of potential losses from storage tanks through breathing losses, working losses and fittings losses, and also the losses expected from the transfer of products to mobile containers.

The assessment, based on conservative estimates of the impact of emissions from the site, has concluded that, as a worst case, the impact of the fuel farm on air quality is likely to be adverse but of minor significance.

Traffic

There are potential increases in emissions from traffic on local roads in the vicinity of the fuel farm, up to 2.5% on the main highway and up to 20% of the local roads, as a result of the road transport of petroleum products.

However, the impact of these increases on pollution concentrations at residential properties is likely to be minor in relation to the EU Limit Values. NO2 is the most significant pollutant, but at distances greater than 20 m from the centre of the road, the impact is predicted to be minor adverse i.e less than 1 μg/m³ as an annual mean.
5.3 Geology, soils, contaminated land and hydrology

5.3.1 Introduction

The section describes the potential impacts associated with the construction and operation of the proposed development to the existing geology, hydrogeology and soils in the project area.

5.3.2 Construction Impacts and Mitigation and Residual impacts

Even after delivery of a “clean site”, the proposed site preparation works will inevitably involve the importation of some aggregates, topsoil and subsoil. Although it is not yet possible to estimate the volume of soils and rock at the site that will need to be moved to produce the flat terraces required for the facility layout, it is intended that this will be reused on site to the greatest extent possible, either as fill or bund material or through its inclusion in landscaping when it is of an appropriate condition. A core objective of the project is to maximise the use of site-won soils and secondary aggregates, and to this effect, a neutral cut and fill mass balance is proposed.

A number of other generic activities that could potentially impact upon (or be impacted upon by) the geology and soils of the site will still arise, as outlined in Table 5.9.

Preparation of the site will require particularly large amounts of soil handling and possibly blasting to allow the final landform to be established.

Clean sand to be imported for foundations and the bund floor membrane beds will be obtained from an off site quarry.

No groundwater resources are proposed to be used during construction of the facility and issues related to water use are addressed in Section 6 Water Resources.

Overall, given that the site will be presented to the project as clean, none of the land affected by the project is protected or currently in production, a cut-fill mass balance will be implemented, and there are no sensitive groundwaters present, the overall impact of the construction works on the geology, soils and hydrogeology is expected to be of only minor adverse impact.
### Table 5.9: Summary of Potential Impacts and Mitigation

<table>
<thead>
<tr>
<th>Activity</th>
<th>Potential Impact</th>
<th>Proposed Mitigation</th>
<th>Residual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breaking out of foundations</td>
<td>Waste generation - loss of landfill void space</td>
<td>Use of concrete breakers allows reuse of material and avoids need to import additional aggregates</td>
<td>Neutral</td>
</tr>
<tr>
<td>Piling for tank foundations</td>
<td>May cause arisings of contamination</td>
<td>All pile arisings to be assessed for contaminants before decision made as to reuse or appropriate disposal</td>
<td>Minor adverse</td>
</tr>
<tr>
<td>Excavation of materials</td>
<td></td>
<td>Clean excavated materials to be reused on site, preserving valuable resources</td>
<td>Neutral</td>
</tr>
<tr>
<td>Re-grading of the cliff face and slope stability improvements</td>
<td>Stabilisation of unstable land</td>
<td>None</td>
<td>Minor beneficial</td>
</tr>
<tr>
<td></td>
<td>Production of additional waste materials</td>
<td>Reuse</td>
<td>Minor adverse</td>
</tr>
<tr>
<td>Importation of fill material, topsoil and subsoil</td>
<td>Loss of valuable aggregate and soil resources from elsewhere in the Authority Area</td>
<td>Reuse material from within the site as much as possible</td>
<td>Moderate adverse</td>
</tr>
<tr>
<td>Re-profiling of ground levels</td>
<td>Improvements to Landform</td>
<td>None</td>
<td>Neutral</td>
</tr>
<tr>
<td>Grading, compaction and concreting works</td>
<td>Destruction of remnant natural drainage profiles resulting</td>
<td>Good design of drainage channels will reduce the impact</td>
<td>Minor adverse</td>
</tr>
<tr>
<td></td>
<td>Decreased infiltration rates and increased storm water runoff</td>
<td></td>
<td>Minor adverse</td>
</tr>
<tr>
<td>Dewatering during construction of foundations</td>
<td>Potential impacts to the environment</td>
<td>Use of settlement ponds would allow sediment to drop out. Water could then be recycled as far as practicable or allowed to flow to lakes via silt fences and/or hay bale dykes and tested to ensure they meet minimum discharge standards</td>
<td>Minor adverse</td>
</tr>
<tr>
<td>Spills and accidental discharged</td>
<td>Potential impacts to groundwater and slight risk to sea water</td>
<td>All potentially hazardous materials will be managed in accordance with good construction practice, including the use of appropriate handling, storage and spill response</td>
<td>Minor</td>
</tr>
</tbody>
</table>
5.3.3 Operational Impacts and Mitigation and Residual Impacts

Operational impacts on geology, soils and groundwaters are likely to be restricted to risks of spills of stored materials leading to contamination of site soils and potentially perched groundwater. This risk will be minimised through the use of lined bunds, coalescence separator and other protection measures as discussed in Section 3 - Project description, as well as the implementation of formal spill response planning as outlined in Chapter 7. Given the implementation of such systems overall impacts are expected to be of only minor adverse significance.

No groundwater resources are proposed to be used during operation of the facility and issues related to water use are addressed in Section 5.4 - Water Resources. Issues related to waste management are addressed in Section 5.8 - Waste.

5.3.4 Non-normal operations

Seismic issues are addressed in detail in as a part of the engineering design of the facility. In the event of a serious earthquake or industrial accident, the loss of integrity of the fuel storage tanks would result in significant contamination issues and would be considered a significant adverse impact. Risks associated with such situations are addressed further in Chapter 6.

5.3.5 De-commissioning Impacts and Mitigation and Residual Impacts

On de-commissioning the site will be cleaned of all contaminants and returned as closely as possible to its original baseline condition, in accordance with applicable legislation in operation at the time. Impacts associated with decommissioning are considered to be moderate beneficial if such an approach is implemented.

5.3.6 Summary

Impacts of construction are considered to be of only minor adverse significance given the nature of the area and the local groundwater resources. Impacts during normal operation are also considered to be only of minor adverse significance, although impacts arising as a result of loss of integrity of the fuel tanks would be considered a major adverse impact.
5.4 Water Resources

5.4.1 Introduction

Containment and treatment of contaminated water and spills will be required to void significant adverse impact on water resources, including groundwater and the lakes area as well as health and safety hazards to site employees and other people in the affected zone.

Spill of material, spill management plans and hazard identification are addressed in Chapter 7, and will not be discussed further in this section.

This section covers current surface water resources, existing drainage infrastructure on site, impacts of site preparation and construction, site drainage, water demand requirements, sewerage and waste water generation during operation.

Water use on site will be limited to domestic use as no processing on the site will take place that will require the use of water.

5.4.2 Assessment Methodology

Baseline information and potential project-related impacts regarding surface water resources and drainage have been assessed and complied through a desk-based review of information currently available on the site and the design of the facility. This includes:

- Baseline Conditions for surface drainage and watercourses,
- Project impacts on any existing surface drainage features and watercourses,
- Potential impacts of operations on surface drainage

5.4.3 Construction Impacts, Mitigation and residual Impacts

Potential Impacts

During the construction programme, the primary potential source of contamination that could pollute surface water drainage is spills of oils, fuels and / or other hazardous chemicals. Such spills, if not properly contained and cleaned-up may also impact groundwater resources. During the construction programme, Bouygues will implement an Erosion and Sediment Control Plan that will reduce the potential for adverse impacts to water quality associated with mobilised sediments and wind blown dust.
A Fuels and Hazardous Materials Control Plan will be prepared and implemented which will include control measures to prevent the potential for an uncontrolled release of hydrocarbons or other hazardous chemicals into the environment. A Construction Emergency Response Plan will detail the responsible person for managing spill response and clean-up equipment. With these in place, residual impacts on surface and groundwater resources are expected to be low.

Once operational, the fuel farm will be equipped with a storm water system that will collect surface water run-off. Surface water runoff and stormwater will be subject to a high level of treatment (oil interceptors and retention pond) before being discharged to the Salt Lake system. Discharges from the fuel farm and from the car park will be regularly sampled and analysed for particulates, metals, hydrocarbons and potentially, salts and nutrients. With these control measures in place, residual impacts to surface water resulting from contamination of surface water run-off from the airport are considered to be low.

During fuel farm operations, groundwater resources are, as per the construction programme, at risk from contamination in the event of a spill or should existing contamination be mobilised as a result of future ground disturbance. These risks will be minimised through the development and implementation of airport operations Fuel and Hazardous Materials Management Plan, the Emergency Response Plan and the Contaminated Land Control Plan. With these control measures in place, residual impacts to groundwater resulting from contamination are considered to be low.

The discharge of any effluents during construction, including site drainage, will be the responsibility of the Contractor who should reach agreement with the relevant Ministry with regard to the detailed methods of disposal. Standard good working practices such as the mitigation measures discussed below should ensure that any impacts due to the water discharging from the site would be insignificant.

Construction activities may cause changes to surface water drainage due to the creation of soil piles. Any runoff may have a high suspended solids content and may require further treatment. The Contractor should be required to protect the lakes in the vicinity of the site from potential contamination during the construction phase.

**Mitigation**

Mitigation measures during construction may include, as appropriate:

- Oil storage tanks should be located on an impervious base provided with a dyke to give a containment capacity of at least 110 per cent of the tank volume. All valves and couplings to be located within the bunded area.
- Any surface water contaminated by hydrocarbons which are used during the construction phase should be passed through oil/grit interceptor(s) prior to discharge.

- Measures should be taken to ensure that no leachate or any surface water that has the potential to be contaminated, is allowed to enter directly or indirectly any water course, underground strata or adjoining land.

- Water inflows to excavated areas should be minimised by the use of lining materials, good housekeeping techniques and by the control of drainage and construction materials in order to prevent the contamination of ground water. Site personnel should be made aware of the potential impact on ground and surface water associated with certain aspects of the construction works to further reduce the incidence of accidental impacts.

- Refuelling of construction vehicles and equipment should be restricted to a designated area with properly designed fuel tanks and bunds and proper operating procedures.

- All channels permanent and temporary, and any temporary evaporation ponds utilised in site drainage should be maintained to prevent flooding and overflowing, and protected where necessary against erosion.

- All temporary hard/compacted areas and exposed surfaces or storage areas should be designed to discharge to evaporation ponds. They should not discharge to natural watercourses, or be allowed to flow off site in an uncontrolled manner.

**Chemical Contamination**

- Fuel/oil tanks and chemical storage tanks/areas on all lands utilised by the contractor should be provided with locks and be placed on compacted areas, within bunds that have a capacity equal to 110 percent of the storage capacity of the largest tank, to prevent spilled fuel oils from leaking off site.

- Oil interceptors should be provided in any drainage system downstream of possible oil/fuel pollution sources. The oil interceptors should be emptied and cleaned regularly to prevent the release of oils and grease into the stormwater drainage system. Waste materials should be taken to an approved disposal site.
Sewage

- Portable chemical toilets and sewage holding tanks should be placed on site to accommodate sewage generated by the construction workforce. A licensed contractor should provide appropriate and adequate portable toilets and should be responsible for appropriate disposal and maintenance.

Spills

- Ensure that handling and storage of any potentially contaminating material takes place only in designated areas designed to ensure that there can be no direct discharge to watercourses, the drainage system, or off the site.

- Ensure that no washdown areas are located adjacent to any watercourse, or open drain and ensure in so far as practicable, that washdown waters are collected and directed to an evaporation pond.

- Ensure that a spill management plan is in place at all sites.

5.4.4 Operational Impacts, Mitigation and residual Impacts

Water resource consumption on site will be made up of potable water supply, service water supply and provision of water for fire fighting.

Drainage of the site will entail sanitary sewers, clean water systems, oily water system, Jet A-1 spill collection, and laboratory chemical waste.

These are outlined below in further detail.

Potable Water

Water required for domestic use will be taken from the potable water supply to the site. Potable water will be sourced from the main public water supply via an existing line. The supply will be metered at this point. It is understood that the water requires no further chlorination or treatment.

Potable water will pass to a potable water tank, which will act as a buffer tank between the public supply and the terminal’s users. The tank will have a working storage capacity of 35 m³, equivalent to 1 day supply at anticipated consumption levels.

Potable water will be supplied to header tanks in various buildings within the terminal for the provision of drinking water and sanitary facilities. Potable water will also be supplied to safety showers and eyewash stations throughout the terminal. The system storage tank will be sized on the basis of 40 persons...
being engaged at the site, each with a usage allowance of 400 litres per person per day.

For the terminal the calculated daily potable water demand is 16 m$^3$/day, giving an average rate of 2 m$^3$/h. The expected peak demand is calculated as two thirds of the daily demand over a two hour period, plus a 20% margin. This gives a peak rate of 6 m$^3$/h (based upon expected distribution of personnel and usage of showers, toilets etc.). This allows for some topping up of header tanks coincident with the use of a Safety Shower. Potable water pumps will be provided to distribute potable water to the various users around the terminal. Consumption of potable water will be monitored by tank level measurement.

**Service Water**

The terminal service water will be sourced from the potable water supply. Service water will be supplied to Utility Stations throughout the terminal for washing and flushing during maintenance, as well as the fresh water supply for the Firewater hybrid system and as make-up water to vendor packages.

Service water will pass firstly to a service water tank. This tank will have a nominal capacity of 2,000 m$^3$, providing enough water to flush the firewater headers after testing of some of the large deluge system in the event of a fire.

Service water pumps are provided to distribute service water around the terminal.

**Fire Water System**

The fuel farm facilities will be provided with a hybrid firewater system, supplied with fresh water and fire retardant foam (Section 3.10).

**Sanitary Sewer**

Sanitary waste from buildings will be routed to the waste water network of the Larnaka International Airport. The network total capacity is based on 40 full time equivalent personnel being present at the terminal in any given day plus a 20% margin for personnel present at the terminal during situations such as maintenance shutdowns.

**Surface Drainage**

Two pipeline grids will be constructed under the ground of the fuel farm site that will collect and transfer the water streams that will be formed due to the rainwater flow and the aqueous mixtures that will emerge in cases of fluid substances spills. Details are given in Section 3.18.
The drainage pipeline grid will be installed along the internal road paths and it will lead the water quantities to a retention tank that will be constructed in the fuel farm site. The outlet of the retention tank ends up to the area adjacent to the fuel farm inside the Larnaka International Airport area.

The sewage pipeline has two branches that end up to a common pipe through which the sewage will be forwarded to the hydraulic network where all the sewage sources will be collected for further processing.

The clean water system will collect water that is known to be free of any contaminants such as grease, oil, petroleum products or chemicals. Such sources as:

- Surface water draining off uncontaminated hardstand areas, i.e. roads and buildings.
- Overflows from any of the water tanks.

Rain water will be routed to the drainage pond that will be also used as regulator of the water flow rate at the oil interceptors. Water from the common oil product storage area will be routed to the oil interceptors. Any oil contamination will be skimmed off and directed to the coalescence separator (Section 3.11).

**Oily Water System**

An oily wastewater drainage system will drain all areas where oil spillages could occur. The design will incorporate one oil interceptor and traps. This will discharge with the other surface water discharge to the storm water drains. The discharge from the oil interceptor will contain no visible oil or grease (i.e. less than 10 ppm, approx. 5 ppm).

Water that is, or can be, contaminated with oil will be kept separate from the clean water system. This water is collected from:

- Jet A-1 tanks retention area
- Offloading - loading installations
- Maintenance hangar
- Pump station
- Parking lots
- Road vehicles service station

Oily water will be collected in several local sumps and the contents will be sent to the coalescence separator. Once the oily product has been removed, the remaining
water will be sent to the LCA International Airport waste water network after quality checks have been carried out.

**Jet A-1 Product Spill Collection**

The oil product storage area is designed with bunded areas provided for all the tanks. Any spill will flow by gravity into spillage collection gulley to a sump and the bunds are sized to accommodate 110% of the largest tank (diesel tank).

Depending on the size of the spill and on potential contamination, the product will either be pumped back into the tank or sent to the coalescence separator. In case of a major spill oily water will be diverted to drainage pond.

**Laboratory Chemical Waste**

Laboratory chemicals and waste will be collected in a dedicated sump and periodically emptied in a vacuum truck. The anticipated sump capacity is nominally 2 m³.

**Mitigation**

It is not anticipated that the site will generate any continuous process wastewater. Principal wastewater discharges will be from drainage and surface water runoff. To reduce the possibility of contamination of surface waters and consequences, mitigation measures will be required.

The Environment Department of the Ministry of Agriculture, Natural Resources and the Environment will set limits on the quality of water that is discharged from the site under the permit issued in accordance with the IPPC Directive.

All aqueous process effluents will be discharged to sewer and will be in accordance with Environment Department limits.

The use of oil interceptors on all areas susceptible to oil spillage prevents the release of visible oil. The effluent from the oil interceptors will be monitored for oil in water content, which will be limited to below 10 ppm (approx. 5 ppm).

All oil and chemical storage tanks and areas where drums are stored will be surrounded by an impermeable bund. Single tanks will be within bunds sized to contain 110 per cent of capacity and multiple tanks or drums will be within bunds sized to contain 110 per cent of the capacity of the largest tank. Permanently fixed taps, filler pipes, pumping equipment, vents and sight glasses will also be located within the bunded area. Taps and valves will be designed to discharge downwards and will be shut and locked in that position.
The surface water drainage system will drain areas of the site unlikely to be contaminated with oil and discharge the water to the nearby storm water drain. The majority of the surface water drainage will be uncontaminated and typical of surface water run off from areas of paved road.

An oily wastewater drainage system will drain all areas where oil spillages could occur. The design will incorporate oil interceptors and traps. These will discharge with the other surface water discharge to the storm water drain. The discharge from each oil interceptor will contain no visible oil or grease (i.e. less than 10 ppm - approx. 5 ppm).

The areas liable to oil spillage are:

- the oil unloading and loading area;
- the bunded areas around the storage tanks, and
- the car parking areas.

Adequate facilities for the inspection and maintenance of oil interceptors will be provided and the interceptors will be regularly emptied and desludged to ensure efficient operation. The sludge will be disposed of off-site by a qualified contractor.

All elements of the treatment systems will be regularly monitored to ensure optimum performance and maintenance.

**Discharges**

Any potentially contaminated water streams should be segregated from non-contaminated water streams. The site should operate and maintain best possible housekeeping practices for the facilities. Spill prevention and control plans should be developed and maintained at all times.

**5.4.5 De-commissioning Impacts, Mitigation and residual Impacts**

De-commissioning of the fuel farm will have a minor impact on surface drainage, as there are no terrestrial drainage features to be affected.

Drainage for de-commissioning will need to be addressed with an approach similar to that of the construction management to ensure surface drainage does not discharge contaminants into the receiving environment.
Site clearance will have to be undertaken to ensure all liquid and hazardous waste are removed from the site. Any liquid or hazardous material or equipment will need to be covered to ensure they are not exposed to rainfall and cause sedimentation of the receiving environment.

Any stockpiles of soil, spoil or other loose material need to also be covered to ensure they are not exposed to rainfall.

The site, once cleared will need to be graded appropriately to allow the site to drain to the lakes. It is likely that surface water will need to be collected into a stabilised channel and discharge into a detention pond to allow any sediment to settle out before this water is discharged into the lake environment.

The retention settling pond and channel should be maintained to ensure that they continue to achieve their function.

5.4.6 Summary

There is little to no surface water features that will be lost or affected by this project, and as such, there is no significant aquatic ecology under threat. Previous construction and development of the Larnaka International Airport at and adjacent to the site have altered the existing drainage patterns.

Construction and development of the project will need to be subject to standard management practices to avoid and reduce any impacts of construction on the receiving environment.

Drainage of the operational site has been undertaken to ensure that ‘normal’ drainage and ‘non-normal’ drainage (i.e. spills, fire fighting waters) are collected and are subject to primary treatment prior to discharge to the receiving environment.

Water resource consumption, waste water effluent/ waste water generation will be limited on the site due to the small work force and the absence of water-utilising processes on the site and thus impacts should be minor.
5.5 Landscape and Visual

5.5.1 Introduction

This section assesses the existing landscape setting for the proposed fuel farm together with potential impacts to landscape form, character and visual amenity that may result from the proposed development.

5.5.2 Assessment Methodology

The assessment has been undertaken in consideration of the site’s sensitivity, the magnitude and significance to the proposed development in the light of landscape and visual effect over an immediate radius of 5 km. The criteria against which these individual components have been measured are set out in the relevant paragraphs.

It should, however, be borne in mind that any assessment of landscape and visual amenity can, by its very nature, only be subjective as it relies on an individual’s sensitivity and perception of the landscape together with their personal attitude towards change and the level of magnitude of that change.

The assessment covers the following conditions:

- Landscape character;
- Scenic attractiveness of the area;
- Concern levels which will outline the degree of public importance placed on the landscape as viewed from transit points and fixed view points;
- Landscape visibility; and
- Scenic quality.

As part of the constructional and operational phases, the cumulative effects of the works has been assessed in conjunction with other proposed projects in the area, such as the Larnaka International Airport facilities. Any impacts that are identified have been assessed for their significance and appropriate mitigation will be proposed.
5.5.3 Construction Impacts and Mitigation and Residual Impacts

Landscape Character

Whilst there will be some loss of greenfield land, much of the proposed facility will be constructed on land, which has already been cleared (the fuel farm will be constructed within the area of the existing Larnaka International Airport). Given the size of the land take and the value of the landscape, the impact on the landscape is considered low.

Visual Amenity

The proposed site will have the appearance of a typical construction site and therefore the following activities are anticipated to impact on local visual amenity:

- presence of exposed un-vegetated earthworks;
- use of construction plant, mobile cranes, site vehicles, other construction equipment and cleared/disused land;
- temporary road and path diversions and changes in traffic flows;
- on site lighting;
- marine impacts due to the physical presence of vessels required to install offshore facilities and pipelines.

Although this activity may be visible from outside the site, particularly in the immediate vicinity, the significance of any impacts will be reduced as the activities will be viewed against the backdrop of the existing structures on site (Larnaca Airport).

Mitigation measures to be adopted during construction to minimise impacts should include the following:

- works design to avoid unnecessary land take and earth removal;
- control of night time construction lighting;
- maintenance of tidy and contained site compounds; and
- spreading of topsoil, reseeding and planting as soon as possible after sections of work are complete.
On implementation of these mitigation measures, it is considered that the overall visual impact of the proposed construction works will be a moderate adverse impact.

5.5.4 Operational Impacts and Mitigation and Residual Impacts

Landscape Character

The new facility will operate within the existing complex of the Larnaka International Airport, and therefore the overall impacts of operation on landscape are considered to be low.

Visual Amenity

The proposed development will give rise to changes in the views of the site as a result of the introduction of new infrastructure, transport and people movements together with lighting, both onshore and offshore.

The proposed layout and dimensions of the fuel farm proposed facilities is discussed in Section 3 - Project Description. In particular, there are five elements of the proposed facility that could potentially have significant visual impacts, namely the storage tank(s), the pump stations, the unloading and loading areas, the buildings and the parking area.

For a major facility as is the case with the proposed fuel farm, with its paramount need for safety and security, there are few mitigation measures which should ameliorate visual impacts, which are considered to be moderate adverse.

A limited amount of landscaping should be undertaken which should partially filter views as trees grow and thus the visual impact would be most noticeable immediately after construction, before reseeding or replanting matures and takes effect (especially along the ground dyke).

The size of the Jet A1 fuel tanks imposes the need of constructing visual obstacles that will screen as much as possible the facilities. The existing tree lines and the 4 m. high ground dyke will screen a significant part of the facilities mainly from the side of them that will be visible by local residents and the visitors of the area. Similarly, the major infrastructure at the site, the tanks, are required to be painted white to minimise thermal input into the tanks causing air emissions.

Night time lighting of the plant will mean that there will also be an element of limited light pollution since the tree lines and the ground dyke will form an
adequate light obstacle toward the adjacent houses and the local road network. This is considered to be a (due mainly to the construction of the dyke) minor impact.

5.5.5 Decommissioning Impacts and Mitigation and Residual Impacts

It would be expected that at the end of the facility’s useful life it will be decommissioned and demolished with all site structures removed. However, after the completion of this process the landscape character will still be affected as the terraced and level site will not fit in with the rolling character of the natural landscape.

5.5.6 Summary

Overall the magnitude of the landscape character and visual amenity impacts are considered to be low at that whilst the landscape will be subject to moderate changes due to the presence and size of the facility, these impacts will be moderated as the landscape is already degraded by other existing industrial premises in the area and as the area is well screened by natural topography.
5.6 Noise and Vibration

5.6.1 Introduction

This section aims to identify and assess the impact of noise and vibration due to the construction and operation of the proposed fuel farm.

The assessment focuses on five Noise Sensitive Receptor locations, which are identified below. Existing baseline conditions at each location were determined as part of the original Environmental Statement for the Larnaka International Airport, which has been made available for reference in the preparation of this assessment.

A prediction of the impact during construction is undertaken following the methodology of BS 5228, and information regarding the noise output of specific items of plant contained therein. The noise and vibration impacts during operation are predicted using a computer noise model, using typical values for the proposed plant items, and considering directional and screening effects.

This section considers the cumulative impact of the proposed fuel farm, the existing Larnaka International Airport and the nearby developments, and recommends mitigation options to control construction and operational impacts.

5.6.2 Legislative Guidance

A review of available local legislation has taken place, and concludes that there is none available that could suitably be applied to assess the level and significance of the noise impact of the proposed scheme. Hence the following legislative guidance is adopted for use in this assessment:

- BS 4142:1997 ‘Method for rating industrial noise affecting mixed residential and industrial areas,’ BSI
- BS 7445: 1991 ‘Description and Measurement of Environmental Noise’ Parts 1 to 3, BSI
- BS 5228: 1997 ‘Noise and vibration control on construction and open sites’ Parts 1 to 4, BSI
BS 4142 'Method for rating industrial noise affecting mixed residential and industrial areas' offers guidance on the assessment of industrial and commercial noise affecting residential and industrial areas. It describes a method for assessing whether industrial noise is likely to result in complaints from nearby residents.

BS7445 'Description and Measurement of Environmental Noise' defines and prescribes best practice during recording and reporting of environmental noise. It is inherently applied in all instances when making environmental noise measurements.

BS 5228 'Noise and vibration control on construction and open sites' gives recommendations for basic methods of noise and vibration control relating to construction sites and other open sites where construction activities are carried out. It offers a methodology for predicting noise levels from construction sites.

5.6.3 Assessment Methodology

The following publications provide an indication as to acceptable environmental noise limits, and are summarised to give an indication of the criterion recommended by international bodies, which can be applied as appropriate significance criteria in this case.

In the ‘Pollution Prevention and Abatement Handbook’ issued by the World Bank Group in July 1998, noise limits for new installations financed by the World Bank are set out, which are summarised below. Additionally, it is stated in the handbook that an increase of up to 3 dB above the existing background levels outside the project property boundary is considered acceptable.

Table 5.10: World Bank Limits

<table>
<thead>
<tr>
<th>Receptor</th>
<th>Maximum $L_{Aeq}$, dB</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day time</td>
</tr>
<tr>
<td>Residential, Institutional, Educational</td>
<td>55</td>
</tr>
<tr>
<td>Industrial, Commercial</td>
<td>70</td>
</tr>
</tbody>
</table>
In the World Health Organisation document ‘Guidelines for Community Noise’, guideline limit values for community noise in various specific environments are provided. Noise levels below the limits are considered necessary to minimize any temporary or long-term deterioration in physical, psychological or social functioning associated with noise exposure. The values form the basis of many international environmental noise policy limits and are summarised below.

**Table 5.11: World Health Organisation Limits**

<table>
<thead>
<tr>
<th>Specific Environment</th>
<th>Critical Health Effects</th>
<th>Maximum $L_{Aeq}, dB$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outdoor living Area (daytime + evening)</td>
<td>Moderate Annoyance</td>
<td>60</td>
</tr>
<tr>
<td>Inside bedrooms</td>
<td>Sleep disturbance</td>
<td>30</td>
</tr>
<tr>
<td>Outside bedrooms, window open</td>
<td>Sleep disturbance</td>
<td>45</td>
</tr>
<tr>
<td>Industrial, commercial</td>
<td>Hearing impairment</td>
<td>70</td>
</tr>
</tbody>
</table>

The maximum external night time level of 45 dB(A) is considered when assessing the significance of the predicted operational noise below.

BS 4142 provides a methodology for the assessment of industrial noise in mixed residential and industrial areas. In this case, the standard suggests obtaining an assessment level by comparing the existing background noise levels with the 'rating level', which is the predicted noise output of the proposed industrial plant, corrected to account for any acoustic features such as tonal or impulsive noises. The semantics used for assessing the likelihood of complaints due to the introduction of a new industrial noise source are as follows:

- When subtracting the background level from the rating level, the greater the difference, the greater the likelihood of complaints.
- A difference of around +10 dB or more indicates that complaints are likely.
- A difference of around +5 dB is of marginal significance.
- If the rating level is more than 10 dB below the measured background noise level then this is a positive indication that complaints are unlikely.
With regard to the change in noise levels caused by increases in traffic flow, a change of 3 dB is the minimum perceptible change under normal conditions. This would arise from a doubling in traffic flow. It is generally accepted that such a change would not be perceptible, particularly if the change occurs over a long period of time. An increase in traffic flow of up to 25% will produce a 1 dB increase in noise levels, which is negligible and will produce no impact.

5.6.4 Construction Impacts, Mitigation and Residual Impacts

Construction Noise

Construction activity inevitably leads to temporary noise generation at locations in close proximity to the construction activities. However, due to the typical distances between the proposed site and the nearest receptors, and significant acoustic screening in all directions, the impact of construction activity on residents and tourists will be minimal.

Construction noise predictions can be made based on the methodology outlined in BS 5228: 1997 ‘Noise and vibration control on construction and open sites.

Construction noise levels are predicted as a ‘free field’ equivalent continuous noise level averaged over a one-hour period (LAeq,1h), and then subsequently averaged over a 12-hour working day to give the LAeq,12h.

The worst case that is taken into account is the contemporary operation of 9 construction vehicles during the civil construction works.

Table 5.12: Example Sound Pressure Levels Associated with the Fuel Farm Construction Activities

<table>
<thead>
<tr>
<th>Vehicle type</th>
<th>Number of vehicles</th>
<th>Noise level (dB)²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loader</td>
<td>1</td>
<td>85</td>
</tr>
<tr>
<td>Hydraulic excavator</td>
<td>1</td>
<td>87</td>
</tr>
<tr>
<td>Motor grader</td>
<td>1</td>
<td>82</td>
</tr>
<tr>
<td>Dump trucks</td>
<td>4</td>
<td>78</td>
</tr>
<tr>
<td>Road roller</td>
<td>1</td>
<td>80</td>
</tr>
</tbody>
</table>

² “Noise and vibration control on construction and open sites, Part 1 ”, British Standards 5228, 1997
The estimated sound pressure levels shown in Figure 5.1 are worst-case estimates based on propagation attenuation only. Noise levels at the boundary of the fuel farm development will not exceed 75 dB. Due to the screening offered by the topography of the intervening land, these levels would be up to 10 dB lower at the receptor locations, which are above the World Bank limits.

However, considering the temporary and changing nature of the proposed construction works, construction noise levels will not significantly impact upon pre-existing daytime ambient noise levels. Hence the impact of construction noise is predicted to be not significant.

Nonetheless, appropriate working practices would be adopted to minimise noise levels where practicable. Suggested mitigation measures for construction are given below.

**Construction Vibration**

Some construction activities can be a source of ground-borne vibration, which can be a cause for concern at the nearest receptors. Typical activities that would lead to vibration effects include compaction, breaking and piling. During piling activities, the maximum level of vibration expected at a distance of perhaps around 100 m from a drop hammer piling rig could be in the range of 2-3 m.

The impact at the nearest properties from any vibration activities is a function of the vibration source and the propagation path to the receptor; larger distances reduce the impact. Due to the large distances involved, construction vibration will not be discernible at the receptor locations. The impact of construction vibration will therefore be negligible.
Figure 5.1: Noise levels during the construction works
Mitigation Measures

In order to keep construction noise to a minimum, the appointed contractor would employ Best Practicable Means (BPM), examples of which are provided in BS 5228. Noise attenuation measures and hours of working should be agreed in advance with the Environmental Service (Ministry of Agriculture, Natural Resources and Environment).

The following mitigation measures may be employed to reduce construction noise:

• Clear lines of communication should be developed between the project team, contractors and any affected premises close to the site so that any complaints can be dealt with and warnings can be given of the likely occurrence and duration of particularly noisy events.

• In order to control the impact of construction noise to residential receptors, work should be carried out during the daytime only, where possible. If night working is required, the contractor should inform and agree the works in advance with the relevant local authority, and provide nearby residents with a point of contact during the night, for any queries or complaints.

• All vehicles and mechanical plant used for construction should be fitted with effective exhaust silencers, and regularly maintained.

• Inherently quiet plant should be used where appropriate. All major compressors should be sound-reduced models fitted with properly lined and sealed acoustic covers which should be kept closed whenever the machines are in use, and all ancillary pneumatic percussive tools should be fitted with mufflers or silencers of the type recommended by the manufacturers. This is particularly important for plant required to run 24 hours a day.

• All ancillary plant such as generators, compressors and pumps should be positioned so as to cause minimum noise disturbance. If necessary, temporary acoustic barriers or enclosures should be provided.
5.6.5 Operational Impacts, Mitigation and Residual Impacts

Day time

During the operation of the FF noise disturbance will be caused mainly due to the operation of hydraulic devices (various types of fuel pumps). The worst case that is taken into account is the contemporary operation of the listed devices during the typical operation of the FF installations. The pieces of equipment that were taken into account are the following:

<table>
<thead>
<tr>
<th>Type of equipment</th>
<th>Number</th>
<th>Power (kW)</th>
<th>Noise level (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrant pump</td>
<td>5</td>
<td>110</td>
<td>70</td>
</tr>
<tr>
<td>Diesel pump</td>
<td>1</td>
<td>1.5</td>
<td>72</td>
</tr>
<tr>
<td>Off-loading pump</td>
<td>3</td>
<td>30</td>
<td>80</td>
</tr>
<tr>
<td>CSS pump</td>
<td>3</td>
<td>1.5</td>
<td>72</td>
</tr>
<tr>
<td>Service pump</td>
<td>1</td>
<td>5</td>
<td>75</td>
</tr>
<tr>
<td>Motor operated valve</td>
<td>6</td>
<td>2</td>
<td>72</td>
</tr>
</tbody>
</table>

Apart of the devices listed above it was assumed also that three road tankers are present in the fuel farm in various positions (entrance - inside road - offloading installations). The noise level produced during the operation of the road tanker it was assumed to 80 dB.

Night time

The operation of the facilities during night time was also modeled taking into account that:

- the hydrant refueling system pumping devices will be under constant operation
- the refueling of the facilities through road tankers will be prohibited in order to decrease the produced noise levels.

The pieces of equipment that were taken into account during this modeling are the following:
Computer based prediction model

To predict the environmental noise contribution from the proposed fuel farm, a computer-based noise model has been created which incorporates the procedure set out in ISO 9613 Parts 1 & 2 ‘Acoustics - Attenuation of sound during propagation outdoors’, and can provide an accurate visual representation of calculated noise levels.

To ensure a ‘worst case’ prediction at the closest to the unit receptors location, the following assumptions have been made:

• ‘Down-wind’ conditions
• A temperature of 15°C and a relative humidity of 70%, resulting in low levels of atmospheric attenuation
• Hard reflective ground between the source and receiver
The software also accounts for the following effects:
• Distance propagation
• Directivity effects
• Screening effects due to existing buildings or plant, or other proposed on-site structures
• Ground effects

The model considers normal operational noise. As such, noise due to emergency facilities and other non-normal operation plant items have not been considered.

The estimated sound pressure levels shown in Figures 5.2 and 5.3 are worst-case estimates based on propagation attenuation only. Noise levels at the boundary of the fuel farm development will not exceed the highest acceptable levels during day and night time (55 & 45 dB respectively) along the borders of the neighbouring houses. It is apparent (taking into account the significant deformation of the noise level curves on Figures 5.2 & 5.3)
that the presence of the ground dyke represents a really effective noise obstacle that minimizes the probable noise disturbance.

**Additional tree line**

The option of shaping an additional tree line along the dyke in order to minimize more the probable noise disturbance was also modeled in order to examine the reduction of the noise disturbance due to the presence of this supplementary obstacle. It was noted that the relatively low density of the tree body caused relatively low noise disturbance reduction (contrary to the ground dyke) and therefore this option was not recommended (as a noise obstacle) to the project designer but rather than an effective visual obstacle.
Figure 5.2: Spatial distribution of produced noise (FF operation - day)
Figure 5.3: Spatial distribution of produced noise (FF operation - night)
Operational Vibration

Sources of vibration on site are minimal. Vibration may be transmitted to the floor from balanced rotating equipment such as pumps; however, the level of induced vibration will not be sufficient to propagate to the nearest sensitive receptors over the distances involved. Hence the impact of operational vibration will not be of significance.

Operational Traffic Noise

Details regarding the baseline and predicted traffic resulting from the operation of the fuel farm are available in Chapter 3, of this environmental statement. The worst case reported daily trips to/from the fuel farm is considered in the assessment of operational traffic noise. It is understood that the majority of site traffic will exit via the old road to Kiti, up to the junction to the new road to Dromolaxia and then to the Larnaka By-Pass. This road currently is not in operation except by the residents of the houses in that area. The predicted operational traffic will increase the traffic flow on this road and this will lead to an increase in road noise. Due to the fact that no data is available as far as the traffic volumes in the road, it is very difficult to make an estimation of the increase of the road noise. However, based on the expected number of trucks that will use the road (approx. 7 per hour), and their size, the impacts cannot be considered as insignificant.

Mitigation Measures

Whilst planning noise limits have been agreed with the relevant Local Authority at the planning consent stage, plant operators should aim to better these limits and reduce noise emissions as far as possible. The following measures should serve to continually monitor and minimise the impact of noise from the proposed power plant.

A programme of continual noise monitoring, including a noise survey shortly following the commissioning of the new plant, should be agreed if required by the Local Authority. The aim of these surveys should be to ensure that plant noise levels as measured at the agreed NSR locations do not exceed the planning noise limits agreed with the local authority. Noise monitoring should be undertaken in accordance with BS4142.
In the event of a complaint by a local resident relating to noise levels during the operation of the plant, an investigation should be carried out by the operator, or a representative thereof, to determine the likely cause of the complaint, and any available remedial measures. Where it is deemed necessary by the Local Authority, a written report detailing these measures and their effectiveness should be provided.

Inherently quiet plant items should be selected wherever practicable. High performance acoustic enclosures should be considered for all noisy plant items where practicable.

Although emergency generators and other ‘normally-off’ plant items have not been included in the modelling of normal plant operation, these should be afforded the same level of noise control as all other plant.

In the interest of maintaining neighbourly relations and residential amenity, the operator should give a reasonable period of notice to residents prior to any non-normal operations that would lead to an increase in noise levels. These should be carried out between 0900 and 1700 hours during the weekdays, wherever possible.

When non-normal and emergency operations lead to noise levels in excess of the agreed planning limits, the operator should inform the local authority and residents of the reasons for these operations, and the anticipated emergency period.

5.6.6 Summary

This section of the Environment Statement identifies and assesses the impact of noise and vibration due to the construction and operation of the proposed fuel farm at Larnaka International Airport. The assessment utilises the pre-existing baseline noise conditions as reported for the Environmental Statement for the New Larnaka International Airport, and uses a computer model to calculate the cumulative noise levels due to the fuel farm equipment and fuel truck movements.

The assessment of impact has been undertaken at nearby residential receptor locations. The significance of the impact is assessed in accordance with BS 4142, World Bank and World Health Organisation criteria.
Construction noise levels will vary as construction activity changes in nature and location, however the impact of construction noise is not predicted to be of significance, due to the large distances and topographical detail between the proposed site and receptors.

A worst-case assessment of the cumulative operational noise levels of all existing and proposed sources, against pre-existing background noise levels, indicates that there will be no significant noise impact due to the construction works at the proposed fuel farm.

Similarly, it is anticipated that the impacts during the operation of the fuel farm on the adjacent houses (within a distance of 750 m) during day and night time will be minor (according to fully objective criteria - max. acceptable noise levels at certain sensitive positions of the area) since the structural and technical design of the facilities (i.e. low noise level pumps, restrictions on vehicle movement pattern, ground dyke construction, etc.) is fully focused on mitigating this specific source of disturbance.

Finally, both constructional and operational vibration will be negligible.
5.7 Infrastructure

5.7.1 Introduction

The aim of this section is to assess the impacts associated with the construction and operational phases of the proposed fuel farm in relation to the existing infrastructure.

5.7.2 Assessment Methodology

This study assessed the impacts on the Larnaka Desalination Company pipeline that is installed underground and passes along a part of the site where the fuel farm will be constructed (Figure 5.5).

In order to undertake this assessment, data has been obtained from the Project's constructor (Bouygues Batiment International). With the data gathered from meetings and electronic data exchange, a desk study has been carried out and assessed using the potential impacts and corresponding significance criteria outlined below.

*Significance Criteria*

The level of significance for impacts on a public infrastructure technical element, critical as this pipeline, is dependent on the sensitivity of the receptor and the magnitude of potential impact.

5.7.3 Construction Impacts, Mitigation and Residual Impacts

The area where the fuel farm installations will be constructed hosts a small part of the pipeline through which desalinated water is pumped from the Larnaka's desalination plant toward the water supply pipeline grid of Larnaka. The indicating pillars of the pipeline and the concrete hull of the pipeline ventilation system stand on the surface of the cultivated field that consists one the main parts of the construction site (items P.I.9 → P.I.14 & A/V 6 on Figure 5.5).
The major potential impact concerning the specific infrastructure refers to the eventuality of pipeline damage during the excavation works that will take place during the construction stage of the project.

The potential impact of such an accident would be very important since the water supply of Larnaka area is fully dependent on the desalinated water flow. The critical importance of this infrastructure is imposed by the fact that any cause of damage would affect immediately Larnaka’s residents as the water demand that is satisfied by this water source is substantial and mainly continuous.

**Mitigation**

The measures that are proposed in order to avoid any damage to the pipeline are the following:

- Excavations in order to detect any deviation of the pipeline trajectory comparing to the available layouts
- Visible marking of pipeline route in order to be avoided by the operators of the construction vehicles
- Permanent marking after the completion of construction works for future maintenance works
- Extra precautions must be taken as for the ventilation hull that must remain over ground level and accessible by the operators of the pipeline.
- Modification of the fuel farm design in order to minimize the length of the pipeline that may be affected by the excavation works.
Figure 5.4: Desalination water pipeline route
5.8 Waste

5.8.1 Introduction

This section aims to identify and assess the impact of waste generated as a part of the construction operation and decommissioning of the fuel farm facilities.

5.8.2 Assessment Methodology

The significance criteria for the impacts arising from waste generation are largely based on compliance to Cypriot legislation, together with the waste type (hazardous or non-hazardous) and the adopted management method. In this context, the significance criteria for impacts from waste generation are summarised in Table 5.15.

Table 5.15 Significance Criteria for Impacts from Waste Generation

<table>
<thead>
<tr>
<th>Minor</th>
<th>Moderate</th>
<th>Major</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-hazardous wastes with disposal according to legislation</td>
<td>Hazardous wastes with likely exceedance of environmental quality standards inside exclusion zone</td>
<td>Hazardous and non-hazardous wastes, breaching legislation, with disposal causing an exceedance of environmental quality outside exclusion zone</td>
</tr>
</tbody>
</table>

5.8.3 Construction Impacts, Mitigation and residual Impacts

Table 5.16 below details the type of solid wastes anticipated to be generated by the construction activities. Wastes are characterised according to the list as defined by Cypriot legislation (Law 215(I)/2002). The list is based on the AEOLIKI’s previous experience in designing and developing facilities of this nature.
## Table 5.16 LCA International Airport Fuel Farm Construction Phase Waste Production

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20 01 21</td>
<td>Spent mercury light bulbs/tubes</td>
<td>Fluorescent tubes and mercury-containing waste</td>
</tr>
<tr>
<td>2</td>
<td>16 06 05</td>
<td>Spent dry-charged batteries</td>
<td>Other batteries and accumulators</td>
</tr>
<tr>
<td>3</td>
<td>16 06 06</td>
<td>Waste sulphuric acid (electrolyte)</td>
<td>Separately collected electrolyte from batteries and accumulators</td>
</tr>
<tr>
<td>4</td>
<td>18 01 08 - 18 01 09 18 02 07 - 18 02 08</td>
<td>Medical wastes</td>
<td>Medical wastes</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Waste chemicals</td>
<td>Waste chemicals general</td>
</tr>
<tr>
<td>6</td>
<td>13 02</td>
<td>Waste lubricating oil</td>
<td>Waste engine, gear and lubricating oils</td>
</tr>
<tr>
<td>7</td>
<td>13 08 99</td>
<td>Oiled rags</td>
<td>Wastes not otherwise specified</td>
</tr>
<tr>
<td>8</td>
<td>16 01 07</td>
<td>Waste oil and air filters</td>
<td>Oil filters</td>
</tr>
<tr>
<td>9</td>
<td>13 05 02</td>
<td>Oil sludge</td>
<td>Sludges from oil/water separators</td>
</tr>
<tr>
<td>10</td>
<td>19 13 01</td>
<td>Oil contaminated soil including absorbents</td>
<td>Solid wastes from soil remediation containing dangerous substances</td>
</tr>
<tr>
<td>11</td>
<td>16 06 01</td>
<td>Batteries - lead cell (without electrolyte)</td>
<td>Lead batteries</td>
</tr>
<tr>
<td>12</td>
<td>05 01 17 05 01 07 - 05 01 08</td>
<td>Bitumen, tar paper, ruberoids, insulation material</td>
<td>Bitumen Tars</td>
</tr>
<tr>
<td>13</td>
<td>20 01 28</td>
<td>Paints/wood dyes, adhesives</td>
<td>Paint, inks, adhesives and resins</td>
</tr>
<tr>
<td>14</td>
<td>17 01 03</td>
<td>Broken ceramic</td>
<td>Tiles and ceramics</td>
</tr>
<tr>
<td>15</td>
<td>16 01 07</td>
<td>Spent filter material not contaminated with harmful substances</td>
<td>Oil filters</td>
</tr>
<tr>
<td>16</td>
<td>19 08 05</td>
<td>Sludge from biological wastewater treatment facilities</td>
<td>Sludges from treatment of urban waste water</td>
</tr>
<tr>
<td>17</td>
<td>10 13 06</td>
<td>Waste cement</td>
<td>Cement dust</td>
</tr>
<tr>
<td>18</td>
<td>20 01 08</td>
<td>Food wastes</td>
<td>Biodegradable kitchen and canteen waste</td>
</tr>
<tr>
<td>19</td>
<td>17 04 05</td>
<td>Ferrous metal scrap</td>
<td>Iron and steel</td>
</tr>
<tr>
<td>20</td>
<td>17 04 01 - 17 04 06</td>
<td>Non-ferrous metal scrap</td>
<td>Non-ferrous metals</td>
</tr>
<tr>
<td>21</td>
<td>16 01 03</td>
<td>Tyres</td>
<td>End-of-life tyres</td>
</tr>
<tr>
<td>22</td>
<td>17 01 01</td>
<td>Waste concrete and reinforced concrete components</td>
<td>Concrete</td>
</tr>
<tr>
<td>23</td>
<td>20 01 38</td>
<td>Brush wood</td>
<td>Wood</td>
</tr>
<tr>
<td>24</td>
<td>17 02 01</td>
<td>Construction wood</td>
<td>Wood</td>
</tr>
<tr>
<td>25</td>
<td>20 01 01</td>
<td>Uncontaminated waste paper/cardboard; paper/cardboard manufacture</td>
<td>Paper</td>
</tr>
<tr>
<td>26</td>
<td>20 01 11</td>
<td>Waste textile clothes (working clothes)</td>
<td>Clothes</td>
</tr>
<tr>
<td>27</td>
<td>20 01 02</td>
<td>Uncontaminated glass / broken glass</td>
<td>Glass</td>
</tr>
<tr>
<td>28</td>
<td>20 03 01</td>
<td>Solid domestic wastes</td>
<td>Mixed municipal waste</td>
</tr>
</tbody>
</table>
Significant waste streams likely to be products as a part of the construction process are discussed below:

**Excavated Soil:** Earthworks will be required to make the site sufficiently level for the purposes of the fuel farm and to establish the level terraces required by the proposed site layout. The amount of earth material to be excavated is unknown at this stage. Where possible, excess cut material will be used as fill for foundations and inner-road formation.

**Excess Excavated Material:** Defined as inert material removed from the ground and sub-surface that will not be reused on site. The volume to be generated is unknown at this stage.

**General Construction Waste:** Comprises unwanted materials generated during construction, including rejected structures and materials, materials which have been over ordered or are surplus to requirements, and materials, which have been used and discarded. These wastes will be generated at all construction sites and will typically comprise wood waste from formwork and falsework, material and equipment packaging/wrapping, and surplus or rejected construction material. There is no firm basis for the estimation of the waste generated at any construction site, but it is expected contractors will typically incorporate waste rates of 0.03 percent to 0.05 percent for major construction items. Although the expected total volume of waste is quite limited, their storage, handling, transport and disposal has the potential to create visual, water, dust and associated traffic impacts.

**Chemical Waste.** Typically generated by the maintenance of equipment, scrap batteries or spent acid/alkali, used engine oils and hydraulic fluids, chemical/oil based emulsions, spent mineral oils and cleaning fluids, and spent solvents. Chemical waste may pose serious environmental, and health and safety hazards if not properly managed. These hazards may include:

- Toxic effects on workers.
- Fire hazards.
- Downstream effects on water quality from spills.
- Downstream effects on sewage treatment plants where disruption is possible if chemical wastes enter the sewerage system in large quantities.

Recyclable materials, such as iron, steel and non-ferrous scrap, welding waste, batteries and used oil will be collected and transported to recycling agencies for further processing. Wastes that cannot be utilised for reuse or recycling will be collected and transported to the Larnaka waste disposal site.
Waste materials generated during construction will include:

- Cut pipes, fixing materials;
- Oiled rags, covering/packing materials;
- Waste oil from engines and machinery;
- Polymeric wastes (including reusable containers, used pallets, etc.);
- Electric supply wastes;
- Welding slag, cinder, expanded welding electrodes;
- Pipe and other scrap metal;
- Waste timber;
- Waste paints and lacquers;
- Construction waste (cement, concrete);
- Surplus concrete, gravel;
- Abrasion sand;
- Process filters;
- Oil and air filters;
- Domestic wastes (waste food, garbage).

During the construction phase, waste materials will be separated at source where possible according to the waste classification outlined in Table 5.16. Waste management based on the following priority principles (each principle listed is less desirable than its predecessor) should be developed for each category of waste:

- Avoidance and minimisation of waste generation by good design.
- Good site management to minimise over-ordering and waste material generation, particularly for bulk materials.
- On-site reuse of materials thereby avoiding unnecessary transport and disposal requirements.
- Off-site recycling. Proper segregation of wastes on site will increase the feasibility of recycling elements of the waste stream by off site contractors.
• Treatment and disposal, which will need to be undertaken according to relevant regulations, guidelines and good practice.

Hazardous and non-hazardous construction wastes can, if not appropriately managed (handled, stored and disposed of), result in significant adverse environmental impacts.

**Recycling**

The Construction contractor should be required to develop and implement a Waste Management Plan for all construction activities. This should be based on the “3R” waste management philosophy i.e. “Reduce, Re-use, Recycle”. The Constructor must avoid waste generation in the first instance. Any waste subsequently generated should be assessed to see if it can be reused, and if not, recycled, then disposed either on site or off-site. The construction contractor should use locally available service providers to assist its recycling programme. A number of local recycling companies have the technology to appropriately recycle mixed waste paper and a number of other recyclable materials.

Where disposal is the only option for waste, it should be undertaken as described in the following sections.

**Non-Hazardous Solid Waste**

Non-hazardous waste will be disposed of at the Larnaka waste disposal site until the new landfill at Larnaka becomes operational.

Options for managing the disposal of the non-hazardous waste soils are still to be determined as the cut-and-fill ratio is still to be finalised and geotechnical investigations undertaken to determine whether excavated material is fill material, however every effort will be made to create a neutral cut and fill balance across the site. However, materials disposed off-site, must be done so in a manner consistent with the appropriate legislation. This will mean disposal at approved disposal sites or exported off Cyprus to an approved disposal facility in another country.

Mitigation options may include disposal in coordination with ongoing remediation works carried out at abandoned quarry sites within Cyprus. Potential disposal sites may include abandoned quarry sites in the broader area of Larnaka. These quarries were originally utilised for extraction gravels and sands. Use of these sites would be subject to approval of the District Officer and the Environment Service of the Ministry of Agriculture, Natural Resources and Environment.
**Hazardous Wastes**

Hazardous waste management should be undertaken in accordance with the law on Solid and Hazardous Waste Management 215(I)/2002 and regulations that exist on waste oils, batteries, PCB-PCT, packaging and packaging waste, animal by-products and landfills.

Cyprus presently does not have a hazardous waste disposal facility and is reliant on safe storage of hazardous waste or export and international disposal. The construction of a national hazardous waste incinerator (in order to comply with EU requirements) is currently the subject of enquiry but at the time of writing a suitable site for the facility had not been established.

The construction contractor should make arrangements for safe on-site storage of hazardous wastes. The wastes would then be transferred under a Chain of Custody control mechanism to a licensed hazardous waste disposal contractor for international disposal.

**Mitigation**

A Construction Waste Control and Disposal Plan should be developed by the construction contractor prior to the commencement of enabling works on site. A description of the alternatives for waste management is provided below. It is expected that one or a combination of these options would be used to appropriately manage construction wastes.

The Construction Waste Control and Disposal Plan should introduce a Reduce, Reuse, Recycle (3R) waste management philosophy. The Construction Waste Control Plan should include:

- A minimisation / collection / storage / treatment / re-use / disposal strategy for each waste stream in accordance with European and local requirements e.g. a strategy for returning packaging waste (containers, plastic wrapping, pallets etc. to their point of origin);

- Identify potential third party re-users; and duty-of-care requirements;

- Methods for properly management (e.g. training, storing, containerising, labelling, transporting and disposing) wastes; and

- A description of the transition of control from the construction contractors to the operator.
The Construction Waste Control Plan should identify contractors with the capacity to manage and dispose of recyclables in the vicinity of the fuel farm area. It is assumed that a number of local recycling companies have the ability to recycle mixed waste paper and a number of other recyclable materials.

In light of the above controls, residual impacts associated with the disposal of construction wastes (hazardous and non-hazardous) are considered to be minor.

5.8.4 Operational Impacts, Mitigation and residual Impacts

All wastes generated by the operation of the fuel farm facility will be temporarily stored prior to transportation off-site. The temporary waste storage facilities will be located in an area enabling access for waste transportation without impending operation. All wastes stored in this site will be packed in containers, and all loading and unloading operations will be conducted in this area.

As noted previously, the types of waste associated with the project will include:

- Non-hazardous combustible solid waste such as waste paper, wood and cardboard;
- Non-hazardous, non-combustible waste such as scrap metal;
- Hazardous solid waste such as paint cans and empty chemical containers; and
- Hazardous liquid waste such as liquid oily wastes.

Non-Hazardous Wastes

All non-hazardous wastes should be stored, collected and disposed of in accordance with the requirements of the Cypriot legislation. Specific guidelines that apply include:

- Storage area shall be readily accessible to collection vehicles.
- Storage areas shall be of adequate size and capacity to accommodate the required number of containers consistent with the waste generated routine and collection schedules.
- Containers shall be clearly labelled for their intended use and equipped with lids.
- Containers and waste storage areas shall be cleaned on a regular basis.
- Waste material shall be removed to the disposal site at the earliest opportunity and as the waste is generated.

Non-hazardous waste will be disposed of at the Larnaka waste disposal site until the new landfill at Larnaka becomes operational.
Table 5.17 LCA International Airport Fuel Farm Operational Waste Generation

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20 01 21</td>
<td>Spent mercury light bulbs/tubes</td>
<td>Fluorescent tubes and mercury-containing waste</td>
</tr>
<tr>
<td>2</td>
<td>19 01 10</td>
<td>Activated carbon</td>
<td>Spent activated carbon for the site Vapour Recovery Unit</td>
</tr>
<tr>
<td>3</td>
<td>16 06 05</td>
<td>Spent dry-charged batteries</td>
<td>Other batteries and accumulators</td>
</tr>
<tr>
<td>4</td>
<td>16 06 06</td>
<td>Waste sulphuric acid (electrolyte)</td>
<td>Separately collected electrolyte from batteries and accumulators</td>
</tr>
<tr>
<td>5</td>
<td>18 01 08 - 18 01 09 18 02 07 - 18 02 08</td>
<td>Medical wastes</td>
<td>Medical wastes</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Waste chemicals</td>
<td>Waste chemicals general</td>
</tr>
<tr>
<td>7</td>
<td>07 03 03 - 07 03 04</td>
<td>Waste organic solvents</td>
<td>Organic solvents</td>
</tr>
<tr>
<td>8</td>
<td>13 02</td>
<td>Waste lubricating oil</td>
<td>Waste engine, gear and lubricating oils</td>
</tr>
<tr>
<td>9</td>
<td>13 08 99</td>
<td>Oiled rags</td>
<td>Wastes not otherwise specified</td>
</tr>
<tr>
<td>10</td>
<td>16 01 07</td>
<td>Waste oil and air filters</td>
<td>Oil filters</td>
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<td>11</td>
<td>13 05 02</td>
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<td>Sludges from oil/water separators</td>
</tr>
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<td>Solid wastes from soil remediation containing dangerous substances</td>
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<td>Batteries - lead cell (without electrolyte)</td>
<td>Lead batteries</td>
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<td>14</td>
<td>05 01 17 05 01 07 - 05 01 08</td>
<td>Bitumen, tar paper, rubberoids, insulation material</td>
<td>Bitumen Tars</td>
</tr>
<tr>
<td>15</td>
<td>20 01 28</td>
<td>Paints/wood dyes, adhesives</td>
<td>Paint, inks, adhesives and resins</td>
</tr>
<tr>
<td>16</td>
<td>17 01 03</td>
<td>Broken ceramic</td>
<td>Tiles and ceramics</td>
</tr>
<tr>
<td>17</td>
<td>19 08 05</td>
<td>Sludge from biological wastewater treatment facilities</td>
<td>Sludges from treatment of urban waste water</td>
</tr>
<tr>
<td>18</td>
<td>19 08 01</td>
<td>Waste generated in the course of mechanical treatment of domestic waste water</td>
<td>Screenings</td>
</tr>
<tr>
<td>19</td>
<td>10 13 06</td>
<td>Waste cement</td>
<td>Cement dust</td>
</tr>
<tr>
<td>20</td>
<td>20 01 08</td>
<td>Food wastes</td>
<td>Biodegradable kitchen and canteen waste</td>
</tr>
<tr>
<td>21</td>
<td>17 04 05</td>
<td>Ferrous metal scrap</td>
<td>Iron and steel</td>
</tr>
<tr>
<td>22</td>
<td>17 04 01 - 17 04 06</td>
<td>Non-ferrous metal scrap</td>
<td>Non-ferrous metals</td>
</tr>
<tr>
<td>23</td>
<td>17 01 01</td>
<td>Waste concrete and reinforced concrete components</td>
<td>Concrete</td>
</tr>
<tr>
<td>24</td>
<td>17 02 01</td>
<td>Construction wood</td>
<td>Wood</td>
</tr>
<tr>
<td>25</td>
<td>20 01 001</td>
<td>Uncontaminated waste paper/cardboard; paper/cardboard manufacture</td>
<td>Paper</td>
</tr>
<tr>
<td>26</td>
<td>20 01 11</td>
<td>Waste textile clothes (working clothes)</td>
<td>Clothes</td>
</tr>
<tr>
<td>27</td>
<td>20 01 02</td>
<td>Uncontaminated glass / broken glass</td>
<td>Glass</td>
</tr>
<tr>
<td>28</td>
<td>20 03 01</td>
<td>Solid domestic wastes</td>
<td>Mixed municipal waste</td>
</tr>
</tbody>
</table>
Hazardous Wastes

Hazardous waste management will be undertaken in accordance with the law on Solid and Hazardous Waste Management 215(I)/2002 and Regulations on waste oils, batteries, PCB-PCT, packaging and packaging waste, animal by-products and landfills.

Management procedures for the handling, storage and disposal of hazardous wastes should include, but not necessarily be limited to, the following:

• Hazardous waste storage areas shall be designed to have spill containment systems.

• Hazardous waste storage areas shall be protected to avoid runoff to and from the storage area and have facilities to monitor and pre-treat any runoff.

• Containment curbs shall be maintained around the loading/unloading area.

• Containers and storage tanks shall be comprised of suitable material to permanently contain the hazardous waste and be clearly identifiable.

• Storage areas shall be inspected regularly for leakage.

• Incompatible materials shall not be stored in common containers.

• The surface impoundment area used to store hazardous wastes shall be adequately lined and monitoring and detection equipment installed to protect against potential leakages; and

• The storage areas shall be paved and appropriately lit with clear signage.

Options for disposal of hazardous waste include:

• Shipment and disposal offshore/internationally within a licensed facility.

• Storage in anticipation of the development and implementation of the Cyprus Central Hazardous Waste Facility.

• Where possible incineration within the adjacent cement plant kiln.
The operators of the Centre will need to determine which options are most applicable to the operation of the facility. It is likely that incineration of the hazardous waste within Cyprus is the most appropriate option for disposal of the waste. It is unknown at the moment whether the Cyprus Central Hazardous Waste Facility has the capacity for this. If not, the cement kiln plant should be considered. The fuel farm should ensure that emissions from such a facility meet international standards for emissions to air.

**Mitigation**

Mitigation measures include those measures adopted for the storage, treatment (i.e. reuse and recycling) and/or disposal of wastes, which will need to be developed into a Waste Management Plan for implementation throughout the lifecycle of the facility. It is important that this plan emphasise the avoidance of generating waste as the first step in waste management.

The environmental impacts of wastes, both hazardous and non-hazardous, generated during construction are considered to be minor, assuming that due duty of care is applied in relation to storage on site, during transportation and that appropriate disposal for the type of waste is applied. It will be important therefore to ensure that this duty of care is outlined and detailed within the contractors Waste Management Plan and that this plan is monitored to ensure these measures are maintained and enhanced where required.

### 5.8.5 Non-normal Operations and Mitigation

The terrestrial activities associated with the fuel farm facility have associated risks of accidents that can lead to spillages of oil, chemicals or other materials. The different phases of the project (e.g. construction, operations) and activities (e.g. vehicle movements, site levelling) have different risk profiles and have to be managed.

**Liquid Hydrocarbons**

Whilst spill risks at the site are discussed in Chapter 6 of this report it is relevant to note that the clean up of hydrocarbons after a spill can create
large amounts of contaminated waste in the terms of clean up material and oily sludge. The handling and disposal of this waste will need to be carefully considered. Depending on the volume of the waste, disposal via incineration would probably be the most appropriate option.

5.8.6 Decommissioning Impacts and Mitigation

It is anticipated that the majority of the project components will be in place for 25 years or more.

As a result of the lack of knowledge concerning future legislation and project developments, it is impossible to accurately predict impacts associated with decommissioning at this stage. It is known, however, that decommissioning will broadly comprise the following activities:

• Operating processes will systematically be shut down in a safe manner;

• Liquid and solid contents/wastes will be removed for treatment and disposal. For pipelines and tanks, this will entail flushing and cleaning to remove oils and gases; and

• The fate of the emptied and cleaned structures and equipment will then be decided by a feasibility study to determine the best environmental and economic solution consistent with international oil and gas industry practice.

It is anticipated, therefore, that all activities are manageable according to best practice at the time of decommissioning and as such, impacts are anticipated to be minor.

5.8.7 Summary

Based on the previous analysis, impacts from waste generated due to construction are considered to be low. However, impacts from waste due to operations are likely to be moderate. The impacts have a low risk of occurring, but if they do occur the impact could be significant.
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6 HSE RISK ASSESSMENT

6.1 Introduction

The new LIA Fuel Farm (FF) will have a number of health and safety hazards associated with its construction and operation phases. In this section an evaluation has been made of the potential key occupational health and safety hazards and proposed risk mitigation measures related to dangerous substances and other agents at the site, during the construction and operation phases of the FF.
6.2 **International Requirements, Principles and Guidelines in Project Financing**

This section identifies international requirements, principles and guidelines in relation to major project funding. Examples include the Equator Principles, World Bank guidelines and International Finance Corporation (IFC) guidelines.

6.2.1 **Equator Principles**

The Equator Principles require that the EIA has addressed several aspects including:

**Human Health Protection.**

- Use of Dangerous Substances;
- Occupational Health and Safety;
- Major Hazards;
- Fire Prevention and Life Safety; and
- Human Health Protection.

Each of these aspects is addressed below with reference to the FF site.

6.2.2 **World Bank guidelines**

The World Bank Group has issued a Pollution Prevention and Abatement Handbook, effective July 1998 which provides General Environmental Guidelines and specific guidelines for certain industry sectors.

6.2.3 **International Finance Corporation (IFC) guidelines**

The International Finance Corporation (IFC) has issued a series of Environmental, Health and Safety Guidelines, which provide general guidance on a range of environmental, health and safety aspects. These guidelines provide advice on best practice for consideration where national legislation may not exist or is not strong. The following IFC guidelines are of most relevance to the FF site:

- Environmental and Social Guidelines for Occupational Health and Safety, June 24, 2003
- Environmental, Health and Safety Guidelines - Oil and Gas Development (Offshore), December 22, 2000
- Environmental, Health and Safety Guidelines - Life and Fire Safety Guidelines, December 2002
These World Bank and IFC guidelines will need to be reviewed, together with the relevant Cypriot legislation and EU Directives, by those responsible for the construction and operation of the FF site.
6.3 Health & Safety Legislative Requirements

6.3.1 Health and Safety Legislation in Cyprus

The Government of Cyprus is currently in the process for the total adoption of EU Directives in Cyprus legal system. The most important requirements implemented into the law defined in EU directives concerning occupational safety and health are in the Framework Directive (89/391/EEC). More detailed provisions concerning particular aspects of occupational safety and health are laid down in the so-called “daughter” directives adopted within the meaning of Article 16 of the Framework Directive. They include the following Directives: 89/654 (workplaces), 89/655 as amended by 95/63 and 2001/45 (work equipment), 89/656 (personal protective equipment), 90/269 (manual handling of loads), 90/270 (display screen equipment), 90/394 (carcinogenic agents), 96/82/EC (control of major-accident hazards, Seveso II), 98/24 (chemical agents), 2000/54 (biological agents), 2003/10 (noise), 98/37 (machinery), 87/404 (simple pressure vessels), and 99/92 (explosive atmospheres).
6.4 Health and Safety Legislative Requirements Associated with the Construction and Operational Phases at the Site

6.4.1 Health and Safety Regulator in Cyprus

In Cyprus, the Department of Labour Inspection (part of the Ministry of Labour & Social Insurance) is the key regulator for Cypriot health and safety legislation. This department has the following responsibilities:

- Protection of the physical integrity, health and welfare of workers and the safeguarding of conditions and terms of work;
- Control of pollution of the environment from industrial wastes and emissions;
- Control of machinery;
- Protection from ionising radiation; and
- Control of dangerous substances.

Current Cypriot health and safety-related legislation can be downloaded (in Greek language) from the Department of Labour Inspection’s website, at the following address:


The legislation is grouped by the following categories (numbers of laws and regulations as of 20th January 2008 shown in brackets):

- Safety and Health at Work (71)
- Machinery (3)
- Equipment (25)
- Non Technical Labour Legislation (11)
- Major Accidents (4)
- Chemical Substances (14)
- Industrial Pollution Control (30)
- Air Quality (13)
- Radiation Protection (7)

A total of 22 EU safety directives have been mostly directly transcribed into Cyprus law, to supplement the pre-existing Cypriot health and safety laws and regulations. None of these regulations require a specific licence, however several have particular relevance to the construction and operation phases of the FF, the main topics of interest being:
• Seveso II
• CE Marking
• Work Site Licence
• Tender Documents and Dangerous Substances
• Fire Risk Assessment
• Health and Safety Plans and Health and Safety Management Systems
• Operational Requirements
• Risk Assessments

Each of these topics are discussed in more detail below.

6.4.1.1 Seveso II

On 9 December 1996, Council Directive 96/82/EC on the control of major-accident hazards - the so-called Seveso II Directive - was adopted. Member States had up to two years to bring into force the national laws, regulations and administrative provisions to comply with the Directive.

The aim of the Seveso II Directive is two-fold. Firstly, the Directive aims at the prevention of major-accident hazards involving dangerous substances. Secondly, as accidents do continue to occur, the Directive aims at the limitation of the consequences of such accidents not only for people (safety and health aspects) but also for the environment (environmental aspects).

The scope of the Seveso II Directive is solely focussed on the presence of dangerous substances in establishments. It covers both industrial “activities” as well as the storage of dangerous chemicals. The Directive can be viewed as inherently providing for three levels of proportionate controls in practice, where larger quantities mean more controls. A company who holds a quantity of dangerous substance less than the lower threshold levels given in the Directive is not covered by this legislation but will be proportionately controlled by general provisions on health, safety and the environment provided by other legislation which is not specific to major-accident hazards. Companies who hold a larger quantity of dangerous substance, above the lower threshold contained in the Directive, are covered by the lower tier requirements. Companies who hold even larger quantities of dangerous substance (upper tier establishments), above the upper threshold contained in the Directive, are covered by all the requirements contained within the Directive.
Due to the volume of storage of dangerous substances, the FF would be considered to be a lower tier\textsuperscript{1} establishment under the Seveso II Directive. Thus, prior to operation, has to proceed to the following actions according to the Articles 6 and 7 of the Directive.

**Article 6 (Notification)**

The operator has to send the competent authority a notification within the following time-limits:

- for new establishments, a reasonable period of time prior to the start of construction or operation,

The abovementioned notification shall contain the following details:

- the name or trade name of the operator and the full address of the establishment concerned;
- the registered place of business of the operator, with the full address;
- the name or position of the person in charge of the establishment;
- information sufficient to identify the dangerous substances or category of substances involved;
- the quantity and physical form of the dangerous substance or substances involved;
- the activity or proposed activity of the installation or storage facility,
- the immediate environment of the establishment (elements liable to cause a major accident or to aggravate the consequences thereof).

In the event of any significant increase in the quantity or significant change in the nature or physical form of the dangerous substance present or any change in the processes employing it, or permanent closure of the installation, the operator shall immediately inform the competent authority of the change in the situation.

**Article 7 (Major-accident prevention policy)**

The operator must draw up a document setting out his major-accident prevention policy and to ensure that it is properly implemented. The major-accident prevention policy established by the operator shall be designed to guarantee a high level of

\textsuperscript{1} Qualifying quantity (tonnes) for the application of Articles 6 and 7: Automotive petrol and other petroleum spirits $\geq 5000$ tn
protection for man and the environment by appropriate means, structures and management systems.

The document must take account of the principles contained in Annex III and be made available to the competent authorities for the purposes of, amongst other things, implementation of Articles 5 (2) and 18.

6.4.1.2 CE Marking

The owner of the project will have to contact the Department of Labour Inspection in order to confirm whether it will be necessary to obtain CE marking for all equipment at the FF. After installation, the whole system may be required to be CE marked and subject to periodic inspection. These various requirements will need to be included in the Invitation to Tender for the engineering procurement and construction (EPC) phase of the FF project.

6.4.1.3 Work Site Licence

The owner of the project will have to contact the Department of Labour Inspection in order to confirm whether it will be necessary to obtain a Work Site Licence as part of the mobile construction site safety directive. This will be required prior to construction work at the FF site and will need to be issued by the Department of Labour Inspection. In order to do this the department requires a minimum of 28 days pre-notification before work is commenced.

6.4.1.4 Tender Documents and Dangerous Substances

The owner of the project will have to contact the Department of Labour Inspection in order to confirm whether the tender documents sent to the contractors there should be the caveat stating ‘no dangerous materials shall be used e.g. asbestos’.

6.4.1.5 Fire Risk Assessment

The owner of the project will have to contact the Department of Labour Inspection in order to issue fire certificates and whether a fire risk assessment will be required to be carried out by the owner/operator.

6.4.1.6 Health and Safety Plans and Health and Safety Management Systems

The owner of the project will have to contact the Department of Labour Inspection in order to confirm whether health and safety plans and management systems for the construction phase will be required as per EU Directive 89/391 and that these must be in place so that if an inspector from the Department of Labour Inspection asks for them, they are made available.
6.4.1.7 Operational Requirements

The owner of the project will have to contact the Department of Labour Inspection in order to confirm whether there will be any health and safety-related or permitting requirements. Once the process is in operation, specific constraints can be specified.

Numbers of employees on the site during the construction phase, will have to be confirmed by the construction manager to the Department of Labour Inspection. In addition, a safety file is required on site which should be updated by the person in charge of it.

6.4.1.8 Risk Assessments

The owner of the project will have to contact the Department of Labour Inspection in order to confirm whether health monitoring will be required if indicated by specific risk assessments, but there is nothing specific in Cypriot regulations which requires health monitoring to be conducted, with the exception of some hazardous substances, such as asbestos and lead. As an example, risk assessments may require other activities, such as noise monitoring, work permits, etc. It may be also required that the relationships between operator - contractor - subcontractors are properly defined in an organisation chart, with clearly defined roles, responsibilities and authorities.
6.5 Health and Safety Aspects

In this section the health and safety aspects of the following are discussed:

- Health Hazards from Dangerous Substances
- Occupational Health and Safety Hazards
- Major Hazards
- Environmental Hazards
- Human Health Protection
- Other Aspects

6.5.1 Health Hazards from Dangerous Substances

In this section the key occupational health hazards to dangerous substances likely to be held at the FF during the construction and operational phases, are reviewed and any risk mitigation measures are noted.

6.5.1.1 Types of Dangerous Substances at the FF Site

During the Construction Phase of the FF development, the following range of petroleum products and other substances could be expected to be present at the site:

- Petroleum-based lubrication oils and greases
- Diesel fuel for vehicles and equipment
- Paints
- Solvents
- Acids
- Cleaning Products

Most of these materials would be expected to be present in small quantities, with only the diesel fuel likely to be present in larger quantities [e.g. 210 litre drums or mobile tanks up to about 5,000 litre capacity].

During the Operational Phase, the FF has been designed to receive, store and transport the following range of petroleum products and other substances:

- Kerosene - Jet A-1 Fuel
- Diesel - Low-Sulphur for automotive use
- Petroleum-based lubrication oils and greases
- Fire-fighting foam
• Cleaning Products
• Laboratory Chemicals

Of these materials, the main bulk storage of products on the FF site will be Jet A-1 Fuel and Diesel.

At the FF site, Jet A-1 will be stored within full containment tanks and Diesel in bullets.

6.5.1.2 Health Hazards Related to the Dangerous Substances at the FF

The main substances that will be stored at the FF site will be Jet A-1 Fuel and Diesel. A summary of the health hazards associated with these substances is provided in Table 6.1. The data in this table comes, with the exception of fuel oils data, directly from International Chemical Safety Cards, which are available from the National Institute for Occupational Safety and Health (NIOSH) at the following web address: http://www.cdc.gov/niosh/ipcsneng/neng0000.html. For fuel oils, health hazard data has been sourced from material safety data sheets from Amerada Hess Corporation [http://www.hess.com/ehs/msds.htm]. The health hazards of other substances stored at the site should be sourced from the specific material safety data sheets for each of these materials.
Table 6.1 Health hazards

<table>
<thead>
<tr>
<th>Material</th>
<th>Main Component</th>
<th>Hazardous Properties</th>
<th>Vapour/Gas Exposure Symptoms</th>
<th>Inhalation Risk</th>
<th>Effects of Short-Term Exposure</th>
<th>Effects of Long-Term Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-S Diesel</td>
<td>Diesel</td>
<td>Flammable or combustible depending on the grade, above 52°C explosive vapour/air mixtures may be formed.</td>
<td>Dizziness, headache, nausea</td>
<td>A harmful contamination of the air will not or will only very slowly be reached on evaporation of this substance at 20°C.</td>
<td>The substance is irritating to the eyes, the skin and the respiratory tract. The substance may cause effects on the central nervous system. If this liquid is swallowed, aspiration into the lungs may result in chemical pneumonitis.</td>
<td>The liquid defats the skin.</td>
</tr>
<tr>
<td>Aviation Fuel, Avgas, Jet Fuel</td>
<td>Kerosene</td>
<td>Flammable, above 37°C explosive vapour/air mixtures may be formed.</td>
<td>Confusion, cough, dizziness, headache, sore throat, unconsciousness.</td>
<td>No indication can be given about the rate in which a harmful concentration in the air is reached on evaporation of this substance at 20°C. or when heated.</td>
<td>The substance slightly irritates the skin and the respiratory tract. Swallowing the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis. The substance may cause effects on the nervous system.</td>
<td>The liquid defats the skin.</td>
</tr>
</tbody>
</table>
6.5.1.3 Risk Mitigation Measures for the Dangerous Substances at the FF

The main risk mitigation measures for dangerous substances at the FF will be associated with the good engineering design of the facility, with design criteria meeting international standards and codes. Good design, together with cognizance to the findings of the quantitative risk assessment, should insure that exposure to large quantities of dangerous substances are avoided.

For inadvertent exposures to dangerous substances, appropriate exposure control measures should be adopted using the hierarchy of controls, namely, elimination, substitution, engineering controls, administrative controls, and, in the last resort, personal protective equipment. Appropriate risk assessments should be conducted, procedures adopted and personnel training carried out, to ensure that all exposures to dangerous substances are minimised.

6.5.1.4 Occupational Health and Safety Hazards

In addition to the hazards of dangerous substances at the FF site, hazards to the occupational health and safety of site workers from other agents should also be considered. Such agents, which may be present during the construction and/or operational phases include dust, noise, vibration, electrical, ionising & non-ionising radiation, thermal stress, lifting equipment, pressurised equipment, slips, trips & falls, as well as general workplace conditions.

**Table 6.2** below provides examples of the hazards and potential effects of these agents and also provides examples of risk mitigation measures for each of these agents.
### Table 6.2 Examples of Hazard / Effects

<table>
<thead>
<tr>
<th>Agent</th>
<th>Examples of Hazard/Effect</th>
<th>Examples of Risk Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dust</td>
<td>Irritated airways Blocked nose and airways Lung damage or disease</td>
<td>Use of local exhaust ventilation Use of general ventilation Working upwind of dust source Wearing respiratory protection</td>
</tr>
<tr>
<td>Noise</td>
<td>Noise-induced hearing loss Restricted communications</td>
<td>Choosing quieter equipment Providing noise enclosure around noisy equipment Wearing hearing protection</td>
</tr>
<tr>
<td>Vibration</td>
<td>Hand-wrist ligament strain/damage Vibration white finger</td>
<td>Choosing equipment with low vibration characteristics Wearing hand protection</td>
</tr>
<tr>
<td>Electrical</td>
<td>Shock Electrocution Burns</td>
<td>Fixed wiring to electrical codes and standards Electrical work only conducted by fully qualified personnel Portable electrical equipment examined regularly Use of residual current devices, transformers, fuses and circuit breakers</td>
</tr>
<tr>
<td>Ionising Radiation</td>
<td>Exposure to radioactivity Cell damage Long-term health effects</td>
<td>Licensed radioactive sources used by approved and competent personnel only Standard operating procedures for the use, storage, transportation and disposal of all radioactive sources Provide signage Other personnel to be kept away from such operations</td>
</tr>
<tr>
<td>Non-Ionising Radiation</td>
<td>Exposure to microwaves, infrared, ultraviolet, electromagnetic and other non-ionising radiation sources Burns, cell damage, eye damage and/or associated health effects</td>
<td>Use equipment with sealed sources Provide signage Maintenance of equipment only by authorised and competent persons</td>
</tr>
<tr>
<td>Thermal Stress</td>
<td>Hot or cold stress Hypothermia Prickly heat Sunburn Heat stroke</td>
<td>Wearing appropriate clothing Provision of drinking water/ fluid replacement drinks Wearing sun cream Work/rest regimes Provision of shaded rest area appropriately heated or cooled</td>
</tr>
<tr>
<td>Lifting Equipment</td>
<td>Manual handling injuries Falls from height Crush injuries Traffic accidents</td>
<td>Regular inspection of equipment Use by competent and approved persons Use of signage, barriers and personal safety equipment Defined traffic routes on-site Defined pedestrian routes, well-separated from traffic routes</td>
</tr>
<tr>
<td>Pressurised Equipment</td>
<td>Impact from the blast of an explosion or release of compressed liquid or gas impact from parts of equipment that fail or any flying debris contact with the released liquid or gas, such as steam fire resulting from the escape of flammable liquids or gases</td>
<td>Safe and suitably designed equipment, which is regularly examined and certified Maintained by competent, properly trained and approved persons Provision of protective devices Provision of signage</td>
</tr>
<tr>
<td>Slips, Trips and Falls</td>
<td>Slips, trips and falls due to workplace conditions</td>
<td>Tidy and ordered workplace Clean up all spills Avoid trailing leads across traffic areas Signage Secure ladders Provide barriers Instruction in safe working practices</td>
</tr>
<tr>
<td>General Workplace Conditions</td>
<td>General injuries from poorly maintained workplace</td>
<td>Work permit systems Risk assessments</td>
</tr>
</tbody>
</table>
6.6  Major Hazards

There are a number of hazards that are present at the FF that potentially may result in injury to people or a fatality in more serious cases. Some hazards may even give rise to multiple fatalities. The Risk Assessment for the FF must include ‘major hazards’, as follows:

- hydrocarbon fires (jet fires, pool fires, fireballs, flash fires),
- tank fires and bund fires,
- others, including vapour cloud explosions, escalation events, and external events.

6.6.1 Mitigation Measures

The mitigation measures that are proposed are the following:

- Adoption of standard codes for the design and construction of the FF facility e.g.:
  - TRbF 20, 8.4.2.3, § 1
  - TRbF 20, 8.4.2.1, § 1-3-5-7
  - TRbF 20, 8.1.2 § 4-7
  - TRbF 20, 8.2.3, § 3
  - TRbF 30, 5.2.2, § 1-11
  - TRbF 30, 5.4.2, § 3-4
- Compliance of site layout with Cyprus law and international standards with regard to tank separation distances
- Provision of specific safety features e.g. full containment of the Jet A-1 tanks

6.6.2 Key Issues

The key issues that must be taken under consideration are the following:

- The offsite residential and recreational population must be generally well removed from the site and unloading facilities and in order to keep the offsite risk profile relatively low. It is necessary to obtain a buffer zone between the facilities and offsite population groups and this should be maintained in the future.
- The plant layout must provide good separation distance between the various hazards and personnel. There must be also less chance of escalation between the various hazardous areas, in particular between Jet A-1 facilities, due to the proposed layout.
- The office building, where most personnel will be housed, must be constructed at a suitable location.
The road tanker off-loading facilities should be located so that the tankers that come in the facilities from the local road network remain as far away from the office building as possible.

### 6.6.3 Fire Prevention and Life Safety

Fire prevention and life safety equipment and engineering systems must included in the basis of the design for the FF. These systems are already described in Chapter 3.
6.7 Other Aspects

6.7.1 General Public access

No access of general public will need to be specified and appropriate security measures taken.

6.7.2 Plane Strike

The site will have to be equipped with all the necessary pieces of equipment and systems in order to avoid plane strike.

6.7.3 On-site pipework protection

Any part of the total pipework system that will be constructed aboveground because of the needs to accommodate pipework contraction and visual inspections should be protected from vehicle impact using appropriate measures such as crash barriers, raised bollards, etc.
6.8 HSE Management Plans

HSE management plans will be required during both the construction and the operational phases of the FF. The following are examples of the elements that should comprise a HSE management plan, using the Construction Phase as an example.

A similar process should be applied, to develop and implement appropriate HSE management systems and procedures for the operational phase of the FF. For the operational phase of the FF, consideration should also be given to accreditation of such HSE management systems and procedures to appropriate international standards, such as ISO 18001 for health and safety management systems and ISO 14001 for environmental management systems.

6.8.1 Development H&S File - Construction Phase

A Safety and Health File should be developed in accordance with the requirements of Directive 92/57/EEC and the Cyprus 2002 Health and Safety Regulations (minimum safety and health requirements at temporary or mobile constructions sites).

Throughout the lifecycle of the project the contractor and employers are responsible for ensuring that all their relevant information for the Safety and Health File is prepared and handed over to the project supervisor for inclusion in the Safety and Health File.

Information contained in the file needs to include that which will assist persons carrying out construction work on the site at any time after completion of the current project and could include:

- Drawings, calculations and plans used and produced throughout the construction process;
- General details of the construction methods and materials used;
- Details of the location and nature of utilities/services and their maintenance/isolation, including emergency and fire-fighting systems, equipment, routes, procedures etc.

6.8.2 Significant Environmental Aspects Assessment - Construction Phase

The potential environmental aspects associated with the project should be assessed as part of the construction activities as outlined in Chapter 5.

6.8.3 Environmental Awareness Program Development - Construction Phase

An environmental awareness program should be developed at the FF to train appropriate site personnel to ensure that all environmental regulations and
requirements are followed during the construction and operation. All site personnel should be made aware of Corporate HSE policies and requirements during initial orientation. Subsequent awareness training should take place during daily tool box talks. The following topics should be included in orientation and briefing talks:

- Importance of environmental awareness
- Employee involvement
- Hazardous waste definition and disposal requirements
- Non-hazardous waste definition and disposal requirements
- Recyclable materials
- Spill prevention
- Spill control
- Dust control
- Odour control
- Noise control
- Traffic safety
- Non-compliance reporting

The main contractor and subcontractors should be required to work to a comprehensive Health, Safety and Environmental management system, which provides a series of control plans for emergency response, waste management, training, and HSE auditing throughout construction. An environmental hazard checklist should be developed and used for preventative management and monthly environmental reporting should be undertaken.

Regular environmental inspections should be conducted by both the Company and contractor, and a checklist should be used to record the findings of the joint inspection. An environmental action list should be maintained to track compliance issues and reporting aspects of the project and all non-compliance issues highlighted should be brought into compliance.

The FF site management should ensure that HSE management principles are upheld, including:

- The management team has a demonstrable, repeated and progressive commitment to HSE excellence.
- Set continually improving annual HSE goals and targets for the project and for managers/departments.
• Develop and implement an HSE plan which includes the rolling out of prioritised procedures which will eventually form a complete management system.

• Monitor performance of the management system against achievement of plans and goals and report periodically.

• Ensure that site management has the degree of HSE control it desires over all contractors and subcontractors through effective contract wording and management supervision and the pursuit of HSE excellence by all employees.

• Use the ALARP (as low as reasonably practicable) principle to test design and ensure tolerable (or less) risk in the operational facility.

• Use the BATNEEC (best available techniques not entailing excessive cost) principle to test design and ensure minimal environmental impacts compatible with efficient operations.
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7 ENVIRONMENTAL MANAGEMENT

7.1 Environmental Management Framework

This chapter of the Environmental Study is intended to provide an outline of the arrangements that will be put in place to ensure that the mitigation and other measurements to control or reduce predicted impacts are implemented and effective. These arrangements draw heavily on the environmental management system (EMS) which will have to be developed and implemented even at the construction / installation phase of the project.

The following sections describe the key elements of the EMS, indicating how they will be applied to the project. The EMS will allow the sponsors of the project to control environmental impacts and will provide assurance that the environmental management is effective, through:

- Identifying environmental hazards for project activities and reducing the risks arising from such hazards to levels that are low as reasonably practical;
- Meeting or exceeding all relevant regulatory and legislative requirements and applying responsible standards of its own where relevant laws and regulations do not exist;
- Setting objectives for continual improvement in environmental performance;
- Preventing pollution and minimizing waste and emissions from the FF operations;
- Requiring contractors to apply the same or equivalent standards;
- Maintaining effective contingency arrangements to deal with emergencies in co-operation with the authorities, emergency services and partners of the project;
- Carrying out regular audits and reviews of environmental management and performance.

The key elements of the EMS are:

- Management, leadership, commitment and accountability;
- Occupational health, safety and environmental policy and strategic objectives;
- Organizational and resources, third party services, information and documentation;
- Hazard identification and risk management;
- Planning and conduct of work;
- System implementation and monitoring, incident reporting and investigation;
- Audit and review.
7.2 Environmental Management Plans

7.2.1 Construction activities

An Environmental Management Plan (EMP) will be produced to manage all construction activities including laying of the pipelines.

The contents of the EMP will include a statement of the operator’s corporate environmental policy, a description of the activity and environment, an assessment of the potential environmental effects and risks and the environmental performance objectives, standards and measurement criteria. It will include also procedures for managing the following issues:

- Air quality;
- Culture and heritage;
- Fire;
- Noise;
- Water;
- Flora and fauna;
- Visual amenity;
- Waste

An Implementation Strategy (IS) for ensuring that the environmental performance objectives and standards are met will also be included in the EP.

The IS will include:

- Specific systems, practices and procedures for reducing environmental risk;
- A description of the roles and responsibilities of personnel;
- Provision for appropriate skills and training measures;
- Provision for the monitoring, audit and review of environmental performance and the IS;
- Provision for the maintenance of records of emissions and discharges;
- Provision for an emergency response manual and provision for consultation with the relevant authorities and interested groups of persons.

Management of the impacts associated with the project’s construction / installation phase places a considerable environmental responsibility on the contractors. These responsibilities will be incorporated into the contracts that will be issued for the works.
7.2.2 Operations

A single operations EMP will be produced to manage routine operations and emergency response procedures during the operational phase of the FF. The operations EP will include procedures for managing the following issues:

- Accidental discharges;
- Air quality;
- Fire;
- Noise;
- Rehabilitation;
- Socio-economic;
- Traffic;
- Visual amenity;
- Waste;
- Water

7.2.3 Decommissioning

An EMP will also be produced to manage the decommissioning phase of the project.

7.2.4 Commitments

The sponsor’s commitments arising from the EMP is presented in Table 7.1.
<table>
<thead>
<tr>
<th>No.</th>
<th>Topic</th>
<th>Objectives</th>
<th>Commitment</th>
<th>Timing</th>
<th>Measurement Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Environmental Management</td>
<td>Ensure appropriate procedures are place to manage environmental issues</td>
<td>EMP will be prepared for the installation/construction and operation phases of the development</td>
<td>Prior the commencement of the installation / construction</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Environmental Management</td>
<td>Ensure contractors are experienced in environmental management and suitable for the work</td>
<td>All primary contractors will undergo an operational audit or audit review which includes examination of environmental management procedures prior to appointment</td>
<td>Prior to appointment of contractors</td>
<td>Record of operational audit</td>
</tr>
<tr>
<td>3</td>
<td>Environmental Management</td>
<td>Ensure compliance with guidelines and commitments</td>
<td>Environmental audits will be undertaken during installation / construction and operations</td>
<td>One during installation / construction and at least two times per year during operations</td>
<td>Records of environmental audits</td>
</tr>
<tr>
<td>4</td>
<td>Environmental Management</td>
<td>Ensure personnel are familiar with the environmental management systems and environmental issues</td>
<td>All personnel going to site will undergo an environmental induction</td>
<td>At all times</td>
<td>Records of inductions and other environmental training kept.</td>
</tr>
</tbody>
</table>

### CONSTRUCTION ACTIVITIES

<table>
<thead>
<tr>
<th>No.</th>
<th>Topic</th>
<th>Objectives</th>
<th>Commitment</th>
<th>Timing</th>
<th>Measurement Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Accidental discharges</td>
<td>Ensure appropriate spill response procedures are in place</td>
<td>A hydrocarbon spill contingency plan (HSCP) will be prepared</td>
<td>Prior to commencement of construction activities</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Flora and fauna</td>
<td>Minimise impact to sensitive habitats</td>
<td>Procedures adopted to minimise damage</td>
<td>Prior to the commencement of construction activities</td>
<td>Audit or procedure implementation</td>
</tr>
<tr>
<td>7</td>
<td>Fire</td>
<td>Ensure that appropriate fire management procedures are in place</td>
<td>Develop a fire management plan as part of the Installation EMP</td>
<td>Prior the commencement of offshore activities</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Fire</td>
<td>Gain local knowledge and integrate plan with existing fire management procedures</td>
<td>Consult with local fire authorities during development of the fire management plan</td>
<td>During the development of the fire management plan</td>
<td>Records of consultation kept</td>
</tr>
<tr>
<td>9</td>
<td>Air quality</td>
<td>Reduce greenhouse gas emissions</td>
<td>Construction equipment and vehicles will be regularly serviced to ensure vehicles/engines run efficiently</td>
<td>During installation activities</td>
<td>Service records kept</td>
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<tr>
<td>11</td>
<td>Transport</td>
<td>Minimise potential for transport accidents</td>
<td>Procedures will be put in place to minimise the potential for transport accidents</td>
<td>At all times</td>
<td>Audit of procedure implementation</td>
</tr>
<tr>
<td>12</td>
<td>Vegetation, flora and fauna</td>
<td>Minimise impact to vegetation, flora and fauna</td>
<td>Minimise area of vegetation clearing during construction activities</td>
<td>During construction activities</td>
<td>Demobilisation report with photos showing extent of vegetation cleared</td>
</tr>
<tr>
<td>13</td>
<td>Hazardous waste</td>
<td>Minimise adverse impacts to public health from asbestos</td>
<td>Procedures will be put in place to minimise the potential for adverse health impacts from asbestos</td>
<td>During construction activities</td>
<td>Audit of procedure implementation</td>
</tr>
</tbody>
</table>

**OPERATIONS**

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<tbody>
<tr>
<td>14</td>
<td>Accidental releases</td>
<td>Ensure appropriate spill response procedures are in place</td>
<td>A hydrocarbon spill contingency plan (HSCP) will be prepared covering all activities during operations</td>
<td>Prior to commissioning</td>
</tr>
<tr>
<td>15</td>
<td>Air emissions</td>
<td>Reduce greenhouse gas emissions and minimise production of incomplete combustion products</td>
<td>Procedures will be put in place to minimise the impacts from air emissions during operation and distillate fuel oil transport and storage</td>
<td>At all times</td>
</tr>
<tr>
<td>16</td>
<td>Waste effluents</td>
<td>Reduce impacts from waste effluents</td>
<td>Procedures will be put in place to minimise the impacts from discharged waste effluents during operation and fuel oil transport and storage</td>
<td>At all times</td>
</tr>
<tr>
<td>17</td>
<td>Solid waste</td>
<td>Reduce impacts from solid waste production during operation activities</td>
<td>Procedures will be put in place to minimise the impacts from solid waste disposal during operation</td>
<td>At all times</td>
</tr>
<tr>
<td>18</td>
<td>Noise</td>
<td>Reduce noise annoyance and impacts from operation activities</td>
<td>Procedures will be put in place to minimise the impacts from noise during operation and distillate fuel oil transport and storage</td>
<td>At all times</td>
</tr>
<tr>
<td>19</td>
<td>Transport</td>
<td>Minimise potential for transport accidents</td>
<td>Procedures will be put in place to minimise the potential for transport accidents</td>
<td>At all times</td>
</tr>
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</table>
7.3 **Spill Contingency and Oil Spill Response**

In this part of the chapter the issue of managing oil spills is under consideration specially due to the operational characteristics of FF installations (storage of vast quantities of fuels, heavy oil fuels transfer traffic, etc.).

7.3.1 **Potential Spill Sources**

Small spills may occur by operational errors in off-loading procedures and damage to pipelines, whilst major accidents may occur due to storage tank major ruptures, fires, bund fires and running liquid fires from spillages at loading racks.

Potential causes of accidents are classified as follows:

- Operational failures, for example, loading/unloading operations and overfilling of tanks.
- Small releases that result in major cascade events.
- Third party incidents
- Generic causes that may occur at any installation, such as corrosion and seal failures
- Site wide events (e.g. earthquakes)

7.3.2 **Mitigation Measures**

A spill prevention, containment and countermeasure action plan will need to be developed for the Construction Phase and Operational Phase of the FF development. This will need to include a monitoring plan of containment areas, valves, tanks and pipelines for spills. If a spill occurs, immediate action will need to be taken. Any spills/leakage identified will need to be addressed immediately and their cause remedied.

The following protective structures and measures to prevent spills from reaching ground are recommended during the Construction Phase and Operational Phase of the FF development.

7.3.2.1 **Construction Phase**

- Secondary containment systems for petroleum products storage tanks, spill clean up absorbent material available, soil covers, concrete paving and bunding, drain covers, designated loading/unloading areas and drain plugs.
- Fences and gates surrounding containment areas.
- Pipelines should have isolation valves, overpressure protection devices, pipeline protective measures such as crash barriers and/or bollards.
• Pipelines corrosion protection measures:
• External corrosion can be prevented by using cathodic protection and coated pipelines which avoid direct contact soil-pipeline.
• The use of inhibitors and internal coatings could prevent internal corrosion.
• Ensure that equipment conforms to the appropriate technical specification of quality and control during construction.

7.3.2.2 Operational Phase

In addition to the provisions noted above for the Construction Phase, which should be also included in the Operational Phase, the FF basis of design includes the following spill prevention or containment design features:

• Paved and bunded areas for groups of storage tanks, sufficient to retain at least 110% by volume of the largest tank within the bunded area;
• Settling basin for the site surface water drainage system;
• Any automatic shutoff valve on discharge to bay and Full containment tanks for Jet A-1 storage.

In addition to these specific measures for the FF, CONCAWE has proposed more general measures for spill prevention and response during operational phases at petroleum products storage facilities, including the creation of a control room to manage surveillance systems, computers and monitors, pressure monitoring systems, and automatic alarms. The use of intelligent pigs is also proposed to detect leaks and metal loss due to corrosion. Patrols should be carried out to detect maintenance requirements, potential leaks and spillage.

Additional recommendations from CONCAWE include a description of safety devices and located to detect releases. This may include electronic spill detectors, visual supervision of activities (cameras), kerbs and bunds, fire water network, double equipment, instrument protection systems and emergency systems. Resources and equipment, communication and organisation procedures, testing of emergency plans and training of personnel should also be described. A monitoring plan would allow checking the state of installations and maintenance activities.

Emergency containment systems and fire fighting strategies should also be provided.