0 NON-TECHNICAL SUMMARY FOR THE EXPANSION OF THE LNG TERMINAL CRYOGENIC FACILITIES (2ND UPGRADING PROJECT) AT REVITHOUSSA ISLAND.

0.1 GENERAL

0.1.1 Introduction

The present document comprises the Environmental and Social Impact Assessment (ESIA) for the expansion of the LNG Terminal Cryogenic Facilities (2nd Upgrading Project) at Revithoussa Island. The expansion will result in increasing the regasification capacity of the LNG Terminal, raising the gas Sustained Maximum Send-out Rate (SMSR) from 1,000 m^3/h to 1,400 m^3/h at normal operation conditions and the peak send out rate up to 1,650 Nm^3/h.

ESIA study aims at assessing, evaluating and addressing the environmental and social impacts stemming from the installation and the operation of the new gasification system for increasing the send out rate within the framework of the 2nd Upgrading of the Revithoussa Island LNG Terminal Station, in combination with the 3rd Tank project which is currently in progress.

The present ESIA has been elaborated - in accordance with the European and National Environmental legislation and international best practice in ESIA implementation - in order to establish key issues for the Project and ensure that adverse impacts to the environment and the society are minimized or mitigated, while potential positive effects are optimized. The ESIA identifies and provides means to address and manage all social and environmental impacts, risks and opportunities associated with the construction and operation of the Project, in a systematic and comprehensive manner.

Both the Station's send-out capacity expansion and the Third Tank projects are developed within the framework of the 2nd Upgrading of Revithoussa LNG Terminal Station, a project enlisted within the planned Major Projects and the Priority Projects of the country's energy sector, contributing to the accession of Greece into the international natural gas transportation networks. The 2nd Upgrading project is considered of great significance for Greece as it will increase the available storage space at Revithoussa LNG Terminal; improve the country's level of security of supply; increase LNG market competition and lead to lower prices for natural gas consumers.

0.1.2 Project Owner

Owner of the examined project is the Hellenic Gas Transmission System Operator (DESFA) S.A., having its registered offices at 357-359 Mesogeion Avenue, Chalandri, P.C. 152 31, VAT 0998808114, Tax Office of Companies in AthensTel.: +30 210-6501200, +30 210-6501793, +30 210-6501399 and Fax: +30 210-6501320.

0.1.3 Study Team

The ESIA study for the particular installation has been assigned from DESFA to the joint venture "RINA SERVICES S.p.A. – D' APPOLONIA S.p.A. – EXERGIA S.A." as part of the project "Basic Engineering Design, Environmental and Social Impact Assessment, Safety and Other Studies for the expansion of Revithoussa LNG Terminal cryogenic facilities" and has been prepared by a joint EXERGIA - D'APPOLONIA team.

0.1.4 Geographic Location

Revithoussa is a small island located in Megara Gulf (part of Saronikos Gulf) with NW-SE direction, at the area of Pachi, at a distance of 45 km west of Athens. More specifically, it lies at a position with geographical coordinates 37 57', 8'' (latitude) and 23 24' (longitude).

The examined installations that included one (1) ORV (Open Rack Vaporizer) and the required auxiliary arrangements i.e. seawater, pumping and lines' system, will be developed within the designated Industrial area at the south part Revithoussa Island, among the current installations of the Terminal.

0.1.5 Aim of the Project

The further upgrade of the LNG gasification rate following the construction of the third tank within the framework of the 2nd upgrade of the Revithoussa LNG Terminal is among DESFA's key priorities regarding the strengthening of the National Natural Gas Transmission System (NNGTS), as this will increase the flexibility of the facility's operation. The regasification rate increase that will accompany the 3rd tank installation will also improve the level of security of supply in case of supply disruption at the northern entry points.

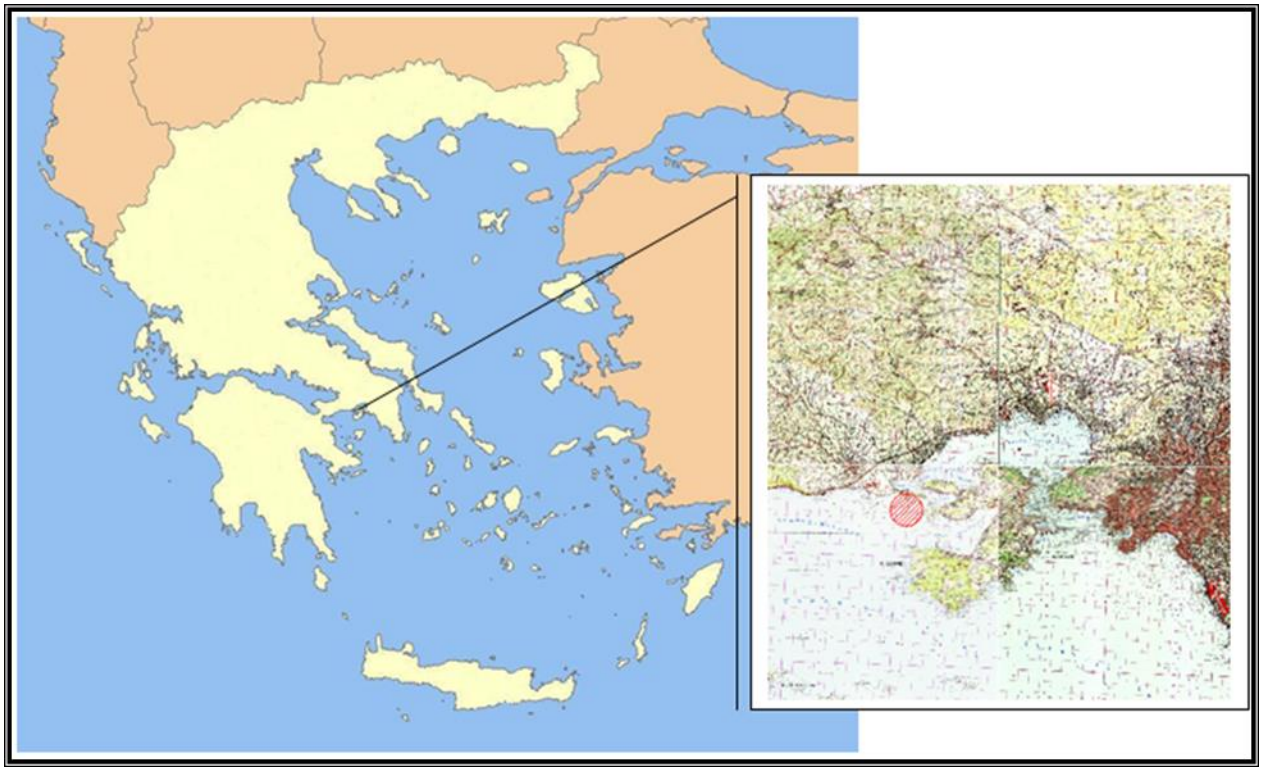

Figure Error! No text of specified style in document..**1: Project setting in Greece**

The importance of the expansion project is further exacerbated by considering that the forecasted gas consumption for 2015 is already 2.7 times more than that of 2010. The General Framework for Spatial Planning and Sustainable Development under Article 6, "Spatial structure of strategic infrastructure networks and transport services for energy and communications" highlights that the integration of energy infrastructure of strategic importance into national planning requires, among others, "**upgrading the LNG Terminal in Revithoussa**".

0.1.6 Study Structure

ESIA document is composed of the following main Sections and supporting Annexes:

- Section 0 Non-Technical Summary
- Section 1 Introduction
- Section 2 Legal and Permitting Review
- Section 3 Project Description
- Section 4 Assessment of Alternatives
- Section 5 Environmental and Social Baseline
- Section 6 Impacts Assessment and Mitigation Measures
- Section 7 Environmental Monitoring and Management Plan

- Section 8 Public Consultation and Stakeholder Engagement
- Section 9 Safety Issues
- Section 10 Conclusions
- Section 11 Annexes
  - Annex 1: Project Area Description Maps
  - Annex 2: Project Description Drawings
  - Annex 3: Photographic Documentation
  - Annex 4: Seawater Dispersion Model
  - Annex 5: Solid Waste Management Plan
  - Annex 6: Approvals and Documentation

0.2 THE PROJECT

0.2.1 Project Description

The Revithoussa LNG Terminal is used for the storage of the transported LNG and its subsequent gasification and send-out to network. The terminal is connected with the main Natural Gas Grid by means of 2 marine crossing pipelines, 24 inch each and 510 m and 620 m long respectively. Send-out to the grid is at 3°C minimum temperature and pressure, between 26 to 64 barg.

The terminal operates 24 hours a day, 365 days per year with the exception of planned shutdowns. The purpose of storage facility and LNG gasification is the satisfaction of the peak demands of consumption and the provision for an alternative source, supplying the Natural Gas Network in case of temporary interruption of the other traditional import lines.

The aim of the Project described and assessed in this ESIA is to increase the LNG vaporization Sustainable Maximum Sendout Rate up to 1,400 m^3/h.

The increased LNG regasification rate of 1,400 m^3/h is achieved by enhancing the vaporization system's capacity – that currently comprises three ORV (Open Rack Vaporizer) type vaporizers and four SCV (Submerged Combustion Vaporizer) type vaporizers – through the installation of one ORV and the required auxiliary arrangements i.e. seawater, pumping and lines' system.

All construction areas are located on the Revithoussa Island. Civil works and subsequent new equipment installation will be carried out in the southern part of the Island.

The activities to be carried out are the following:

- installation of the new ORV and the subsequent civil works in order to adapt the seawater discharge channel and pipe.
- replacement of HP Pump;
- replacement of Sea Water Pumps;
- installation of new Sea Water Strainers;
- sea Water Chlorination Package Upgrading;
- installation of a new gas sendout pipeline (24") in order to manage for the increased plant capacity (up to 1,400 m^3/h SMSR).

In detail the new ORV area has been identified few meters southward from existing ORVs and westward of the existing seawater discharge channel (see aerial view sketch in next Figure). Seawater pumps as well as HP Pump installation activities require dismantling of existing equipment and the subsequent installation of new ones in the same Terminal area.

The renewal of the sea water discharge system consists in civil works in order to adapt the existing system (10,000 m^3/h) to drain the increased future flow rate (15,000 m^3/h):

- deepening of the existing concrete pit;
- substitution of the drain pipe with a new submarine pipeline with an increased diameter (44'').

Figure Error! No text of specified style in document.**.2**: Aerial View Sketch of New Equipment Work Areas

0.2.2 Project Development Schedule

After the yard mobilization completion, about 6 months are expected for civil works realization. A total amount of 9 months is foreseen for the installation of new equipment. The estimated duration of the activities are reported in the table below:

Table Error! No text of specified style in document.**.1: Estimated Works Duration**

Activity	Duration of the activity (months)
Yard mobilization	1.5
ORV structures construction	2
ORV installation	2
SW-HP pumps installation and piping	5.5
Mechanical erection	7.5
Electrical connection	5
Equipment dismantling/removal	4
Send-out piping installation	2.5
Sea water discharge system civil works	3.5
Sea water Strainers foundations	0.75
Other activities on utilities	4

The overall duration of construction activities is estimated as 11 months.

An overall maximum number of personnel can be estimated of about 50 people.

0.2.3 Construction Philosophy

During Construction the following aspect shall be taken into account in order to guarantee the maximum level of HSE protection:

- emissions of pollutants to air due to the use of construction, installation/dismantling equipment, terrestrial and maritime dedicated traffic;
- particulate matter emission to air due to demolition/excavation activities;
- noise emissions due to the operation of construction, installation/dismantling of machinery/equipment;
- production of solid and liquid wastes;
- increase of the maritime and terrestrial traffic.

In the project development all the applicable measures to avoid or, at least when not available, to reduce the impacts originated by the above listed actions will be implemented. In particular:

- the schedule for the construction activities will be organized in such a way (whenever possible) to reduce the length of the potential critical activities and/or to concentrate them in periods of the year when the impact on the potentially affected compounds will be of minor entity;
- the equipment and machinery shall be duly certified according to national and international standards and subjected to periodical maintenance;
- all the equipment shall be kept off when not in use;
- in order to avoid the re-suspension and dispersion of particulate matter due to demolitions and/or excavations, the soil and the concrete structures (where applicable) should be kept wet. In any case, the excavation activities shall be minimized and carried out in suitable weather (mainly wind) conditions;
- duly attention will be paid to minimize the waste production; furthermore, solid wastes will be compacted and collected/managed separately according to regulation in order to optimize the waste recycling and/or reuse. Liquid wastes (and discharges) will be managed in order to avoid any direct discharge to soil and to the sea;
- emergency response measures will be identified and made available for the whole construction phase.

0.2.4 Environmental and Social Aspects

Interactions with social and environmental component both during construction and operational phases have been identified and described in the ESIA in order to gather the information to be used in the Impact Assessment and Mitigation Measure Section. The following aspects have been studied:

- <u>chemicals, raw materials and fuel use</u>:
  - construction phase: materials needed for the construction process include steel, wood, pipelines, water, sand gravel and cement. The required supplies will be transported to site by truck and then by supply vessel,
  - operational phase: the LNG Terminal uses the following chemical/materials:
    - nitrogen (supplied in liquid status by truck): no continuous consumption is requested by the 2nd expansion project,
    - sodium hypochlorite: is produced on the island by means of the existing chlorination package which will be upgraded in order to increase the design capacity from 35 kg/h equivalent Chloride to 50

kg/h. Two electrolytic cells identical to the four existing ones will be added,

- sodium sulphite: an increase of sodium sulphite requirement is expected (about 25.9 kg/h). Sodium sulphite is transported to the island in drums,
- other chemicals: corrosion inhibitor and caustic soda. No changes are expected in relation of the 2nd Expansion Project development,
- Diesel Oil: no additional consumption of Diesel Oil is necessary for the 2nd expansion project.
- Fuel Gas: no increase in Fuel Gas consumption will occur with the 2nd expansion of the Terminal (the SCV vaporization capacity will not be changed and the maximum fuel requirements, at Peak Sendout conditions, will be the same as current maximum);

- water use:
  - during construction, water use is essentially related to construction needs (concrete mixing and use of water for dust abatement) and civil use (construction personnel).
  - during the operational phase the following water uses are foreseen:
  - potable water (supplied via pipeline from mainland): no additional consumption is foreseen,
  - fresh water (sourced directly from the Potable Water supply network): a total increase of about 0.3 m^3/h is foreseen,
  - sea water (supplied by means of seawater pumps and used for ORVs and electro chlorination package): an increase of about 5,800 m^3/h of seawater withdrawal is foreseen in order to increase the regasification rate; no additional water withdrawal area foreseen for the operation on the revamped chlorination package;

- water discharge:
  - during construction storm water will be controlled to minimize the risk of erosion and sedimentation and prevent water contamination. Regarding civil water discharge an increment is expected considering the increased presence of construction staff.
  - during the operation phase water discharges are related to the use of seawater water for the vaporization process (ORVs) in which chlorination (sea water) and

subsequent sodium-sulphite addition is required (fresh water). Due to the installation of a new ORV and the related upgrading of the electro-chlorination package the increasing of flow rate will be of 5,000 m^3/h giving a total amount of about 15,000 m^3/h. No additional discharge is envisaged for the 2nd expansion project regarding to sewage due to personnel presence (collected in a biological wastewater treatment system), cooling water (there will be no additional cooling water demand), storm water;

- waste production:
  - waste production is expected during civil works and demolition/dismantling of existing structure or equipment. All waste will be managed according to local regulation requirements and reuse or recycling will be adopted where possible,
  - during operational phase due to the theoretical increase in sodium sulphite demand for future operation, an increase in waste production can be foreseen regarding the sodium sulphite container which is provided to the Terminal in powder transported in drums. No other relevant differences regarding to waste production and management are envisaged for the 2nd expansion Project (SCV water, other chemicals, oily water); It is noted that the sodium sulphite unit has never been used up today.

- air pollutants emissions:
  - during the construction atmosphere pollutants emissions are related with the functioning of construction equipment and machinery,
  - during normal operation of the LNG Terminal, temporary gas emissions are generated from the flare system, the SCV vaporizers and the unit generator of the CHP plant. There are also some transient, fugitive hydrocarbon emissions. In peak operation SCVs are used, resulting in exhaust gas emissions (natural gas combustion). Considering that no additional fuel consumption is expected for the 2nd Expansion Project no air pollutants emission changes are envisaged due to the regasification;

- noise emissions:
  - during the construction stage noise emissions are related with the functioning of construction equipment and machinery,
  - the 2nd expansion Project involves the installation of a new additional ORV and the replacement of HP Pumps and Sea Water Pumps. An upgrading of sea

water chlorination package is also required. No relevant change in noise emission is envisaged;

- maritime and road traffic:
  - during construction: raw materials, new equipment, construction machinery, workforce transfers as well as waste disposal will be carried out by means of one supply vessel which will connect the Revithoussa Island with the mainland. The use of one barge is necessary in order to substitute the seawater discharge pipeline. On shore traffic will be essentially related with raw material supply and waste disposal. Regarding the latter a preliminary estimation of traffic (considering the use of 20 m^3 capacity trucks- 2 charge/ discharge operation and 3 trucks per day) for the disposal of the total amount of moved soils and dismantled concrete (1,380 m^3) is about 12 days,
  - during operational phase: no relevant differences regarding to induced on shore traffic during operational phase are envisaged for the 2nd expansion Project. The 2nd expansion Project accompanied by the 3rd tank installation will imply the increase of storage capacity and regasification rate.
- landscape:
  - no relevant differences regarding to visual perception during construction phase are envisaged for the 2nd expansion Project. Works will be carried out with typical construction machinery,
  - no relevant differences regarding to visual perception during operational phase are envisaged for the 2nd expansion Project. All the new equipment will be installed in the southern part of the Island. The New ORV will be installed near the existing ones. New pumps will substitute the existing ones;

- manpower needs (during construction): during the different steps of construction phase, 2 to 6 workers are necessary in order to develop each activity. The estimated maximum daily number of workers on site is 50. An average of 25 workers can be expected daily on site. Whenever possible local or regional manpower will be involved.

0.3 THE ALTERNATIVE ASSESSMENT

The assessment of alternatives has been described in terms of:

- no development option description;
- alternative location analysis;
- alternative technologies evaluation.

In the particular case of the project under review, the zero option is the one that would leave unchanged the conditions of the area maintaining the current operational configuration of the Revithoussa LNG Terminal. Considering that Greece needs for an increase and optimization of the Natural Gas import system, mainly by means of LNG Terminals, the zero option will then reasonably imply the need for the construction of an LNG Terminal in another area, probably by developing a "green-field" project or in any case a fully new Plant. The development of the increase of regasification capacity of Revithoussa Terminal instead is to be seen as an optimization of the existing Plant rising significantly minor impacts if compared with the construction of a new LNG Terminal.

Regarding to alternative location considering that the Project area is located inside the existing Revithoussa LNG Terminal any alternative location solution would be detrimental in terms of techno-economic and environmental impacts. The analysis have been also carried out in term of "micro-alternative": the chosen location near/inside the existing facilities implies the saving of unused areas and location in the south-side part of the Island will keep them in a far and hided position from potential receptors.

Finally, regarding the alternative technologies, in order to expand the current vaporizing capacity during the earlier phase of the Project design development two different LNG vaporization options have been evaluated:

- new Open Rack Vaporizer (ORV);
- new Submerged Combustion Vaporizer (SCV) type.

The options have been verified both under a technical-economical and an environmental and safety point of view: the Open Rack Vaporizer (ORV) technology has been confirmed as preferable solution considering the following reasons:

- technical:
  - vaporizer is operated continuously for base-load operation, therefore ORV is the most favorable solution,
  - sea water available has temperature and composition suitable for ORV,
  - no direct gas consumption, gas consumption for sea water pumps additional electrical load on gas engine generators is less than 1/10 compared to SCV fuel gas request,

  - extremely lower operating costs,
  - smaller foundation,
  - static equipment, involving Higher availability and reliability,
  - spare parts requirement negligible;
- environmental and safety:
  - extremely lower pollutants emissions,
  - significantly smaller footprint,
  - no chemical consumption other than hypochlorite originated on the Island by means of Electro-Chlorination Package and sodium sulphite dosage,
  - no ignition source,
  - no electrical equipment in hazardous area.

0.4 ENVIRONMENTAL AND SOCIAL BASELINE

This section covers the project's baseline description in terms of Physical Environment, including biotic and abiotic, as well as marine environment parameters, Socioeconomic Environment, Cultural Environment and Existing Pollution Status, with focus on current marine pollution issues.

0.4.1 Physical Environment

0.4.1.1 Abiotic Factors

Morphology, Topography and Landscape

Revithoussa Island has a mild relief with average gradient of 35%, with two hills of a maximum elevation of +50.00 m in its centre. Due to the terrain, between the island and the opposite peninsula of "Agia Triada", a natural canal is formed, where the depth of the seabed reaches a depth of 40.00 - 45.00 m. In the wider area, industrial landscape and marine landscape are encountered.

Geology

The wider area of the project (Salamina and Megara wider areas) consists of geological formations of Sub-pelagonian Geotectonic Zone. Revithoussa Island consists of thick-bedded to massive limestones and dolomitic limestones, locally karstic, with rare schist and sandstone intercalation, which belong to Pelagonian Geotechnical Zone.

Seismicity

Detailed seismic hazard studies and seismic risk assessment have been elaborated, for Revithoussa Island, in order to avoid the risk of destructions in case of maximum seismic activity. Generally, the area is considered to comprise a low seismic zone. The structures and systems of LNG Terminal have been designed in any case, in accordance with NFPA 59A, classified in the relevant seismic categories.

As far as it regards "Tsunami Waves", the possibility for their creation is considered negligible, based on existing data from seismic stations and neo-tectonic data from Saronikos Gulf. Volcanic earthquake analysis also concluded that there is no risk of volcanic earthquake activity in the area of Revithoussa Island.

Soils

The area is structured entirely of karstified limestone formations. Typical characteristic is the lack of soil mantle in the wider area of the island. The project area is covered by topsoil which comprises mostly sediment.

Oceanography

The sea depth at the north side of the island increases along North-East direction and reaches a depth of 30 m. The morphology of the seabed between Revithoussa Island and the Island of Makronissos is smooth with small slopes reaching 10o. On the west side of the Terminal a 'ridge' is formed, connecting Revithoussa Island with the cape of "Agia Triada". South of the island, no specific physiographic abnormalities are observed. The slope of the seabed is smooth from the coast to the south, but gradually the sea bottom slopes are reaching 15o on the west side and 19o on the east side. After the contour of 60 m the slope becomes stable.

Seabed stratigraphy around the island demonstrates the following characteristics: In the section that extends north of the island the depth is low and determined by the 35 m counter. The depth increases more than 60 m south of the island. The seabed sediments around the island consist of sand evolving into muddy sands. Submarine stratigraphy is identified in three main sections of seabed (sections A, B and C). Section A represents the Holocene sediments consisting of sands and muddy sands. The thickness of this sand is more than 11 m in the north and no more than 3 m in the south of Revithoussa Island. Section B is beneath section A and consists of Holocene formations of the shore. It consists of granular materials and its thickness cannot be determined. These two sections are superimposing inconsonantly on section C, which represents the Triassic limestones of Revithoussa.

Tide

According to the investigation, the maximum tide reaches 1.0 m. The difference between the maximum and minimum sea level is 1.20 m and the correlation between the average and the minimum water level is 0.75 m. Generally, a change in sea level is expected during the last 20 years because of climate change and rising sea level.

Sea Currents

Surface currents are not considered critical for Revithoussa Island area. Generally, surface currents are weak and with counter clockwise direction in the area of Saronikos Gulf and up to south – east of Aegina. Therefore this sea current direction is expected in Revithoussa area. The S-SW and SW-D wind directions are very important because of their contribution to the creation of high energy waves.

Oceanographic Conditions

The calculations of geostrophical currents (equipotential surfaces and application of the simplified equilibrium model of pressure levels and Coriolis Effect) in Western Saronikos Gulf, which is the main basin coupled with Megara Bay, lead to the estimation that for the majority of meteorological conditions in the main field, the cyclonic movements under the action of density gradient are prevailing. These currents reflect the "basis" hydrodynamic condition that prevails in the field due to seasonal density variation depending on the wind. From the form of these circulations, it is concluded that the water mass exchanges among Megara Bay, Elefsina Bay and Western Saronikos Gulf are minor.

Climatic Conditions

The closest meteorological stations in the wider study area are these of “Elefsina” and “Megara”, providing processed climatic data over long time-periods that are mostly the same. For both stations the coldest winter months are December, January, February, however, the minimum temperature has dropped below zero in March (-2.5ºC), because of the cold air masses.

For Elefsina M.S. maximum rainfall appears in November and minimum in September. For the M.S. of Megara maximum rainfall appears in April and minimum in June.

For the M.S. of Elefsina maximum cloud cover appears in December and minimum in August. For the M.S. of Megara maximum cloud cover appears in February and minimum in August. Generally, relative humidity appears in maximum for both

meteorological stations during December (73.1%, 73.3%) and in minimum during July (42.6%, 48.3%).

Regarding the M.S. of Elefsina the prevailing winds are of north direction (approximately 28%), northwest winds follow (approximately 12.5%), while calm appears in approximately 29.4% of the year. Regarding M.S. of Megara, prevailing winds are of northwest direction (approximately 42.70%), south winds follow (approximately 19%), while calm appears in approximately 31% of the year.

0.4.1.2 Biotic Factors

The natural environment of Revithoussa Island is generally degraded because of the coverage of the major part of the land by the LNG Terminal facilities. In the wider area Salamina Island is found, with pine forests, which sometimes reach the coastline. The two most important pine forests of the island are the one at “Faneromeni” in the north-western part of the island and the forest at “Kanakia” in the south part. However, no natural ecosystem of Salamina Island is designated as protected area (in any form).

Terrestrial Flora

The vegetation of the wider area belongs to Quercetaliai licis Vegetation zone (coastal, hilly and sub-mountain area) and specifically in the subzone of Oleo – Ceration. Generally, the natural vegetation has been degraded. No azonic formations are observed.

Due to the existing facilities of the Terminal, the terrestrial vegetation of Revithoussa Island has been largely limited, especially on the hill of the island. The species are limited to phrygana or other therophytes and typical annual flora taxa of areas with intense anthropogenic effects.

Marine Flora

The marine vegetation and flora of the study area consists mainly of phytobenthos, although during the last decade in Saronikos Gulf there was an improvement of plant communities associated with an overall improvement of trophic status. Around Revithoussa Island there was no evidence of presence of posidonia beds (Posidonia oceanica) or other type of undersea meadow or presence of other angiosperms.

There is no rare and endemic flora species on the island and in the wider area. The same is expected for the marine flora.

Terrestrial Fauna

The fauna is dominated by rodents (Rodentia), and occasionally many species of birds, mainly passerines (Passeriformes) and sea gulls (Larussp). Sea gulls particularly, are encountered in great numbers. Rodents are typical of anthropophilic. Small lizards, are also expected in Revithoussa Island. It is also note that the area of Revithoussa Island is not being used by any of the fauna species and populations of Vourkari Bay for feeding, nesting or reproduction.

Marine Fauna

It is expected that common fish fauna of Elefsina Bay and Vourkari Bay will be present. All these species are generally euryhaline and tolerant to disturbed environments. The island's fish fauna consists of Atherina hepsetus, Engraulisen crasicholus, Boops boops, Mugil cephalus, Scomber japonicus, Dicentrarchus labrax, Pagellus erythrinus, Oblada melanura, Mullus surmuletus, Voops salpa, Diplodus sargus, Sardinapil chardus, Scorpaena sp., (Diplodus annularis, Spicaras maris etc). Finally, the marine fauna in the coastal waters of Revithoussa also includes mollusks and octopuses. Marine mammals have been observed neither in Revithoussa, nor in the wider Study Area. It is important to note that fish populations in the coastal waters of Revithoussa have not been affected by the LNG Terminal's operation.

Rare and Endemic Fauna Species

There are no rare and endemic fauna species (terrestrial or marine) in Revithoussa Island area. In addition, the project area is far from Vourkari Bay, so no interaction is anticipated.

Environmental Protected Areas

There are no environmental protected areas in a radius of several km from the LNG Terminal. However, there is an on-going consultation of a Presidential Decree for the establishment of its wetlands in a protection status. In any case, no significant impact is expected on Vourkari Bay because of the 3 km distance from Revithoussa Island.

0.4.2 Socioeconomic Environment

Demographics

The Island of Revithoussa belongs to the Municipality of Salamina, under the administration responsibility of the Regional Unit of the Islands of the Attica Region, according to Law 3852/2011. Revithoussa Island is uninhabitable.

Employment and Economic Development

There is a continuous decrease regarding the employment in the primary and secondary sector, while there is a large increase in the tertiary sector, especially in occupations related to services.

Land Uses

The LNG Terminal is defined as industrial area, according to relative MD 57640/2203/1993 (Gov. Gaz. 369/Δ/15.05.93). The land uses of the wider area are characterized mainly as agro-industrial. Main agricultural uses include non-intensive agricultural activities and livestock farming. The area has no tourism activity, with the exception of country houses in the coastal area of Pachi – Ag. Triada – Iremo Kima, as well as in the northern coast of Salamina and the Bays of Iliakti and Kseno. In the mainland of Elefsina and Megara, significant number of industrial facilities, and specifically petroleum storage facilities, are located. Part of the coastal areas in Salamina and Iliakti is characterized as areas appropriate for aquaculture.

In a distance of 7 km the industrial park (VIOPA) of Megara is found, south of the Athens-Corinth railway, as well an industrial area (VIPE) in the eastern part of Megara.

In a distance of 6 km the city of Megara is located, characterized as growth pole. On the south coast of Megara non-demarcated areas of the settlements of Pahi, Agia Triada and Iremo Kima lie, approximately at a distance of 3.5 km, 1.6 km and 1.5 km respectively. On the east side, the settlements of Ksenou and Iliakti (at Salamina Island) are located at a distance of 3 km.

Existing Infrastructure

Selecting the LNG Terminal as reference point, the following infrastructure is recorded in the study area: industrial (Crude oil Storage Tanks of Aspropirgos Hellenic Refineries, Petroleum unloading facilities for Hellenic Petroleum, Oil storage facilities of KYDEP etc.), residential (Agia Triada, Iremo Kimo, Iliakti, Xenos and Pachi settlements, the city of Megara etc.), transportation (marine facilities at Agia Triada and Perama, New and Old National Road Athens-Corinth) and telecommunications facilities (ERT radio transmitter). Other infrastructure in the area

comprise Vourkari Bay with broiler facilities on both sides; poultry farms and other agricultural facilities and the Vehicle Technical Control Centre of Megara.

0.4.3 Cultural Environment

There are no antiquities or monuments at Revithoussa Island, neither any marine antiquities, since the Island has always been uninhabitable. In addition there are no recorded archaeological areas and general cultural heritage areas in the wider area that be influenced by the proposed project.

0.4.4 Current Pollution Status

Air Quality

Based on data of the Ministry of Environment, Energy and Climate Change (Air pollution report of 2010), the air pollution in wider area of Revithoussa Terminal has been reduced between 2001 and 2010.

During normal operation of the LNG Terminal, temporary gas emissions are generated from the flare system, the vaporizers and the unit generator of the CHP plant. There are also some transient, fugitive hydrocarbon emissions. The emissions are relatively low, while low gas temperatures minimize the potential dispersion of pollutants in the area.

Marine Pollution

Generally, the level of marine pollution in Revithoussa is low compared with neighboring areas.

Visual Amenities

The area has already accepted changes from the existing facilities. No additional visual impacts are expected from the construction of the 3rd Tank. Furthermore, there are no designated landscapes in the area.

Thermal Radiation

There are not any sources of thermal radiation in the wider area. However, there are sources of thermal radiation in the Terminal. These are resulting from the operation of the Flare facilities. Certain equipment in the LNG Terminal and especially in the storage tanks has been installed for protection by the heat radiation in case of local-scale fire in adjacent equipment.

Noise and Vibrations

The existing facilities operate within the statutory noise limits and no high levels of noise in the area of the LNG Terminal, nor in the coastal areas of the mainland, are observed. There are no sources of vibrations in the wider area.

Planned Projects in the Study Area and Development Trends

LNG facilities on Revithoussa Island are considered crucial for Greece, if not for Europe, as already described.

Regarding planned projects in the wider area, there are no such scale development activities that could have cumulative impacts with the particular project.

0.5 ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT AND MITIGATION

The methodology applied for assessing the impacts regards the Construction Phase and the Operation Phase of the project. For each baseline parameter the anticipated impacts are presented, while mitigation measures are proposed and the residual impact is conclusively assessed.

Impact Assessment during Construction Phase

All construction activities will take place within Revithoussa Island, and more specifically within the current facilities of the Terminal Station, which minimizes any impact. The following measures are proposed for all parameters:

1. Timely notification of the competent authorities regarding construction works initiation;
2. Application of Best Available Techniques on the construction site;
3. Designation of responsible person for environmental measures monitoring;
4. Designation of public relations officer at the worksite for receiving, recording and appropriate forwarding of potential requests.

Impact Assessment during Operation Phase

Revithoussa's LNG Terminal has been operating without problems and special impacts. Furthermore, the 3rd tank project developed within the framework of the 2nd upgrade of the Terminal, will not substantially affect the quantities of solid, air and

liquid waste already generated in the Station that will remain the same after the 3rd tank's installation and the mitigation measures application.

The LNG regasification rate increase (expansion of LNG Terminal Cryogenic Facilities) is considered to have the following impacts:

0.5.1 Marine Flora and Fauna

Flora – Offshore Section

Construction Phase: The construction works in the marine environment are limited to the substitution of the steel drain pipeline, in order to respond to the increased needs of the Station, resulting in some agitation and suspension of the sea bottom sediments. However, the duration of the pipe replacement works is relatively small and the impacts are anticipated to be geographically limited and reversible. No sea grass meadows that could be affected by the physicochemical changes in water column and generally the receptor's sensitivity is considered to be low. Consequently these impacts are considered negligible.

No special impact mitigation measures are proposed beyond good construction practices.

Operation Phase: Any impacts on marine flora during the operational phase of the gasification system relate to the discharge of 5,800 m^3/h additional seawater, used for the function of the new ORV. The characteristics of temperature and chlorine concentration comply with the requirements of the pertinent approval of Environmental Terms, but for the given increase of the water amount the impact is considered of moderate magnitude. In combination however with the low sensitivity of the receptor, the impact is negligible.

Systematic use of the sodium sulphite dosing system at the vaporizer's exit will be continued, for regulating the concentration of residual chlorine in the seawater discharge that ends in the marine receptor and ensuring compliance with the required by the Authority limit of 0.4 mg/l[1]. The temperature of discharged seawater will be also monitored to ensure compliance with the legislative limit of the maximum temperature difference of 7°C.

[1] Note: 3rd Tank Environmental Terms Approval recently stated a maximum concentration at the discharge of 0.4 mg/l. It has to be highlighted however that monitoring of chlorine concentration at the sea water discharge underlined a concentration lower than 0.4 ppm.

Fauna – Offshore Section

Construction Phase: The mechanisms causing pressures on marine fauna are the same as those for marine flora. In brief, the seawater drain pipe replacement works will result in temporary suspension of sediments and temporary alteration in the water column's physicochemical parameters, such as turbidity, nutrients concentrations, light, etc. Fish are not expected to be directly affected, while it is anticipated that they will return to the area after completion of the construction works. Greater sensitivity observed during summer, when fish's eggs may be affected by suspended sediments settling. In any case, the area's fish fauna species are common of the Saronic Gulf. Taking into account the fact that reported no presence of high ecological value species or under any protection scheme, the receptor's sensitivity is considered low to moderate and the relevant impacts negligible.

Regarding fish, avoidance of construction works during summer months will be tried in every best effort, in order to minimize any impacts on their eggs.

Operation Phase: Similarly, the increase in the amount of discharged seawater is expected to have negligible impacts on the marine fauna, taking into account the low sensitivity of the area's species.

The same mitigation measures as in the case of offshore flora will apply.

0.5.2 Onshore Flora and Fauna

Flora – Onshore Section

Construction Phase: During construction works (excavation, earthworks and foundations) for the expansion of the gasification rate of the Terminal Station, no impacts on the flora of the region are anticipated. Endemic species will not be affected; as such species are not present, while the construction activities will not interfere with the area's climatic or bioclimatic characteristics and generally no alterations will take place in the island's habitat. The locations where the proposed project will be developed are located between the existing industrial facilities.

No special measures for the mitigation of adverse impacts are proposed, apart from good construction practices.

Operation Phase: During the operation phase of the proposed project it, negative impacts are not expected, not only on the limited vegetation of the island, but also on the vegetation of the wider area. Instead, potential plantings that will be made for the harmonization of the landscape will have a positive impact.

No specific mitigation measures are proposed.

Fauna – Onshore Section

Construction Phase: The extent of construction works is very limited and is not expected to have any impacts on the onshore fauna that comprise no special populations of mammals and reptiles. Moreover, due to its geographical position and the insular nature of the project area, no interaction with other onshore ecosystems takes place.

No special measures for the mitigation of adverse impacts are proposed, apart from good construction practices.

Operation Phase: During the operational phase of the proposed project, no negative impacts are expected on the fauna of the island, which is anyway limited. Because of the insular nature of the project area there is no interaction with other onshore ecosystems.

No specific mitigation measures are proposed.

0.5.3 Oceanography

Construction Phase: The seawater drain pipe replacement works are expected to have negligible impacts on the morphology of the sea bottom, as these only regard the replacement of the existing pipe and not a new installation. Furthermore it is expected that upon completion of the replacement works, natural restoration of sea bottom morphology will take place locally, as it has happened up to now.

The nature of the relevant works is such that does not relate to impacts on the marine geology or the sea currents.

No special impact mitigation measures are proposed.

Operation Phase: No impacts are anticipated during operation phase on the bathymetry of the sea bottom, the marine geology and the area's sea currents.

No special impact mitigation measures are proposed.

0.5.4 Surface and Groundwater

Construction Phase: Some impacts to the marine water column are anticipated by replacing the sea water discharge pipe, which as above mentioned will be limited both in extent and duration. No other surface waters that may be affected during the construction phase are identified in the project area.

As far as it regards the generation of liquid and solid waste at the worksite during the construction phase, it is indicated that in general the anticipated quantities will be small and managed at the wastewater treatment unit of the Terminal's current facilities. Consequently, the relative impact is considered negligible.

Generally all liquid and solid waste produced during construction will be appropriately collected and managed according to the applicable procedures and the legislative provisions.

Operation Phase: The only impacts on surface waters are associated with the discharge of additional quantities of seawater (approximately 5,800 m^3/h) used in the vaporizers, about 50 meters from shore. As mentioned above, the temperature and the chlorine concentration of the discharged water will fall in any case within the legislative limits – so the magnitude is small, while the sensitivity of the receptor is low, resulting in negligible impacts.

Liquid and solid waste potentially generated during the project's operation will be managed in accordance with the integrated Waste Management Plan, in order to eliminate any impacts.

Use of the sodium sulphite dosing system to the output of the vaporizers will take place, if and when is required, in order to adjust the concentrations of residual chlorine in the water that ends to the receptor and ensure compliance with the required limit[2] mg/l. Monitoring of the temperature of the discharged water will be also continued to ensure compliance with legislative limit of the maximum temperature difference of 7°C.

0.5.5 Soil and Subsoil

Construction Phase: The earth works will take place entirely on Revithoussa Island. There is no topsoil anymore as the bedrock is already revealed and the project area is already developed. The produced liquid and solid wastes during construction, through proper management, are not expected to come into contact and contaminate the soil. Zero impacts are anticipated.

No special mitigation measures are proposed. In any case, Best Available Techniques will be applied during construction.

Operation Phase: During operation, no impacts to soil are anticipated as there is no interaction with it. The produced liquid and solid wastes during construction, through proper management, are not expected to come into contact and contaminate the soil. Zero impacts are anticipated.

No special mitigation measures are proposed.

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[2] Note: 3rd Tank Environmental Terms Approval recently stated a maximum concentration at the discharge of 0.4 mg/l. It has to be highlighted however that monitoring of chlorine concentration at the sea water discharge underlined a concentration lower than 0.4 ppm.

0.5.6 Air Quality

Construction Phase: During project construction phase, dust emissions are anticipated, resulting from earth moving operations and the circulation of vehicles (trucks, bulldozers, excavators, utility vehicles). The relevant impacts are local, of small magnitude and reversible, therefore are considered negligible. Other atmospheric pollutants (NOX, CO, SO2, etc.) resulting from machinery operation, will be emitted at very low quantities, and the relevant impacts at local level will be negligible.

No special mitigation measures are proposed. In any case, best practices at construction site will be employed.

Operation Phase: During normal operation of the regasification system no emissions to the atmosphere are expected and therefore zero impacts are anticipated. Only fugitive emissions of natural gas may be foreseen, but the relevant impact will be negligible.

No special mitigation measures are proposed.

0.5.7 Noise – Vibrations – Radiation

Construction Phase: During construction phase no vibrations and emission of radiation is expected and therefore the relevant impacts are zero.

Temporary increase in noise levels is expected at the Terminal during earth moving works and vehicles and machinery circulation. Nevertheless, disturbance to the closest inhabited areas is anticipated to be negligible since the closest receptor is more than 1,250 m away from the project area.

No special mitigation measures are proposed, besides the application of best construction site practices. The duration of the daily construction works will be from 08:00 to 17:00, or 18:00 in summer.

Operation Phase: During operation phase no emission of radiation or vibration is expected and therefore the relevant impacts are zero.

During the operation of the new regasification system, the only sources of noise emissions are the seawater pumps and the high pressure pump. In essence, these are higher capacity pumps which will replace the existing ones so that the additional regasification capacity needs are met. As a result, the additional noise emissions are considered negligible.

No special mitigation measures are proposed.

0.5.8 Protected Areas and Ecosystems

Construction Phase: There are no protected areas or ecosystems of high value in the project area. Vourkari Bay, where the homonymous wetland is situated, is about 2.5-3.0 km away from the project area. Although the ecological value of the wetland is appreciated, as it is likely to comprise nest area for protected bird species or main feed area for birds, the distance from the project area and the nature of the project are such that disturbance to birds is unlikely. The magnitude of the impact is therefore small and, combined with the high sensitivity of the bird population, results in impacts of medium significance.

During the preparation of the detailed schedule of project construction, it is suggested to apply every effort to avoid works during the birds migration period (April and September) to the extent possible. Following the implementation of this restriction, impact significance to protected areas and ecosystems during project construction is negligible.

Operation Phase: During operation, no interaction with any protected areas is expected. Therefore, zero impacts are anticipated. No special mitigation measures are therefore proposed.

0.5.9 Land uses

Construction Phase: The project area is within an Industrial Area. The Revithoussa terminal is already in operation for years without any problems and with no effect to the land use of the neighboring areas, especially those hosting holiday houses. The relevant impacts are considered negligible. No special mitigation measures are proposed.

Operation Phase: During operation, no effect or impact to existing land use in Revithoussa or the neighboring areas. Zero impacts are therefore anticipated. No special mitigation measures are therefore proposed.

0.5.10 Archaeology

Construction Phase: The location of the project lies within a designated industrial area, while no archaeological findings or monuments have ever been recorded on Revithoussa. As a result, no impacts to cultural heritage are anticipated from project construction. No special mitigation measures are proposed.

Operation Phase: No impacts to cultural heritage are anticipated as a result of project operation. No special mitigation measures are therefore proposed.

0.5.11 Landscape

Construction Phase: Due to the distance of the project area from inhabited areas as well as the relatively short duration of project construction activities, no visual impacts or impacts to landscape are anticipated during project construction. It is noted that project construction will take place within an industrial installation where the landscape is already of industrial character. No special mitigation measures are proposed.

Operation Phase: Given that the project installations will eventually be integrated in the existing ones, in a way that the final visual result is very similar to the existing situation, while potential visual points within inhabited areas are at a significant distance from the project area, landscape impacts during operation are considered negligible. No special mitigation measures are therefore proposed.

0.5.12 Existing Infrastructure

Construction Phase: The project will be constructed without any impact to the current terminal operation or any other existing infrastructure in the area. No special mitigation measures are proposed.

Operation Phase: During operation, no impacts to existing infrastructure are anticipated, other than the obvious upgrading of the regasification capacity of the Terminal. As already stressed, the 2nd upgrading of the Revithoussa LNG terminal serves national development objectives with positive influence to the national economy but also to the environment of the area and the country.

0.5.13 Other (Health, Employment, Economic Development)

Construction Phase: The project, due to its small size and nature, is not expected to affect demographic characteristics, health or the economic activity in the wider project area. A small increase in employment may be anticipated as a result of the employment opportunities related to project construction. The relevant impacts range from negligible to positive. No special mitigation measures are proposed.

Operation Phase: The project, due to its small size and nature, is not expected to affect demographic characteristics, health or employment in the wider project area. At national level, the project will have a positive contribution to economic activities

related to the industrial sector, due to increase in competitiveness in the NG market. The relevant impacts range from negligible to positive. No special mitigation measures are proposed.

0.5.14 Cumulative and Secondary Impacts

Cumulative impacts may take place during project construction in combination with the construction of the 3rd tank, which is expected to start soon. Appropriate planning of the two projects on behalf of DESFA is expected to minimize likely cumulative impacts and potentially explore synergies.

No other projects are known to be planned in the wider project area that could potentially interact with the proposed project.

0.5.15 Impacts from Decommissioning

The life time of the proposed project is related to the overall operation of Revithoussa terminal, and so is the decommissioning of the project installations which will comply with the terms and conditions of the decommissioning of the terminal at the end of its life time. In any case, DESFA will comply with the provisions of the environmental legislation in effect at the time, as well as the best practices related to the management of the resulting materials and the reinstatement of the environment to the extent possible.

0.6 ENVIRONMENTAL MONITORING AND MANAGEMENT PLAN (EMMP)

The EMMP section of the ESIA discusses DESFA's approach to the management and monitoring of environmental and social issues. It also presents an outline of the requirements that the Construction Contractor and the Operator of the proposed project will be expected to meet. The plan is expected to develop throughout the life of the project. The EMMP will cover the detailed design, construction, and reinstatement of the Project, as well as its operation.

The main output of the EMMP Section are:

- the Environmental and Social Management Plan, in which proper actions are identified and addressed for different stages of the 2nd Expansion Project:
  - Prior to Construction works: monitoring of the marine environment, Waste Management Plan, Construction Emergency Response Plan, Workforce Health and Safety Plan;

- Construction: environmental supervision, protection of fish species and bird species, wash-water from construction equipment, surface water protection (bunded areas and spill avoidance), waste management, dust and air emissions control, cultural heritage protection, tourism;
- Operation: monitoring of various parameters of the marine environment during operation, maintenance, waste management, emergency response, seawater discharge,
- Decommissioning: environmental assessment of decommissioning.

- the Monitoring Program, where air emissions and wastewater/ discharged sea water monitoring is addressed in detail, along with general aspects.

With reference to the Monitoring Program, in the EMMP main elements for the plant overall monitoring programme during operation are presented, including:

- air emissions: periodical measurements from exhausted stack of the internal combustion engine of the power plant and of the submerged combustion vaporisers, flare;
- wastewaters and discharges: periodical sampling of: total residual chlorine in three wastewater samples before final disposal at sea, sodium sulphite (if and when it is used), municipal wastewater (Active acidity, pH, Biochemical Oxygen Demand, BOD_5, Chemical oxygen demand, COD, Total suspended solids). Furthermore continuous monitoring for the sea water and other wastewater discharged at sea (Active acidity, pH, Temperature of sea water intake, Temperature of sea water discharged).

0.7 SAFETY ISSUES

A Safety Study [DSF-11-019-02/LNG-2UV-540-12-GEN-SAF-STU-003, "Safety Study (Quantitative Risk Assessment)", RINA Services S.p.A. – D' APPOLONIA S.p.A. – EXERGIA S.A., 2013] for the Expansion of Revithoussa LNG Terminal Cryogenic Facilities (2nd Upgrading) has been prepared, in compliance with the requirements of Joint Ministerial Decision 12044/613/2007 (GG376/B/19.03.2007), transposing SEVESO II Directive into national legislation, with the scope of identifying, selecting and classifying the principal events that may lead to dangerous situations or accidents in the installations and assessing the relevant frequency of occurrence and consequences. In addition, the study discusses on measures and

management systems appropriate to prevent or mitigate such dangerous situations or accidents.

The methodology adopted for the assessment of the potential accidents deriving from the installation of the new pieces of equipment involves predicting the frequency of release events and the relevant consequences, as presented in more detail in the relevant section.

The analysis is based on the following:

- Identification of credible potential hazards;
- Frequency assessment of the identified release events;
- Consequences assessment of credible release events.

In order to identify credible accidental events that can lead to fire, explosion and flammable gas dispersion scenarios, loss of containment events (e.g. piping, valves and flange leakages) are taken into account. With the aim of identifying all the relevant release sources generating significant consequences on the operators' safety, a number of representative sections are defined on the basis of similar process condition, identifying a source of release for each one. Estimations are performed for different atmospheric stability classes and hole size release scenarios (1'' – significant rupture and 4'' – major rupture). For each identified scenario, release frequency and consequences assessment takes place for the two selected rupture classes, in order to determine the distances to the threshold values, for fire events, explosions and flash-fires.

From the analysis of the credible accidental scenarios, potentially leading to an external leakage of flammable fluid, it can be concluded that all of the considered events are limited to the Revithoussa Island, and cannot reach nearby coastal region. Damages to assets are only foreseeable in the same unit in which the leakage originated, and they do not involve the LNG storage tanks.

It is noted Revithoussa LNG Terminal Atation exhibits a sophisticated system of measures and procedures designed to prevent or mitigate potential accidents or non-routine events. As far as it regards this project, emphasis is placed in fire protection and fire-fighting measures that are more relevant to potential accidents. Such measures or systems indicatively include fire protection/ proofing/ fighting systems, fire water/ fixed water spray system, dry chemical/ foam systems, portable fire extinguishers, fire hose boxes etc. Details of these systems are provided in the Safety Study and in other relevant studies.

A Safety Management System is also in place in Revithoussa, comprising Major Accidents Prevention Policy and an over-arching set of SMS procedures.

0.8 CONCLUSIONS

It has been emphasized that the upgrade of the Revithoussa terminal is a priority project for Greece, contributing to the improvement of NG market operation in the country and having indirect but clear environmental and socioeconomic benefits in providing an environmental-friendlier alternative to the use of liquid or solid fossil fuels for space heating and electricity generation.

No impacts of major significance were identified in relation to project construction or operation, mainly due to the small size and nature of the project as well as the fact that the island of Revithoussa is already characterized as Industrial Area and dominated by the terminal installations.

The impacts related to project construction are the typical ones associated with construction sites, i.e. the generation, handling and disposal of solid waste or effluents from materials, machinery or personnel; dust or emissions from earth moving works and machinery; and likely visual disturbance of neighboring tourist areas. Such impacts are effectively mitigated by the application of standard practices at construction sites, including proper management of solid waste and effluents, maintenance of equipment and seasonal constraints to the extent possible.

The only notable impact of project operation is the discharge of seawater – which is used as heating medium for LNG regasification in ORVs – back to the sea, at a lower temperature and with traces of chlorine. Comprehensive monitoring is already carried out and will be further employed to ensure that seawater quality complies with the provisions of the pertinent legislation while 3D modeling has been used to assess the dispersion of the discharged water. Considering the low sensitivity of the receptor, the relevant impacts are not significant.

In conclusion, the installation and operation of the new regasification system is a project associated with minimum or no impacts to the local natural, socioeconomic or cultural environment but important environmental and socioeconomic benefits at national level.