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ENVIRONMENTAL IMPACT ASSESSMENT (EIA)
FOR A PROPOSED
METHANOL FACILITY IN DAMIETTA PORT

(Draft Report)

Prepared for:

Egyptian Methanex Methanol Company S.A.E.

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EXECUTIVE SUMMARY

This report presents the Environmental Impact Assessment (EIA) for the construction and operation of a proposed Methanol facility in Damietta Port, Egypt.

The overall objectives of the EIA are mainly to assist with project planning; meet the regulatory requirements; assist in ensuring environmentally sound implementation of the project; provide investors with an insight of the resource values and constraints; provide a forum for local residents and industry to become knowledgeable about the project; and, provide a baseline of management information including monitoring and review requirements.

This report was developed by WorleyParsons Komex for EMethanex, a joint venture between the public sector Egyptian Petrochemicals Holding Company "ECHEM" and Methanex Cooperation, a Canadian Private Sector Company. The project site is located inside Damietta Port, on the Egyptian Mediterranean Coast. The proposed project consists of stand alone methanol plants. A two phase production plan will be used for the project implementation, with a design production capacity of 3,600 MTPD of methanol for each phase.

The regulatory framework for the EIA is described in Section 2 of the report, including but not limited to: the Egyptian legislation; the European Investment Bank's (EIB) environmental guidelines for projects outside of the European Union; the lender requirements adhering to the Equator Principles (EP),International Finance Corporation (IFC), and World Bank guidelines; EMethanex requirements/commitments; and WorleyParsons Komex high environmental standards.

Section 3 of the EIA report provides a description of the proposed project. A description of the existing environment (baseline data) is described in Section 4, which includes the outcome of several field visits to the proposed project location and surrounding areas (onshore and offshore locations) as well as a thorough literature review. The onshore baseline assessments included a terrestrial survey, noise measurements within the site and surrounding areas, ambient air quality measurements, and groundwater monitoring wells installation and sampling and analysis of soil and groundwater samples from the wells. The offshore surveys included the assessment of the marine environment at the proposed outfall and jetty locations, and the assessment of the freshwater intake in the Damietta Nile branch, including the sampling and analysis of water and sediment samples. GPS coordinates and meteorological conditions for the monitoring locations were recorded during all the field visits, and public consultation meetings were conducted with interested individuals. Baseline studies have also included a noise model, an air dispersion model, an oceanographic thermal dispersion model, in addition to studies concerning the human environment and cultural heritage. The project alternatives are described in Section 5, including the "no action" alternative, alternative sites, and alternative design and technologies.

An environmental impact analysis was carried out and is described in Section 6, including a detailed classification of the potential positive and negative impacts from the proposed facility. The major significant negative impacts are mainly due to the operation of the loading jetty and marine outfall, in addition to accidental events (ship collision, fire and explosion). Positive socio-economic impacts are expected during both construction and operational phases of the project. The mitigation measures required to eliminate/reduce the significant negative impacts are discussed in Section 8 of the report. Appropriate mitigation procedures will ensure that limited to insignificant residual environmental impacts will result from the proposed facility. For all potential accidental events (fire, explosion, and releases), an onshore and offshore emergency response plan will be set in place to immediately respond to the event, and all employees will be appropriately trained to implement the response plans in the event of emergency. The facility will be equipped with emergency warning alarms to cover for all potential human health implications. Detailed mitigation measures for all the project aspects are discussed in Section 8.

Two public meetings were carried out as part of the EIA (presented in Section 7), aiming to present the project and obtain feedback from interested parties, including but not limited to representatives from the Egyptian Environmental Affairs Agency (EEAA), governmental officials, Non Governmental Organizations (NGO's), university professors, local residents and the general public. The first meeting (attended by 20 people) was held on 16 May 2006 at the Center for Documentation of Cultural and Natural Heritage (CULTNAT) in Cairo. The second public meeting (attended by 84 people) was held on 8 June 2006 at El-Amal Club in Damietta. Meetings included questions from the attendees reflecting their interests/concerns and the response from EMethanex. Major interests of the attendees included the creation of new employment opportunities for local residents, and the importance of a comprehensive environmental assessment for the Port area.

An environmental management plan (EMP) is discussed in Section 9, which represents a framework Environmental Management System (EMS), to provide a process that ensures environmental statutory compliance, consistency with external standards, and promotes an effective environmental management at the facility during all project phases. A monitoring plan (including environmental monitoring, socio-economic monitoring, and documentation monitoring) is discussed as part of the EMP, with recommendations for compliance with regulatory requirements. The EMP also presents a framework and recommendations for assessing environmental effects and setting targets, procedures and procedural review, emergency preparedness, community partnerships, reporting, and auditing and management review.

A qualitative risk assessment is presented in Section 10, which reveals that there are a range of potential hazard scenarios arising from the proposed project, however these are all considered to be 'typical' for developments of this type. No unusual or novel features have been identified during the course of this study. Section 11 presents an environmental cumulative impact assessment (for EMethanex, SEGAS, and UGD Plants), the associated mitigation measures, and the expected residual cumulative environmental impacts.

Finally, based on the findings and recommendations of the environmental impact assessment for the proposed facility, the assessment team concludes that if mitigation and monitoring measures are followed, the facility can be constructed and operated without significant adverse impacts to the environment.

الملخص التنفيذى

يقوم هذا التقرير بعرض لنتائج دراسة تقييم الأثر البيئي لإنشاء وتشغيل مصنع الميثانول المقترح في مجمع البتروكيماويات بميناء دمياط، جمهورية مصر العربية.

الأهداف العامة لدراسة تقييم الأثر البيئي هى المساعدة في تخطيط المشروع، التوافق مع المتطلبات القانونية، المساعدة في تضمين البعد البيئي عند تنفيذ المشروع. وكذا تقوم الدراسة بتقديم للمستثمرين لمحة عن قيمة وقيود استخدام المورد المتاحة، توفر للسكان المحليين والقطاعات الصناعية معلومة عن المشروع، وتوفير قاعدة معلومات للإدارة البيئية متضمنة الرصد البيئي ومراجعة الاحتياجات.

هذا وقد قامت شركة WorleyParsons Komex بإعداد هذه الدراسة بتكليف من شركة EMethanex ، شركة مشتركة بين القطاع العام ممثلاً فى الشركة المصرية القابضة للبتروكيماويات "ECHEM" وشركة Methanex Cooperation أحدى الشركات الكندية الخاصة. هذا ويقع المشروع داخل مجمع البتروكيماويات بميناء دمياط علي ساحل البحر المتوسط في مصر. المشروع المقترح يتكون من مصنع الميثانول قائما بذاته. ومن المقرر أن يتم إنشاء المشروع على مرحلتين بطاقة إنتاجية مقترحة تقدر بنحو 3600 طن يوميا من الميثانول لكل مرحلة.

يتضمن الفصل الثانى من هذه الدراسة الإطار التشريعي لتقييم الأثر البيئي لمشروع الميثانول، والذي يشمل علي سبيل المثال لا الحصر: التشريعات المصرية المختلفة، الإرشادات البيئية لبنك الاستثمار الأوروبي للمشاريع المزمع إقامتها خارج الاتحاد الأوروبي، متطلبات المقرض الخاصة بمبادئ الإيكويتور، متطلبات المؤسسة المالية الدولية، إرشادات البنك الدولي، متطلبات وتعهدات شركة EMethanex. والمعايير البيئية العالية لشركة WorleyParsons Komex.

كما يقوم الفصل الثالث من دراسة تقييم الأثر البيئي بوصف المشروع المقترح. كما يشمل الفصل الرابع من الدراسة وصف البيئة الحالية/القائمة (قاعدة البيانات الأساسية) والذي يعرض نتائج العديد من الزيارات الميدانية إلي موقع المشروع المقترح والمناطق المحيطة به (سواء المواقع البرية والبحرية) وكذلك جمع ومراجعة الدراسات السابقة لمنطقة المشروع. كما شملت الدراسات لموقع المشروع إجراء مسح للحياة الطبيعية والبرية، قياسات الضوضاء داخل الموقع والمناطق المحيطة، رصد نوعيه الهواء بالمنطقة المحيطة، حفر أبار لرصد نوعية المياه الجوفية بالموقع مع أخذ وتحليل عينات من التربة ومياه الجوفية. بينما تضمنت الدراسات البحرية للمشروع تقييم البيئة البحرية فى الموقع المقترح للمصب outfall والرصيف البحري Jetty، وكذلك إجراء تقييم للمياه العذبة من فرع النيل بدمياط المقرر استخدامها فى المشروع بما في ذلك اخذ العينات من المياه والرواسب وتحليلها. كما تم تسجيل إحداثيات الموقع المختلفة والأحوال الجوية بمواقع الرصد المختلفة خلال مختلف الزيارات الميدانية. وكذلك قامت الشركة بعقد اجتماعات التشاور العام مع الأفراد المهتمين بالمشروع والجهات المعنية المختلفة. كما شملت الدراسات الأساسية إعداد نموذج للضوضاء، نموذج

الانتشار الجوي، نموذج التشتت الحراري، بالإضافة إلي الدراسات المتعلقة بالبيئة البشرية والتراث الثقافي. كما تم استعراض بدائل المشروع المختلفة في الفصل الخامس بالدراسة، بما في ذلك بديل "عدم إقامة المشروع"، ودراسة المواقع البديلة، وكذلك التصميمات والتكنولوجيات المختلفة.

تحليل الأثر البيئي للمشروع تم شرحه في الفصل السادس، بما في ذلك تفاصيل تصنيف احتمالات الآثار الايجابية والسلبية من المنشئ المقترح. أهم الآثار السلبية للمشروع ترجع إلي تشغيل رصيف الشحن البحري والمصب البحري بالإضافة إلي الحوادث العارضة (مثل اصطدام سفينة، الحرائق والانفجار). بينما يحقق المشروع آثار اجتماعية اقتصادية ايجابية متوقعه خلال مراحل الإنشاء والتنفيذ للمشروع. إجراءات التخفيف اللازمة لمنع/ للحد من الآثار السلبية للمشروع يتم مناقشتها فى الفصل الثامن من هذه الدراسة. يضمن تطبيق إجراءات التخفيف الملائمة حدوث أثار بيئية محدودة ناتجة عن المشروع المقترح. جميع احتمالات الحوادث العارضة (الحريق، الانفجار)، سيتم وضع خطة طوارئ برية وبحرية محكمة للاستجابة الفورية لمثل هذا الحدث، وسيتلقى جميع العاملين التدريب الملائم لتنفيذ خطط الاستجابة في حاله الطوارئ. كما سيتم تجهيز المنشاة بأجهزة إنذار للطوارئ لتغطيه جميع الآثار المحتملة علي صحة الإنسان. هذا ويقوم الفصل الثامن مناقشة التفاصيل الخاصة بإجراءات التخفيف لجميع جوانب ومراحل المشروع.

تم عقد جلستين تشاور عام كجزء من إعداد دراسة تقييم الأثر البيئي (الفصل السابع من الدراسة)، بهدف تقديم المشروع والحصول علي ردود أفعال من الأطراف المعنية ، بما في ذلك علي سبيل

المثال لا الحصر ممثلين عن جهاز شئون البيئة والمسئولين الحكوميين والمنظمات غير الحكومية وأساتذة الجامعات والسكان المحليين والجمهور. تم عقد أول اجتماع (حضره نحو 20 شخصا) يوم 16 مايو 2006 في مركز توثيق التراث الحضاري والطبيعي بالقاهرة. بينما الجلسة تنظيم جلسة التشاور الثانية (حضرها 84 شخصا) يوم 8 يونيه 2006 في نادى الأمل بدمياط. تضمنت الجلستين تبادل الآراء والرد على استفسارات الحضور والتى تعكس المصالح والاهتمامات المختلفة وردود EMethanex. من الاهتمامات الرئيسية للحضور العمل على ضرورة خلق فرص عمل جديدة للسكان المحليين، وأهميه إجراء تقييم بيئي شامل علي منطقة الميناء.

يناقش الفصل التاسع خطة الإدارة البيئية، والتى تمثل إطاراً لمنظومة الإدارة البيئية، لتوفير خطوات تساهم فى الالتزام بالقوانين للبيئة والتوافق مع المعايير الدولية ، وتعزيز فاعلية الإدارة البيئية خلال جميع مراحل المشروع. كما تناقش خطة الرصد (خطة الرصد البيئي، الرصد الاقتصادي والاجتماعي، ورصد الوثائق) كجزء من برنامج الإدارة البيئية مع توصيات التوافق مع المتطلبات التشريعية. كما يقدم برنامج الإدارة البيئية إطاراً وتوصيات لتقييم الآثار البيئية مع تحديد الأهداف وإجراءات المراجعة والاستعداد للطوارئ، ومشاركه المجتمع والإبلاغ والمراجعة وكذا مراجعة الإدارة.

الفصل العاشر من الدراسة يناقش تقدير الأخطار النوعي، والتي تبين أن هناك مجموعه من سيناريوهات المخاطر المحتملة الناتجة عن المشروع المقترح ولكن هذه كلها تعتبر "تقليدية" لمثل هذا

النوع من المشروعات. كما لا يوجد خصائص غير عاديه أو جديدة تم تحديدها أثناء إجراء هذه الدراسة. بينما يعرض الفصل الحادي عشر من الدراسة نتائج دراسة تقييم الآثار البيئية المتراكمة لكل من مشروعات (Methanex, SEGAS, UGD)، وربط تدابير التخفيف، واحتمالات الآثار البيئية المتراكمة المتبقية.

أخيراً، وبناء علي نتائج وتوصيات دراسة تقييم الأثر البيئي للمشروع المقترح، فان دراسة التقييم توصلت إلي انه إذا ما تم إتباع تدابير التخفيف والرصد، يمكن إقامة المشروع وتشغيله بدون أية آثار سلبيه علي البيئة.

1 INTRODUCTION

WorleyParsons Komex was retained by EMethanex to conduct an Environmental Impact Assessment (EIA) for a proposed Methanol facility inside Damietta Port, on the Egyptian Mediterranean Coast.

The project company was registered in March 2005 and is currently a joint venture between the public sector Egyptian Petrochemicals Holding Company “ECHEM” (24%) and Methanex Cooperation “Methanex” (76%), Canadian Private Sector Company.

1.1 Project Background

The proposed project involves the construction and operation of stand alone methanol plants. A two phase production plan will be used for the project implementation. Each of the two phases has an anticipated capacity of 3,600 MTPD of methanol. Phase I is expected to start operation in 2009, and Phase II in 2015. This EIA shall only focus on the details of Phases I and II.

The feed gas will consist of natural gas from the Egyptian Natural Gas Holding Company. The process employs licensed technology from Johnson-Matthey and Davy Process Technology, for the combined reforming, methanol synthesis and methanol distillation processes. Crude methanol is then refined for export.

1.2 Purpose of the Environmental Impact Assessment

This document covers the EIA for construction, operation, and decommissioning of the proposed Methanol facility in Damietta, Egypt.

The overall purposes/objectives of the EIA are:

- To assist with project planning, including identification of key issues and opportunities;
- To meet or surpass the environmental requirements of relevant authorities in Egypt, lenders requirements and guidelines, EMethanex specifications, Methanex commitments as a Responsible Care Company, relevant international conventions, and WorleyParsons Komex high environmental standards;

- To assist in ensuring environmentally sound and sustainable implementation of the project;
- To provide investors with an understanding of the resource values, their constraints and other resource users in the area;
- To provide a forum for other local industry and local residents to become knowledgeable about this project; and
- To provide a baseline of management information essential to the long-term viability of the project, including monitoring and review requirements.

2 LEGISLATIVE AND REGULATORY FRAMEWORK

The main objective of the EIA is to meet or surpass the relevant environmental legislative requirements and guidelines, including but not limited to:

- Egyptian legislation: EEAA Law 4 of the year 1994 and its Executive Regulations issued via Decree No.338 of 1995 and amended via Decree No.1741 of 2005; and the requirements of EEAA publication of Environmental Impact Assessment (EIA) guidelines for Oil and Gas sector (October 2001/January 2005);
- The European Investment Bank's (EIB) environmental guidelines for projects outside of the European Union;
- The lender requirements which adhere to the Equator Principles (EP) (July 2006); International Finance Corporation (IFC) and World Bank guidelines, including the Pollution Prevention and Abatement Handbook (PPAH), World Bank Group (July 1998);
- Methanex requirements/commitments as guided by Responsible Care and CSR;
- Egyptian Petrochemicals Holding Company (ECHEM's) HSE standards; and
- WorleyParsons Komex high environmental standards.

2.1 Egyptian Environmental Regulations

Law No. 4, passed in 1994, is the main Environmental Law in Egypt concerning the environment. This law established the Egyptian Environmental Affairs Agency (EEAA) as the competent authority. The Executive Regulations of this law were set out in 1995. The EEAA has the power to set criteria and conditions, monitor compliance and to take action against violators of these criteria and conditions. Various decrees have also been passed dealing with drainage of liquid wastes, and protection of the River Nile and other waterways from pollution.

Law 4 dictates that the licensing authority must assess the environmental impacts of proposed facilities. The assessment shall include a statement of all elements of the facility's self-monitoring system, and the expected contaminant levels. The Egyptian Environmental Affairs Agency shall verify the foregoing whenever necessary (Article 10, Decree 338, amended by Decree 1741 of 2005 (A10/D338, amended by D1741). The license application must include comprehensive data about the facility, to fulfil the requirements of the form structured by the EEAA and the Competent Administrative Authority (CAA) (A12/D338, amended by D1741).

A register shall be maintained to record the facility's impact on the environment (A17/D338, amended by D1741), according to Annex 3[1] of the Executive Regulations and such register shall include the following information:

- Emissions and effluents emanating or draining from the facility and the limits thereof;
- The efficiency of treatment processes and specification of any residual material from the treatment process;
- Details of environmental safety and environmental self-monitoring procedures applied in the facility;
- The results of periodic tests and measurements, together with a record of sampling time, location, and the number of samples; and,
- The name of the officer in charge of maintaining the register.

The Egyptian Environmental Affairs Agency must be notified by registered letter of any deviation from the established criteria. The letter must also outline the procedures taken to correct the problem (A17/D338, amended by D1741). The EEAA shall be responsible to follow up the data included in the facility's register, to ensure its conformity with the actual conditions, the facility's commitment to the self-monitoring plan and the efficiency of equipment and personnel responsible for the monitoring. The EEAA has the authority to visit the facility and take samples to ensure conformity. If a violation occurs and the establishment fails to comply within 60 days, the facility could be closed; the violating activity suspended, and/or court action taken (A18/D338, amended by D1741).

The EEAA must be notified of any expansions, modifications or renewals to the existing facility or any work that might result in an adverse impact on the environment or workers. Such expansions/modifications/renewals are subject to Articles 19, 20, 21, and 22 of Law 4 (A19/D338, amended by D1741).

2.1.1 Conditions in the Workplace

The facility must operate such that leakage or emission of air pollutants inside the workplace will not affect worker's health and safety (A45/D338). Annex 8 of the Executive Regulations provides the maximum limits for air pollutants inside the workplace.

[1] All Executive Regulations annexes were amended by Decree 1741 of the year 2005.

The facility must operate such that humidity and temperature will be maintained within the set limits for workers (A46/D338, Annex 9 of the Executive Regulations). Suitable Personal Protective Equipment is to be provided as required for workers in different areas of the facility (A46/D338).

2.1.2 Use of Dangerous Materials and Management of Wastes

The production and circulation of dangerous materials and wastes is prohibited without a license. The license is issued for a fixed time interval. The permit requirements are summarised in A26/D338, amended by D1741. Management of dangerous wastes is subject to rules and procedures, which are set out in (A28/D338, amended by D1741).

Dangerous materials are defined by Law 4 as “substances having dangerous properties which are hazardous to human health, or which adversely affect the environment, such as bio-hazardous materials, toxic, explosive, flammable substances, or those with ionizing radiation”.

A Dangerous waste is defined by Law 4 as the “waste of activities and processes or its ashes which retain the properties of hazardous substances and have no subsequent original or alternative uses, such as clinical waste from medical treatments or the waste resulting from the manufacture of any pharmaceutical products, drugs, organic solvents, printing fluid, dyes and painting materials”.

2.1.3 Air/Odour Emissions

The facility must demonstrate that it will meet air/odour emission standards taking into account, not only the facility’s emissions, but also those of existing industries in the same area (A34 - 36/D338, amended by D1741). The cumulative contaminant levels due to incremental effects when combined with discharges from all industries in the area should not exceed the limits in Annex 5 of the Executive Regulations (presented in Table 2-1). The location of the facility must take into account suitability with respect to distance from urban areas, the prevailing wind direction, and the ability of the natural environment to “absorb” contaminants (A34/D338, amended by D1741).

Reference is also made in D1741/2005 to “guidelines for specific limits”, which shall be published by the EEAA in coordination with the authorities involved. However, the latter guidelines have not been published yet.

Gas releases from the facility, noxious and harmful smoke, fumes resulting from burning fuel, precautions and permissible limits as well as specifications of chimneys at a facility are regulated by Articles 36, 37, and 42/D338, amended by D1741, and Annex 6 of the Executive Regulations.

Table 2-1: Ambient Air Quality Criteria ($\mu g.m^{-3}$) (Law 4/1994)

Pollutant	Average Period	Egyptian Standards[2]
Sulphur dioxide (SO_2)	1 hour	350
	24 hours	150
	1 year	60
Carbon monoxide	1 hour	30 000
	8 hours	10 000
Nitrogen dioxide (NO_2)	1 hour	400
	24 hours	150
Ozone	1 hour	200
	8 hours	120
Suspended Particles measured as black smoke	24 hrs	150
	1 year	60
Total Suspended Particles	24 hrs	230
	1 year	90
Lead	24 hour average over 1 year in urban areas	0.5
	24 hour average over 6 months in industrial zones	1.5
Thoracic particles PM (10)	24 hrs	150
	1 year	70

2.1.4 Noise Emissions

The facility must meet noise regulations for within the workplace, outside the facility and for the area as a whole (A44/D338). Table 2-2 presents the permissible noise levels in different areas, of which the industrial zone levels are applicable for the proposed project location (Annex 7 of the Executive Regulations). Permissible noise levels inside the workplace are also regulated in Annex 7 of the Executive Regulations.

[2] Taken from Law 4 of 1994, Promulgating The Environment Law and its Executive Regulation, Egypt.

Table 2-2: Maximum Permissible Limits for Noise Intensity (dBA) (Law 4/1994)

Type of Zone	Day	Evenin	Night
Rural dwelling zones, Hospitals and Gardens	45	40	35
Dwelling suburbs together with an existing weak movement	50	45	40
Dwelling zones in the city	55	50	45
Dwelling zone including some workshops or commercial business or on a public road	60	55	50
Commercial, administrative and downtown areas	65	60	55
Industrial zones (heavy industries)	70	65	60

NOTE: "Day" from 07:00 to 18:00; "Evening" from 18:00 to 22:00; "Night" from 22:00 to 07:00

2.1.5 Disposal of Liquid Wastes

A license is required to discharge industrial liquid wastes into the public sewer system (A7/Law 93 of year 1962, as amended by Law 48 of year 1982, and Decree 44 of year 2000). Liquid wastes licensed for drainage must adhere to the standards decreed by the Ministry of Housing and Utilities, after obtaining the approval of the Ministry of Health (A8/Law 93, A14/Decree44). Analyses of the liquid wastes should be carried out periodically to prove compliance (A9/Law 93). The authority in charge of sewerage has the right to obligate the owner to undertake treatment or purification (A11/Decree 44).

Surface drainage of liquid wastes is not allowed except with a license from the department in charge of sewerage works, and should be according to the drainage techniques, specifications, and criteria determined by the Minister of Health and issued by a decree from the Minister of Housing and Utilities (A14/Law 93).

Oily discharges are required to pass through an oil/water separator prior to being discharged (A10/D44).

2.1.6 Protection of the River Nile and its waterways

Law 48/1982 regulates the protection of the River Nile and its waterways against pollution. There is no discharge from the facility to the River Nile, except for the raw water silt return. The quality of the raw water silt return would be compared to criteria presented in Article 61of the executive regulations of Law 48, issued via Decree 8/1983. Parameters of interest are presented in Table 2-3.

Table 2-3: Criteria for treated industrial discharges to the River Nile (A61, D8/1983, Law 48/1982)

Parameters	Units	Limiting criteria
Temperature	^{o}C	35
pH		6-9
TDS	mg/L	800
Oil and grease	mg/L	5
Residual Chlorine	mg/L	1

2.1.7 Specific Relevant Laws for Marine Effluent

Industrial establishments are licensed to discharge effluents containing degradable substances into the marine environment after treatment to effluent quality that complies with the limits presented in Annex 1 of the Executive Regulations. "Industrial establishments shall also be prohibited to drain the non-degradable substances, as prescribed in Annex No. 10 to these Regulations, into the water environment" (Article No. 58 of the Executive Regulations D338, amended by Decree 1741).

Samples of treated waste water would be periodically analyzed by the Egyptian Environmental Affairs Agency's laboratories and the results passed to the Competent Administrative Authority (CAA). In the event that the waste water does not comply with permissible limits in Annex 1 of the Executive Regulations, the EEAA takes administrative procedures together with the CAA and allows the licensed party a period of one month to treat their wastes so as to comply with permissible limits. If the establishment fails to comply, discharge of the waste would be administratively discontinued, the license would be withdrawn, and the establishment may be subject to the penalties stated in Law 4. The protection of the water environment from pollution due to land sources is covered in Articles No. 69 to 75 of the Law and Articles No. 57 to 60 of its Executive Regulations, amended by Decree 1741 of year 2005.

Annex 1 of the Executive Regulations of Law 4 sets specifications and criteria (permissible limits) for draining and disposing liquid wastes into the marine environment (presented in Table 2-4). In all cases, no drainage is permitted to the marine environment at distances of less than 500 meters from the shoreline. Drainage is also forbidden in bathing, fishing and natural protectorates' zones. Fishing and natural protectorates' zones are identified and monitored according to specific national laws presented below. However, no relevant national law was found available for the identification and monitoring of bathing zones.

- Fishing, aquatic life, and fish farms are mainly regulated by Law 124 of the year 1983. The Law designates the General Authority for Fish Resources Development (GAFRD) as the Competent Administrative Authority. The GAFRD was established by Presidential Decree No. 190 of the year 1983, under the Ministry of Agriculture. Section 2 of Law 124 of the year 1983 concerns water pollution and fishing obstructions. Presidential Decree 465 of the year 1983 has designated coastal areas to be developed and monitored by the GAFRD.
- Natural protectorates in Egypt are mainly regulated by Law 102 of the year 1983. The Law defines a natural protectorate as "any area of Land, coastal or inland water, characterized by flora, fauna, and natural features having cultural, scientific, touristic or aesthetics value, which is designated by a Decree from the Prime Minister, based on a recommendation from the Egyptian Environmental Affairs Agency" (Article 1/Law 102). Decree 1067of the year 1983, concerning the implementation of some provisions of Law 102/1983, has designated the Egyptian Environmental Affairs Agency as the Competent Administrative Authority responsible for the implementation of Law 102/1983 and the decrees related to this law for the protection of natural protectorates (A1/D1067).

Table 2-4: Law4/1994- Criteria and Specifications for Liquid Wastes when Discharged into the Marine Environment

Parameters	Units	Criteria for Discharge to Marine
Temperature	^oC	should not exceed 10^oC above prevailing rate, with a maximum of 38^oC
pH		6 - 9
Colour		Free from colouring materials
BOD	mg/L	60
COD (dichromate)	mg/L	100
TDS	mg/L	2000 above or below the prevailing TDS level in the marine environment to which waste water is disposed of
TSS	mg/L	60
Turbidity	NTU	50
Sulphides	mg/L	1.0
Oil and grease	mg/L	15
Phosphate	mg/L	5.0
Nitrate	mg/L	40
Phenols	mg/L	0.015
Fluorides	mg/L	1.0
Aluminium	mg/L	3.0
Ammonia (nitrogen)	mg/L	5.0
Mercury	mg/L	0.005
Lead	mg/L	0.5

Parameters	Units	Criteria for Discharge to Marine
Cadmium	mg/L	0.05
Arsenic	mg/L	0.05
Chromium	mg/L	1.0
Copper	mg/L	1.5
Nickel	mg/L	0.1
Iron	mg/L	1.5
Manganese	mg/L	1.0
Zinc	mg/L	5.0
Silver	mg/L	0.1
Barium	mg/L	2.0
Cobalt	mg/L	2.0
Other metals	mg/L	0.1
Pesticides (of all types)	mg/L	0.2
Cyanide	mg/L	0.1
Industrial Detergents	mg/L	0.5
Coliform (Most Probable Number in 100 cm^3)		4000

Annex 10 of the Executive Regulations presents the non-degradable polluting substances which industrial establishments are prohibited from discharging into the marine environment. Non degradable polluting substances are defined as substances that are found in the environment for a long period, depending basically on the quantities disposed of. Some of these substances are decomposed after long periods, ranging from months to several years, based on the composition of such substances and their concentrations in the environment.

First, Non-organic substances:

It is forbidden to discharge the compounds and salts of the following non-organic substances into the marine environment, except within the concentrations mentioned in Annex 1: Mercury, Lead, Cadmium, Cobalt, Nickel, Zinc, Iron, Manganese, Silver, Barium, Chromium, Arsenic, Copper, Vanadium, and Selenium.

Second, Organic substances:

It is completely forbidden to discharge the following organic substances:

a) Organophosphorus pesticides, which are decomposed with very small quantities within months:

- Dimethoate
- Malathion

b) Halogenated organic pesticides, which are not decomposed easily and leave traces that are persistent for several years:

Organochlorine Pesticides

- Aldrin
- Dieldrin
- DDT
- Chlordane
- Endrin

Also, non-degradable chlorinated compounds, which are considered to be highly toxic even in very low concentration:

Polychlorinated Biphenyls (PCBs) (Aroclor)

- 2,3,5,6 - Tetrachlorobiphenyl
- 2,3,6 -Trichlorobiphenyl

c) Polycyclic aromatic compounds that degrade with very small quantities over years:

Polynuclear Aromatic Hydrocarbons (PAH)

- Benzo (a) Pyrene
- Naphthalene

Third, Solid Materials:
For example, plastic, fishing nets, ropes, and containers.

It is also forbidden to discharge other persistent organic pollutants (for example, toxaphene. mirex, heptachlor, and hexachlorobenzene) and other toxic substances specified by the international conventions to which Egypt is a signatory.

2.1.8 EEAA Environmental Impact Assessment Guidelines

According to the national EIA guidelines for Oil and Gas sector (October 2001/January 2005), the project is considered a “Category C” project. A full EIA report is required. A summary of the EIA report requirements includes the:

a) analysis of relevant environmental national, regional and international legislation,

b) detailed description of the proposed project and the existing environment-baseline data,

c) expected environmental impacts of the proposed project,

d) mitigation measures,

e) project alternatives,

f) monitoring plan, the environmental management plan, and

g) rehabilitation programme.

These EIA requirements are used as a reference during the preparation of the EIA report.

In addition, the EIA also takes into consideration the general EEAA Guidelines for Egyptian Environmental Impact Assessment (October 1996), as well as relevant specific requirements of the EIA guidelines for Ports, Harbours and Marinas, such as:

- Water quality and waste management issues;
- Hydrological/coastal impact evaluation/mitigation measures; and,
- Cumulative impacts for aspects related to the marine environment.

2.1.9 Additional Relevant National Laws

- Law 48/1982 concerning the protection of the River Nile and waterways against pollution;
- Law 117/1983, promulgating the Law on Protection of Antiquities;
- Law 53/1966, concerning the Agriculture Law;
- Law 12/2003 “Labour Law”, sections concerning “Vocational Safety and Health and Ensuring Labour Environment Security”;
- Law 124/1983 for fishing, aquatic life, and the regulation of fish farms in Egypt;
- Law 102/1983 for the natural protectorates; and,
- The Egyptian drinking water quality standards, adopted by the Ministry of Health (Decree 108/1995).

2.2 International Standards

Since 1936, Egypt has been party to many regional and international conventions, treaties and agreements addressing environmental protection, the conservation of nature in general and biodiversity in particular. Relevant international legislation and guidelines include but are not limited to:

- Convention Relative to the Preservation of Fauna and Flora in their Natural State. London, 1933 (ratified in 1936).
- The UN Framework Convention on Climate Change. Kyoto, 1995 (Ratified in December 1994)

- Convention on the Conservation of Migratory Species of Wild Animals. Bonn, 1979 (ratified in 1982).
- Convention on Biological Diversity. Rio de Janeiro, 1992 (ratified in 1994).
- Protocol Concerning Mediterranean Specially Protected Areas. Geneva, 1983 (ratified in 1986).
- Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean (Barcelona, 1995).
- Agreement for the Establishment of a General Fisheries Council for the Mediterranean (Rome, 1951).
- Convention for the Protection of the Mediterranean Sea against Pollution (Barcelona Convention 1976).
- Convention for the Prevention of Marine Pollution from Land-based Sources (Paris, 1974).
- Basel Convention on Trans-boundary Movements of Waste (1995).
- International Convention on the Protection of Wetlands (Ramsar, Iran, 1971).
- International convention on Oil Pollution Preparedness, Response and Cooperation. London, 1990 (ratified in 1992).
- United Nations Convention on the Law of the Sea (1982).
- Regional Convention for the Conservation of the Red Sea and Gulf of Aden Environment (Jeddah, 1982).
- International Convention for the prevention of pollution from ships (MARPOL, 1973/78)

2.2.1 European Investment Bank (EIB) Environmental Guidelines

The EIB takes environmental guidance from the European Union environmental legislation, some of the strictest and best developed in the World. EU Directives which are relevant to the Methanex project have been summarised and are included in Appendix I. By applying EU environmental policies as its benchmark, the Bank's approach to safeguarding the environment is at least equivalent to international good practice, such as the 'Equator Principles' (Section 2.2.2).

The EIB ensures that all projects it finances:

- Comply with EU environmental policies and standards;
- Take into account local conditions and law in regions outside the EU, as well as EU standards as a benchmark;
- Comply with the EU's Directive on Environmental Impact Assessment;

- Apply 'best available techniques', as appropriate (e.g. industrial projects);
- Apply good environmental management practices during project implementation and operation;
- Adhere to international good environmental practice; and,
- In developing countries, accord with internationally recognised social safeguard measures, including labour standards.

The EIB applies a relatively broad definition of the term "environment" to cover the natural environment, the human living and working environment as well as a number of social aspects. In all its lending activities, the EIB applies core environmental and social safeguard measures that are, as a minimum, equivalent to international good practice.

The Bank subscribes to the following principles when operating outside the EU:

- In its lending activities, the EIB applies "the precautionary principle" and the principles that preventive action should be taken, that environmental damage should as a priority be rectified at source and that the polluter should pay" (EC Treaty, Article 174).
- In regions outside the EU and the Candidate Countries, projects must comply with the principles and standards set by EU policies, subject to local conditions and law. Issues taken into account include income per head, institutional capacity and the costs and benefits of alternative standards. In certain circumstances, higher environmental standards may be introduced in stages; in others, a project may be designed in anticipation of future higher standards.
- Projects should comply with any obligations and standards of multilateral environmental agreements to which the host country - and/or the EU in the case of a Member State - is a party.
- The EIB requires that all projects likely to have a significant effect on the environment be subject to an Environmental Impact Assessment (EIA), according to the definitions and requirements of Directive 85/337/EEC, amended by Directive 97/11/EC. The EIA, which includes public consultation, is the responsibility of the promoter and the competent authorities. It should be completed and its main findings and recommendations must satisfy the requirements of the Bank prior to disbursement. The Bank may request more studies if necessary.
- Projects financed by the EIB must safeguard biodiversity. In support of the general approach described in the sixth "Environmental Action Programme" and the principles of Directive 92/43/EEC (Habitats), the Bank requires an appropriate assessment of the biodiversity

effects of a project, including a detailed assessment of effects on protected sites and/or species. Where the effect is likely to be significant, it requires the identification and implementation of appropriate mitigation and compensation measures, as a contractual undertaking.

- For industrial installations, the EIB promotes the application of "best available techniques" (BAT), according to the guidelines associated with Directive 96/61/EC (Integrated Pollution Protection and Control) and other best practice guides (e.g. the "Pollution Prevention and Abatement Handbook - Toward Cleaner Production", World Bank Group, 1998). The Bank seeks to promote the development of products and processes that make efficient use of resources during their manufacture and use, respectively, as well as appropriate end of life solutions, including decommissioning. It aims to promote the development and transfer of appropriate European environmental technologies to other regions of the World.

The EIB also uses other international guidelines and standards to assist in its assessment of the environmental acceptability of projects:

- The EIB seeks to promote the development and implementation of good environmental management practices in project implementation and operation, such as those enshrined in the EU's Environmental Management and Audit System (EMAS) and ISO 14000: 2004.
- The EIB is guided by the findings and recommendations of recognised international good practice for particular sectors. The Bank follows closely relevant international debates, such as those on the findings and recommendations of the "World Commission on Dams" (2000).

2.2.2 Equator Principles (July, 2006)

The objective of the Equator Principles (EP) is to provide ***a financial industry benchmark for determining, assessing and managing environmental and social risk in project financing.***

The conditions under which The Equator Principles Financial Institutions (EPFIs) will provide loans to projects are summarised in Principles 1-9 below.

- ***Principle 1: Review and categorisation:*** As part of the EPFI's internal social and environmental review and due diligence, the EPFI will categorise each project based on the magnitude of its potential impacts and risks, in accordance with the environmental and social screening criteria of the International Finance Corporation (IFC) (Exhibit I of the EP).

- Based on these criteria (Exhibit I of the EP), the proposed project is considered a category B, as there are '*potential limited adverse social or environmental impacts that are few in number, generally site- specific, largely reversible and readily addressed through mitigation measures'.*

- ***Principle 2: Social and Environmental Assessment:*** For a project classified as category A or B, the borrower should carry out a Social and Environmental Assessment ("Assessment") which addresses all relevant social and environmental risks of the project. The Assessment may address, if relevant, the illustrative list of issues described in Exhibit II, which includes the following items:
  a) Assessment of baseline environmental and social conditions;
  b) Consideration of feasible environmentally and socially preferable alternatives;
  c) Requirements under host country laws and regulations, applicable international treaties and agreements;
  d) Protection of human rights and community health, safety and security;
  e) Protection of cultural property and heritage;
  f) Protection and conservation of biodiversity, including endangered species and sensitive ecosystems in modified, natural and critical habitats, and identification of legally protected areas;
  g) Sustainable management and use of renewable natural resources;
  h) Use and management of dangerous substances;
  i) Major hazards assessment and management;
  j) Labour issues and occupational health and safety;
  k) Fire prevention and life safety;
  l) Socioeconomic impacts;
  m) Land acquisition and involuntary resettlement;
  n) Impacts on affected communities, and disadvantaged or vulnerable groups;
  o) Impacts on indigenous peoples, and their unique cultural systems and values;
  p) Cumulative impacts of existing projects, the proposed project, and anticipated future projects;
  q) Consultation and participation of affected parties in the design, review and implementation of the project;
  r) Efficient production, delivery and use of energy; and
  s) Pollution prevention and waste minimisation, pollution controls (liquid effluents and air emissions), solid and chemical waste management.

Note: As mentioned in Exhibit II of the Equator Principles, the above list of issues is for illustrative purposes only. The Assessment process of each project "may or may not identify all issues noted above, or be relevant to every project" (Equator Principles, July 2006).

The Assessment should also propose mitigation and management measures appropriate to the nature and scale of each specific project.

- ***Principle 3: Applicable social and Environmental Standards:*** For projects located in non-Organisation for Economic Co-operation and Development (OECD) countries (including Egypt), and those located in OECD countries not designated as High-Income, as defined by the World Bank Development Indicators Database, the Assessment should also refer to the then applicable IFC Performance Standards (Exhibit III of the EP) and the then applicable Industry Specific Environmental Health and Safety Guidelines ("EHS guidelines") (Exhibit IV of the EP). For all projects, the assessment process should address compliance with relevant requirements of host country laws, regulations, and permits pertaining to social and environmental matters.

- ***Principle 4: Action plan and management system:*** For all Category A and Category B projects located in non- OECD countries, and those located in OECD countries not designated as High-Income, as defined by the World Bank Development Indicators Database, the borrower should prepare an Action Plan (AP), which addresses the relevant findings and draws on the conclusions of the Assessment. The AP should describe and prioritise the actions needed to implement mitigation measures or corrective actions, and monitoring measures necessary to manage the impacts and risks identified in the Assessment. Borrowers will build on, maintain or establish a Social and Environmental Management System that addresses the management of impacts, risks, and corrective actions.

- ***Principle 5: Consultation and Disclosure:*** For category A and, as appropriate, category B projects located in non-OECD countries, and those located in OECD countries not designated as High-Income, as defined by the World Bank Development Indicators Database, the government, borrower or third party expert should consult with project affected communities in a structured and culturally appropriate manner.
  The Assessment documentation and AP or a non-technical summary thereof, should be made available to the public by the borrower for a reasonable minimum period in the local

language and in a culturally appropriate manner. The borrower should take account of and document the process and results of the consultation, including any actions agreed resulting from the consultation.

- ***Principle 6: Grievance Mechanism:*** For category A and, as appropriate, category B projects located in non-OECD countries, and those located in OECD countries not designated as High-Income, as defined by the World Bank Development Indicators Database, to ensure that consultation, disclosure and community engagement continues through construction and operation of the project, the borrower will establish appropriate procedures in order to receive and address concerns or grievances about the project's social and environmental performance.

- ***Principle 7: Independent Review:*** For all Category A and, as appropriate for Category B projects, an independent social or environmental expert not directly associated with the borrower should review the Assessment, AP and consultation process documentation, to assist EPFI's due diligence, and assess Equator Principles compliance.

- ***Principle 8: Covenants:*** An important strength of the Principles is the incorporation of covenants linked to compliance. The borrower will covenant to:
    a) Comply with all relevant host country social and environmental laws, regulations and permits;
    b) Comply with the AP (where applicable);
    c) Provide regular reports in a format agreed with EPFIs on compliance with the AP (where applicable), and on compliance with relevant local, state and host country social and environmental laws, regulations and permits; and
    d) Decommission the facilities in accordance with an agreed Decommissioning Plan (where applicable). The level of detail contained in a decommissioning plan (where necessary) will depend on the identified impacts and risks of the project (please refer to quote below):

  "The Action Plan may range from a brief description of routine mitigation measures to a series of documents (e.g., resettlement action plan, indigenous peoples plan, emergency preparedness and response plan, decommissioning plan, etc). The level of detail and complexity of the Action Plan and the priority of the identified measures and actions will be commensurate with the project's potential impacts and risks" (Equator Principles, July, 2006)

Where a borrower is not in compliance with its social and environmental covenants, EPFIs will work with the borrower to bring it back into compliance to the extent feasible, and if the borrower fails to re-establish compliance within an agreed grace period, EPFIs reserve the right to exercise remedies, as considered appropriate.

- ***Principle 9: Independent Monitoring and Reporting:*** To ensure ongoing monitoring and reporting to EPFIs over the life of the loan, EPFIs will, for all Category A projects, and as appropriate, for Category B projects, require appointment of an independent environmental and/or social expert or require the borrower to retain qualified external experts to verify its monitoring information.

- ***Principle 10: EPFI reporting:*** Each EPFI adopting the Equator Principles commits to report publicly at least annually about its Equator Principles implementation processes and experience, taking into account appropriate confidentiality considerations.

2.2.3 IFC Performance Standards on Social and Environmental Sustainability (Exhibit III of EP, July 2006)

As of April 30, 2006, the following list of IFC Performance Standards were applicable:

- Performance Standard 1: Social and Environmental Assessment and Management System
- Performance Standard 2: Labour and Working conditions
- Performance Standard 3: Pollution Prevention and Abatement
- Performance Standard 4: Community Health, Safety and Security
- Performance Standard 5: Land Acquisition and Involuntary Resettlement
- Performance Standard 6: Biodiversity Conservation and Sustainable Natural Resource management
- Performance Standard 7: Indigenous Peoples
- Performance Standard 8: Cultural Heritage

(The IFC Performance Standards, Guidance Notes (accompanying each performance standard), and Industry Sector EHS Guidelines can be found at www.ifc.org/enviro).

2.2.4 Industry-Specific Environmental, Health and Safety (EHS) Guidelines (Exhibit IV of EP)

The IFC uses two complementary sets of guidelines for its projects:

- Environmental guidelines contained in Part III of the World Bank Pollution Prevention and Abatement Handbook (PPAH) (July 1998). The relevant section of the PPAH, for the proposed project, is the Petrochemical Manufacturing Guidelines section. Additional regulations would also be referred to from the PPAH General Environmental Guidelines.
- A series of IFC environmental, health and safety guidelines (1991-2003). Ultimately new guidelines, incorporating cleaner production concepts and environmental management systems, will be written to replace this series of industry sector, PPAH and IFC guidelines.

2.2.4.1 Petrochemicals Manufacturing Guidelines, PPAH, World Bank Group (July, 1998)

The *Pollution Prevention and Abatement Handbook (PPAH)* (World Bank Group, July 1998) refers to guidelines for Petrochemicals manufacturing. Pollution prevention and treatment technologies recommended by the guidelines are taken into consideration in the preparation of the EIA. Guidelines are provided for pollution prevention, treatment technologies, pollutant loads, and allowable emissions, which are summarized in the following sections.

2.2.4.1.1 <u>Pollution Prevention and Control Guidelines</u>

- Reducing air emissions. Procedures suggested by the PPAH include:
  - minimise leakages of volatile organics from equipment, using good design practices and equipment maintenance procedures;
  - use mechanical seals where appropriate;
  - minimise loss from storage tanks, product transfer areas, and other process areas;
  - recover catalysts and reduce particulate emissions;
  - reduce nitrogen oxide emissions and optimize fuel usage; and
  - In some cases organics cannot be recovered and are destroyed by routing them to flares and other combustion devices.
- Elimination or reduction of pollutants. Procedures suggested by the PPAH include:
  - using non-chrome-based additives in cooling water; and
  - using long-life catalysts and regeneration to extend the cycle.

- Recycling and reuse. Procedures suggested by the PPAH include:
  - Recycling cooling water and treated waste water to the extent feasible; and
  - Recovery and reuse of spent solvents and other chemicals to the extent feasible.
- Improving Operating Procedures. Procedures suggested by the PPAH include:
  - Segregating process waste waters from storm water systems;
  - Optimising the frequency of tank and equipment cleaning;
  - Preventing solids and oily wastes from entering the drainage system; and
  - Establishing and maintaining an emergency preparedness and response plan.

2.2.4.1.2 Target Pollution Loads

Implementation of cleaner production processes and pollution prevention measures would serve to achieve economic and environmental benefits. The PPAH suggests the following production-related targets:

- Reduce total organic emissions (including Volatile Organic Compounds (VOCs)) from the process units to 0.6% of the throughput.
- Target maximum levels for air releases per ton of product are:
  - 0.06 kg for ethylene
  - 0.02 kg for ethylene oxide
  - 0.2 kg for vinyl chloride
  - 0.4 kg for 1,2-dichloroethane.
- Vapour recovery systems to control losses of VOCs from storage tanks and loading areas should achieve close to 100% recovery.

2.2.4.1.3 Treatment Technologies

A list of treatment technologies are suggested in the PPAH petrochemical guidelines, concerning air emissions, liquid effluents, solid and hazardous wastes. Such technologies would present useful tools to achieve cleaner production and to maintain effluent/emissions quality at acceptable levels.

2.2.4.1.4 Emissions Guidelines

The PPAH states that, for each project, the emission levels (for design and operation) are to be established through the Environmental Impact Assessment (EIA) process, based on the country legislation and the Pollution Prevention and Abatement Handbook, as applied to local conditions.

Air emission, liquid effluent, and ambient noise guidelines presented below indicate levels that normally acceptable to the World Bank Group.

Air Emissions

Table 2-5 shows the allowable levels for air emissions and target ambient air levels from petrochemical manufacturing.

Table 2-5: Air emissions from Petrochemicals Manufacturing and Target Ambient Levels (PPAH)

Parameter	Maximum value (mg/m^3)
PM (of all sizes)	20
Nitrogen Oxides	300
Hydrogen Chloride	10
Sulphur oxides	500
Benzene	5 mg/m^3 for emissions 0.1ppb at the plant fence
1,2-dichloroethane	5 mg/m^3 for emissions 1.0 ppb at the plant fence
Vinyl chloride	5 mg/m^3 for emissions 0.4 ppb at the plant fence
Ammonia	15 mg/m^3

Notes:

- Maximum ambient levels for ethylene oxide are 0.3 ppb at the plant fence;
- Maximum total emissions of the VOCs acetaldehyde, acrylic acid, benzyl chloride, carbon tetrachloride, chlorofluorocarbons, ethyl acrylate, halons, maleic anhydride, 1, 1, 1 trichlorethane, trichloroethylene, and trichlorotoluene are 20 mg/Nm^3,
- Maximum total heavy metals emissions are 1.5 mg/Nm^3.

The PPAH also provides general guidelines for industrial and commercial projects, for which there are no specific environmental guidelines. These criteria may be used as guidance for parameters/conditions that are not regulated by the petrochemicals manufacturing guidelines. The World Bank General Environmental Guidelines specify that ambient air concentrations at the property boundary should not exceed the values in Table 2-6.

Table 2-6: Ambient Air Conditions at Property Boundary, for General Application (General Environmental Guidelines, PPAH)

Pollutant	Maximum concentration (mg/m^3)
Particulate matter	
Annual arithmetic mean	50
Maximum 24-hour average	70
Nitrogen oxides	
Maximum 24-hour average	150
Sulphur dioxide	
Annual arithmetic mean	50
Maximum 24-hour average	125

Liquid effluents

Table 2-7 shows the allowable levels for liquid effluents from Petrochemical Manufacturing.

Table 2-7: Liquid effluents from Petrochemicals Manufacturing (PPAH)

(milligrams per litre, except for pH and temperature)

Parameter	Maximum value
pH	6-9
BOD	30
COD	150
TSS	30
Oil and grease	10
Cadmium	0.1
Chromium (hexavalent)	0.1
Copper	0.5
Phenol	0.5
Benzene	0.05
Vinyl chloride	0.05
Sulphide	1
Nitrogen (total)	10
Temperature increase	≤ 3°C[(a)]

Notes:

- Effluent requirements are for direct discharge to surface waters.

- Note (a). The effluent should result in a temperature increase of no more than 3°C at the edge of the zone where initial mixing and dilution take place. Where the zone is not defined, use 100 meters from the point of discharge.

The World Bank General Environmental guidelines also provide general regulatory limits for liquid effluents before being discharged to surface water, as presented in Table 2-8.

Table 2-8: Additional regulatory concentrations for effluents prior to discharge to surface waters, for general application (PPAH)

(milligrams per litre unless otherwise stated)

Parameter	Limit
Iron	3.5
Lead	0.1
Mercury	0.01
Nickel	0.5
Selenium	0.1
Silver	0.5
Zinc	2.0
Cyanide (free)	0.1
Cyanide (total)	1.0
Ammonia	10
Fluoride	20
Chlorine, total residual	0.2
Phosphorus	2.0
Coliform Bacteria	< 400 MPN/100 ml

Notes:

- MPN, most probable number
- Levels of pesticides, dioxins, furans, and other toxics, such as polynuclear aromatic hydrocarbons (PAHs), in effluent discharges, should not exceed either 100 times the WHO guidelines for drinking water or 0.05 mg/L.

Solid Wastes and Sludges

The generation of sludge should be minimised as much as possible, and treatment must be applied to reduce the concentrations of toxic organics to undetectable levels. For the wastes containing toxic metals, stabilisation is required before disposal.

Ambient Noise

After the application of noise abatement measures, noise levels should meet the criteria in Table 2-9 or a maximum increase in background levels of 3 decibels (measured on the A scale) [dB(A)]. Noise measurements should be recorded at noise receptors outside the project property boundary.

Table 2-9: Ambient Noise Allowable Levels (Petrochemicals Guidelines, PPAH)

(maximum allowable log equivalent (hourly measurements) in dB(A))

Receptor	Ambient Noise (maximum allowable log equivalent (hourly measurements), in dB(A))	
	Day (7am – 10pm)	Night (10pm -7am)
Residential, institutional, educational	55	45
Industrial, commercial	70	70

2.2.4.1.5 <u>Monitoring and reporting requirements of the PPAH</u>

As stipulated within the PPAH guidelines, frequent sampling may be required during start-up and upset conditions. Once a record of consistent performance has been established, sampling for the parameters listed in this document should be as described below:

- Air emissions from stacks should be visually monitored for opacity at least once every eight hours.
- Annual emissions monitoring of combustion sources should be carried out for sulphur oxides, nitrogen oxides, and the organics listed above, with fuel sulphur content and excess oxygen maintained at acceptable levels during normal operations.
- Leakages should be visually checked every eight hours and at least once a week using leak detection equipment.

- During start up or upset conditions, liquid effluents should be monitored at least once every eight hours for all the parameters cited above except metals, which should be monitored at least monthly.
- Each shipment of solid waste going for disposal should be monitored for toxic substances.
- Monitoring data should be analyzed and reviewed at regular intervals and compared with the operating standards so that any necessary corrective actions can be taken. Records of monitoring results should be kept in an acceptable format. The results should be reported to the responsible authorities and relevant parties, as required.

2.2.4.2 IFC Environmental, Health and Safety Guidelines

In addition to the General Health and Safety Guidelines, the IFC presents guidelines for 'Port and Harbour Facilities'. The latter are applicable for the design, construction, and use of ports, harbours and associated facilities. The requirements of these guidelines include:

- Project siting procedures should be conducted in a manner that takes into consideration environmental factors and minimises impacts, considers the application of the World Bank resettlement policy, indirect environmental and socio-cultural impacts, consultation with governmental agencies, affected communities, and NGOs, and considers the alternative sites;

- Dredging should take into consideration minimising impacts on environmental resources:
  - The dredging program should be designed to minimise impacts;
  - Field investigations and physical and chemical analyses of sediments should be conducted prior to dredging activities; and a plan should be developed to minimise sediment re-suspension in environmentally sensitive areas;
  - Evaluation of disposal options;
  - Minimising and monitoring turbidity at the dredged site; and,
  - Minimising the impacts associated with land disposal of dredged material.

- General environmental requirements:
  - Assessment of the potential impacts to shoreline vegetation, coral reefs, fisheries, bird life, other sensitive aquatic and near-shore habitat, etc. A plan should be developed to mitigate these impacts;

- Locations of stationary installations (e.g. waste water outfalls, underwater cables, pipelines) should be identified and incorporated in the dredging plan;
- Avoiding project designs that would increase saltwater intrusion to groundwater or surface waters;
- Mitigation of impacts on air quality during construction;
- Minimising the impacts on ambient noise levels;
- Emergency plans to prevent spills and fires during construction and operation;
- Minimising onsite storage of hazardous materials and wastes, which should be disposed of in accordance with local requirements. International conventions (e.g. the London Convention 1972, the Basel Convention, other regional waste management agreements) should be taken into consideration as a minimum requirement. "In no case should waste be indiscriminately dumped onto land or into surface, coastal or marine waters"; and,
- Assessment of pollution control options, according to the requirements of the International Convention for the prevention and Management of pollution from Ships (1973), as modified by the Protocol of 1978 relating thereto (MARPOL 73/78).

- Port and Harbour Safety:
  - Coordination is required with government agencies, including port and harbour safety and emergency response plans;
  - Coordination of harbour traffic with other marine activities;
  - General harbour safety operational measures, including signals, wind directional instruments, and emergency procedures;
  - Ensuring that only authorised personnel are allowed to enter hazardous or restricted areas;
  - Establishing procedures for handling, storage, and transportation of hazardous materials; and,
  - Implementation of operations and public emergency response programs for spills, fires and major accidents.

- Hazards Protection:

  Design criteria, as well as the location of the facilities should be chosen as to insure the minimisation of potential risks from earthquakes, tides, floods and fires, taking into consideration the local seismic risk, wind and snow loading or any other dynamically imposed loads associated with climatic or geological factors. Structural engineers or architects must provide a certification of the design criteria.

- Training:
  - Training is required for personnel involved in the construction and operation of the facility, in accordance with the General Health and Safety Guidelines and the General Environmental Guidelines;
  - Training of an on-site team for emergency response plans, and for handling oil and chemical spills and fire fighting equipment; and,
  - Training is required for the monitoring and mitigation of the environmental and socio-cultural impacts of the project.

- Record keeping and reporting:
  - Significant environmental matters must be recorded, including monitoring data, spills, occupational accidents and illnesses, fires, as well as any other emergencies;
  - A record of public complaints and accidents must be kept; and,
  - A review and evaluation of the above information must be conducted in order to improve the effectiveness of the environmental, health and safety program.

2.3 EU Legislation

The following summary of EU legislation is divided into sections relating to the different stages of production of an industrial plant, such as that proposed by EMethanex. Thus, the relevant EU Directives, are listed, along with a brief summary, according to the following subsections: Community Involvement and Environmental Management Standards; Processing; and Discharges (All EU legislation documents are viewable at http://europa.eu.int/eur-lex/en/search/search_lif.html).

It can be seen in the following summary that generally the EU legislation provides overarching guidance on environmental compliance (such as the Directive for legislation on Noise). Specific quantitative regulation is normally provided for within national legislation. Conversely, where there may be a lack of national regulation, the EU legislation may be adhered to.

Specific emission and effluent standards are given in certain Directives relating to air pollution and water effluents:

- Directive 01/80/EC Directive on the limitation of emissions of certain pollutants into the air from large combustion plants;
- Directive 99/30/EC Directive relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air; and
- Directive 00/69/EC Directive relating to limit values for benzene and carbon monoxide in ambient air.

The emission standards laid out in these Directives have been summarised in Table 2-10 alongside the equivalent standards stipulated in the Equator Principles (PPAH petrochemicals) and the Egyptian national legislation.

Note that in the following summary, where an 'annex' is referred to, this applies to the annex of the Directive.

2.3.1 Community Involvement and Environmental Management Standards

2003/4/EC Council Directive on public access to environmental information and repealing Council Directive 90/313/EEC

Objectives:

- To guarantee the right of access to environmental information held by or for public authorities and to set out the basic terms and conditions of and practical arrangements for its exercise; and
- To ensure that as a matter of course, environmental information is progressively made available and disseminated to the public in order to achieve the widest possible systematic availability and dissemination to the public of environmental information. To this end the use, in particular, of computer telecommunication and/or electronic technology, where available, shall be promoted.

2003/35/EC Directive providing for public participation in respect of the drawing up of certain plans and programmes relating to the environment and amending with regard to public participation and access to justice Council Directives 85/337/EEC and 96/61/EC - Statement by the Commission

Objectives:

- To contribute to the implementation of the obligations arising under the Arhus Convention in particular by:
  a) providing for public participation in respect of the drawing up of certain plans and programmes relating to the environment; and
  b) improving the public participation and providing for provisions on access to justice within Council Directives 85/337/EC and 96/61/EC

01/761/EC Commission Regulation allowing voluntary participation by organisations in a Community eco-management and audit scheme (EMAS) (+ corrigendum (OJ L 114 of 24.4.2001)

The Eco-Management and Audit Scheme (EMAS) is the EU voluntary instrument which acknowledges organisations that improve their environmental performance on a continuous basis. EMAS registered organisations are legally compliant, run an environment management system and report on their environmental performance through the publication of an independently verified environmental statement. They are recognised by the EMAS logo, which guarantees the reliability of the information provided.

Objectives:

- A scheme allowing voluntary participation by organisations to provide for the evaluation and improvement of the environmental performance of organisations and the provision of relevant information to the public and other interested parties.
- Promote continual improvements in the environmental performance of organisations by:

  - The establishment and implementation of environmental management systems by organisations as described in Annex 1;
  - The systematic, objective and periodic evaluation of the performance of such systems as described in Annex 1;
  - The provision of information on environmental performance and open dialogue with the public and other interested parties; and
  - The active involvement of employees in the organisation and appropriate initial and advanced training that makes active participation in the tasks referred to

under the first point possible. Where they so request any employee representatives shall also be involved.

The environmental management systems requirements (which are implemented according to the requirements laid out in ISO 14001:1996) are provided in Annex 1.

97/265/EC Commission Decision on the recognition of the international standard ISO 14001:1996 and the European standard EN ISO 14001:1996, establishing specification for environmental management systems, in accordance with Article 12 of Council Regulation (EEC) No 1836/93 of 29 June 1993, allowing voluntary participation by companies in the industrial sector in a Community eco-management and audit scheme (Text with EEA relevance)

This Commission Decision recognises ISO 14001:1996 in relation to EMAS Regulation.

85/337/EEC Council Directive on the assessment of the effects of certain public and private projects on the environment.

- *Council Directive 97/11/EC of 3 March 1997 amending Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment.*

This Directive applies to the assessment of the environmental effects of those public and private projects which are likely to have significant effects on the environment. Article 2: 'Member states shall adopt all measures necessary to ensure that, before consent is given, projects likely to have significant effects on the environment by virtue inter alia, of their nature, size or location are made subject to an assessment with regard to their effects'.

The EMethanex project is one subject to the regulation (as described in Article 4) since it is included in the list of activities described in Annex II (3. Energy industry, (b) Industrial installations for carrying gas, steam and hot water..').

2.3.2 Processing

67/548/EEC Directive on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances

This directive recognised the need to ensure the protection of public health, in particular the health of workers handling dangerous substances.

The Directive introduced common provisions on the

- classification of dangerous substances,
- packaging of dangerous substances,
- labelling of dangerous substances.

The Directive is permanently updated to take account of the scientific and technical progress in the field of dangerous substances. Until today it has been amended 9 times (9th Amendment: Directive 1999/33/EC) and adapted to technical progress 29 times. Protecting the environment from the dangerous effects of substances was only introduced with the 6th amendment of the Directive, adopted in 1979.

Currently there are fifteen classes of danger in Directive 67/548/EEC, such as “explosive”, “very toxic”, “carcinogenic” or “dangerous for the environment”. The Directive also includes a list of substances classified as dangerous in Annex I, danger symbols (such as a skull with crossed bones underneath) in Annex II, standard phrases on the nature of special risks from substances (R-phrases) in Annex III and the wording of safety precaution phrases (S-phrases) relating to the handling and use of dangerous substances in Annex IV. Annex V contains testing methods to determine the dangerous properties of substances, Annex VI provides detailed criteria on the proper choice of the class of danger and on how to assign the danger symbols, R- and S-phrases to a tested substance. Annexes VII and VIII do not relate to the classification or labelling of substances, but to the notification of “new” substances. Annex IX includes provisions on child-proof fastenings and tactile warning devices as special packaging and labelling elements.

2.3.3 Discharges

2.3.3.1 Waste

75/442/EEC Framework Directive on waste.

- *Amending acts: 91/156/EEC Directive,* 91/692/EEC *Directive,* 96/350/EEC *Directive and Regulation (EC) No* 1882/2003

These measures apply to all substances or objects that the holder disposes of or is obliged to dispose of pursuant to the national provisions in force in the Member States. They do not apply to radioactive waste, mineral waste, animal carcases and agricultural waste, waste water, gaseous effluents, and waste subject to specific Community rules.

Member states should take the necessary measures to ensure that waste is recovered or disposed of without endangering human health and without using processes or methods which could harm the environment and in particular:

- Without risk to water, air soil and plants and animals;
- Without causing a nuisance through noise or odours; and
- Without adversely affecting the countryside or places of special interest.

More specific legislation on waste disposal may be stipulated by member states (i.e. national law).

2.3.3.2 Water effluent

91/271/EEC Council Directive concerning urban waste water treatment.

- *Commission Directive 98/15/EC of 27 February 1998 amending Council Directive 91/271/EEC with respect to certain requirements established in Annex I thereof (Text with EEA relevance)*

This Directive concerns the collection, treatment and discharge of urban waste water and the treatment and discharge of waste water from certain industrial sectors. Its aim is to protect the environment from any adverse effects due to discharge of such waters.

Industrial waste water entering collecting systems, and the disposal of waste water and sludge from urban waste water treatment plants, are both subject to regulations and/or specific authorisations on the part of the competent authorities.

The Directive establishes a timetable, which Member States must adhere to, for the provision of collecting and treatment systems for urban waste water in agglomerations which meet the criteria laid down in the Directive. The main deadlines are as follows:

- o 31 December 1998: all agglomerations of more than 10 000 "population equivalent" * (p.e.) which discharge water into sensitive areas must have a proper collection and treatment system;
- o 31 December 2000: all agglomerations of more than 15 000 p.e. must have a collection and treatment system which enables them to satisfy the requirements in Table 1 of Annex I; and
- o 31 December 2005: all agglomerations of between 2 000 and 10 000 p.e. which discharge water into sensitive areas, and all agglomerations of between 2 000

and 15 000 p.e. which do not discharge into such areas must have a collection and treatment system.

Annex II requires Member States to draw up lists of sensitive and less sensitive areas that receive the treated waters. These lists must be updated regularly.

The treatment of urban water is to be varied according to the sensitivity of the receiving waters. The Directive lays down specific requirements for discharges from certain industrial sectors of biodegradable industrial waste water not entering urban waste water treatment plants before discharge to receiving waters.

Annex I: Requirements for Urban Waste Water:

C. Industrial waste water

Industrial waste water entering collecting systems and urban waste water treatment plants shall be subject to such pre-treatment as is required in order to:

- Protect the health of staff working in collecting systems and treatment plants;
- Ensure that collecting systems, waste water treatment plants and associated equipment are not damaged;
- Ensure that the operation of the waste water treatment plant and the treatment of sludge are not impeded;
- Ensure that discharges from the treatment plants do not adversely affect the environment, or prevent receiving water from complying with other Community Directives; and
- Ensure that sludge can be disposed of safety in an environmentally acceptable manner.

76/160/EEC Council Directive concerning the quality of bathing water.

Concerns the quality of bathing water, with exception of water intended for therapeutic purposes and water used in swimming pools.

The Directive lays down the minimum quality criteria to be met by bathing water:

- the physical, chemical and microbiological parameters;
- the mandatory limit values and indicative values for such parameters; and

- the minimum sampling frequency and method of analysis or inspection of such water.

Effluent standards for pH, colour, mineral oils, surface active substances reacting with methylene blue, phenols, transparency, dissolved oxygen, tarry residues, ammonia, nitrogen kjeldahl, heavy metals, nitrates and phosphates (among others) are provided in the table included in Appendix VII.

2000/60/EC Directive establishing a framework for Community action in the field of water policy (Water Framework Directive).

The purpose of this Directive is to establish a framework for the protection of inland surface water, transitional waters, coastal waters and groundwater which:

- Prevents further deterioration and protects and enhances the status of aquatic ecosystems and with regard to their water needs, terrestrial ecosystems and wetlands directly depending on the aquatic ecosystems;
- Promotes sustainable water use based on long-terms protection of available water resources;
- Aims at enhanced protection and improvement of the aquatic environment, inter alia, through specific measures for the progressive reduction of discharges, emissions and losses of priority substances and the cessation or phasing-out of discharges, emissions and losses of the priority hazardous substances;
- Ensures the progressive reduction of pollution of groundwater and prevents its further pollution; and
- Contributes to mitigating the effects of floods and droughts and thereby contributes to:
    - The provision of the sufficient supply of good quality surface water and groundwater as needed for sustainable balanced and equitable water use,
    - A significant reduction in pollution of groundwater.

80/68/EEC Directive on the protection of groundwater against pollution caused by certain dangerous substances

This Directive will be repealed by the Water Framework Directive (in 2013).

Objective: To prevent the pollution of groundwater by substances belonging to the families and groups of substances in lists I or II in the Annex, and as far as possible to check or eliminate the consequences of pollution that has already occurred.
Lists I or II in the Annex are shown in Appendix VII.

76/464/EEC Directive on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community

- *Council Directive 86/280/EEC of 12 June 1986 on limit values and quality objectives for discharges of certain dangerous substances included in List I of the Annex to Directive 76/464/EEC Complement to 76/464/EEC*
- *Amended by Directive 91/692/EEC standardizing and rationalizing reports on the implementation of certain Directives relating to the environment*

This Directive will be repealed by the Water Framework Directive (in 2013).

Objective: to harmonise the legislation of the Member States on discharges of certain dangerous substances into the aquatic environment and to take preventive action at source.

Both these Directives have been corrected and amended several times (see Appendix VII).
The Directive applies to inland surface water, territorial waters, internal coastal waters and groundwater.

To eliminate pollution of these waters, two lists of dangerous substances to be monitored are established:

- pollution caused by discharges of substances on list I must be ended; and
- pollution caused by products on list II must be reduced.

Directives on limit values and quality objectives for discharges of certain dangerous substances are included in List I of the Annex to Directive (see Appendix VII).

2.3.3.3 Air emissions

2001/80/EC Directive on the limitation of emissions of certain pollutants into the air from large combustion plants (+ Corrigendum)

This Directive applies to combustion plants, the rated thermal input of which is equal to or greater than 50 MW irrespective of the type of fuel used (solid, liquid or gaseous).

The aim of the Directive is gradually to reduce the annual emissions of sulphur dioxide and oxides of nitrogen from existing plants and to lay down emission limit values for sulphur dioxide, nitrogen oxides and dust in the case of new plants.
Provisions concerning permits for the construction of combustion plants or licences for the operation of new plants:

- o must comply with the emission limit values laid down in part B of Annexes III to VII for sulphur dioxide, oxides of nitrogen and dust.

The methods of measurement of emissions are defined in Annex VIII. Member States must take the necessary measures to ensure that emissions from the plants covered by the Directive are monitored. They may require such monitoring to be carried out at the operator's expense.

The emission standards relevant to the EMethanex plant, detailed in the Annexes of this Directive are summarised in Table 2-10.

00/69/EC Directive relating to limit values for benzene and carbon monoxide in ambient air

Objectives:

a) to establish limit values for concentrations of benzene and carbon monoxide in ambient air intended to avoid, prevent or reduce harmful effects on human health and the environment as a whole;
b) to assess concentrations of benzene and carbon monoxide in ambient air on the basis of common methods and criteria;
c) to obtain adequate information on concentrations of benzene and carbon monoxide in ambient air and ensure that it is made available to the public; and
d) to maintain ambient air quality where it is good and improve it in other cases with respect to benzene and carbon monoxide.

Annex II Limit value for Carbon Monoxide:

Averaging period: Maximum daily 8 hour mean

Limit value: 10 mg/m³.

Date of limit enforcement: January 2005.

Detailed descriptions of the measurement and assessment of concentrations of benzene and carbon monoxide are given.

99/30/EC Directive relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air

To maintain or improve the quality of ambient air, the EU has established limit values for concentrations of sulphur dioxide, nitrogen dioxide and nitrogen oxides, particulate matter and lead, as well as alert thresholds for concentrations of sulphur dioxide and nitrogen oxide, in ambient air. It has also laid down common methods and criteria for evaluating those concentrations, and gathers appropriate information on such concentrations in order to keep the public informed.

The emission standards in this Directive are included in Table 2-10.

2.3.3.4 Noise

2002/49/EC Directive relating to the assessment and management of environmental noise

Objective: to provide a common basis for tackling the noise problem across the EU. The underlying principles of this text, are similar to those for other overarching environment policy Directives:

- **Monitoring the environmental problem**; by requiring competent authorities in Member States to draw up "strategic noise maps" for major roads, railways, airports and agglomerations, using harmonised noise indicators L_{den} (day-evening-night equivalent level) and L_{night} (night equivalent level). These maps will be used to assess the number of people annoyed and sleep-disturbed respectively throughout Europe;
- **Informing and consulting the public** about noise exposure, its effects, and the measures considered to address noise, in line with the principles of the Aarhus Convention;
- **Addressing local noise issues** by requiring competent authorities to draw up action plans to reduce noise where necessary and maintain environmental noise quality where it is good. <u>The Directive does not set any limit value, nor does it prescribe the measures to be used in the action plans, which remain at the discretion of the competent authorities</u>; and

- o **Developing a long-term EU strategy**, which includes objectives to reduce the number of people affected by noise in the longer term, and provides a framework for developing existing Community policy on noise reduction from source. With this respect, the Commission has made a declaration concerning the provisions laid down
- o in article 1.2 with regard to the preparation of legislation relating to sources of noise.

2.3.3.5 Biodiversity

EU nature conservation policy is based on two main Directives - the Birds Directive and the Habitats Directive and benefits from a specific financial instrument - the LIFE-Nature fund. Its priorities are to create the European ecological network (of special areas of conservation), called NATURA 2000, and to integrate nature protection requirements into other EU policies such as agriculture, regional development and transport.

92/43/EEC Directive on the conservation of natural habitats and of wild fauna and flora

This Directive aims to protect other wildlife species and habitats. Each Member State is required to identify sites of European importance and to put in place a special management plan to protect them, combining long-term conservation with economic and social activities, as part of a sustainable development strategy. These sites, together with those of the Birds Directive, make up the Natura 2000 network - the cornerstone of EU nature protection policy. The Natura 2000 network already comprises more than 18 000 sites, covering over 17% of EU territory, and is due to be completed in 2005 for EU 15. It is co-financed through the Commission's LIFE programme (set up in 1992 to develop EU environmental policy) and other Community finance instruments.

79/409/EEC Directive on the conservation of wild birds

The 1979 Birds Directive identified 193 endangered species and sub-species for which the Member States are required to designate Special Protection Areas (SPAs). Over 4000 SPAs have been designated to date, covering 8% of EU territory.

2.3.3.6 Other

96/61/EC Directive concerning integrated pollution prevention and control (IPPC) (+ 4 Corrigendums)

Objective:

This Directive ("the IPPC Directive") imposes a requirement for industrial and agricultural activities with a high pollution potential to have a permit which can only be issued if certain environmental conditions are met, so that the companies themselves bear responsibility for preventing and reducing any pollution they may cause.

Integrated pollution prevention and control concerns highly polluting new or existing industrial and agricultural activities, as defined in Annex I to the Directive (energy industries, production and processing of metals, mineral industry, chemical industry, waste management, livestock farming, etc.). Relevant sections from Annex I of the Directive are also included in Appendix VII.

Mandatory environmental conditions

In order to receive a permit an industrial or agricultural installation must comply with certain basic obligations. In particular, it must:

- use all appropriate pollution-prevention measures, namely the best available techniques (which produce the least waste, use less hazardous substances, enable the recovery and recycling of substances generated, etc.);
- prevent all large-scale pollution;
- prevent, recycle or dispose of waste in the least polluting way possible;
- achieve efficient energy use;
- ensure accident prevention and damage limitation; and
- return sites to their original state when the activity is over.

In addition, the decision to issue a permit is accompanies by a number of specific requirements, in particular including:

- emission limit values for polluting substances (with the exception of greenhouse gases if the emissions trading scheme applies - see below);
- any soil, water and air protection measures required;
- waste management measures;
- measures to be taken in exceptional circumstances (leaks, malfunctions, temporary or permanent stoppages, etc.);
- minimisation of long-distance or transboundary pollution;

- release monitoring; and
- and other appropriate measures as required.

2.4 Summary of Emission Standards

A summary of the relevant emission standards is provided in Table 2-10 according to the different legislation applicable to the EMethanex project. This summary facilitates comparison of the applicable emission standards for the relevant pollution parameters. In Table 2-10, the black text highlights the strictest standards.

It can be seen that where NOx, SO_2, CO and particulate matter is concerned, the EU standards are the strictest, although matched in some cases by the national law. For noise standards, national legislation is the most stringent, although matched in some cases by the EP standards. For temperature of marine effluents, the EP standards are most stringent. Where the NO_x and SO_2 emissions are concerned, emission ceilings from two Directives (in 1999 and 2001) have been included. This is because the more recent 01/80/EC Directive has not repealed the older 99/33/EC Directive.

Table 2-10: Summary of Emission Standards

Parameters	EU Standards	Equator Principles PPAH for Petrochemicals (based on WB and IFC standards)	Egyptian National Law 4/ 1994 and executive regulations)	Comments/notes
NOx emissions (measured as NO_2)	**DIRECTIVE: 01/80/EC** Solid fuel (50 – 500 MWth): 600 mg/Nm³ Solid fuel (>500 MWth): 500 mg/Nm³ (From 1 January 2016 Solid fuel (50 – 500 MWth): 600 mg/Nm³ (>500 MWth): 200 mg/Nm³) Liquid fuel (50 – 500 MWth): 450 mg/Nm³ (>500 MWth): 400 mg/Nm³ Gaseous: (50 – 500 MWth): 300 mg/Nm³ (>500 MWth): 200 mg/Nm³ **DIRECTIVE: 99/30/EC** 200 µg m^3 (Average period 1 hour) not to be exceeded more than 18 times a calendar year. Due date to meet limit: 1/1/10 40 µg m^3 (Average period 1 year) Due date to meet limit: 1/1/10 Annual value for the protection of vegetation: 30 µg/m³ (Average period 1 year). Due date to meet limit 19/7/01(no margin of tolerance)	Liquid fuel (Nitrogen total) 10 mg/l Gaseous fuel: 300 mg/Nm³	**NO_2** 400 µg m^{-3} (Average period 1 hour) 150 µg m^{-3} (Average period 24 hours)	EC Directive **01/80/EC** applies to combustion plants, the rated thermal input of which is equal to or greater than 50 MW, irrespective of the type of fuel used (solid, liquid or gaseous). (O_2 content 6% for solid fuels, 3% for liquid and gaseous fuels) **Directive 99/30/EC:** The volume must be standardised at a temperature of 293 °K and a pressure of 101,3 kPa. Alert threshold for nitrogen dioxide: 400 µg/m³ measured over three consecutive hours at locations representative of air quality over at least 100 km² or an entire zone or agglomeration whichever is the smaller. Margin of tolerance for both 1 hour and 1 year averaging periods: 50% on the entry into force of this Directive, reducing on 1 Jan 2001 and every 12 months thereafter by equal annual percentages to reach 0% by 1 Jan 2010.

Parameters	EU Standards	Equator Principles PPAH for Petrochemicals (based on WB and IFC standards)	Egyptian National Law 4/ 1994 and executive regulations)	Comments/notes
SO_2 emissions	**DIRECTIVE: 01/80/EC** 50 – 100 MWth: 850 mg/Nm³ 100-300 MWth: 400 to 200 mg/Nm³ (Linear decrease, see graph in Directive) >300 MWth: 200 mg/Nm³ Liquefied gas: 5 mg/Nm³ Gaseous fuel: 35 mg/Nm³ **DIRECTIVE: 99/30/EC** 350 µg m^3 (Average period 1 hour) not to be exceeded more than 24 times a calendar year. Due date to meet limit: 1/1/05 125 µg m-3 (Average period 24 hours) not to be exceeded more than 3 times a calendar year. Due date to meet limit: 1/1/05 Limit value for the protection of ecosystems: 20 µg m^{-3} (Average period 1 year and winter 1 Oct to 31 March) Due date for limit: 19/7/01	Gaseous: 500 mg/Nm³	350 µg m^{-3} (Average period 1 hour) 150 µg m^{-3} (Average period 24 hours) 60 µg m^{-3} (Average period 1 year)	EC Directive **01/80/EC**: SO_2 emission limit values expressed (0_2 content 3%) **Directive 99/30/EC:** Alert threshold for sulphur dioxide: 500 µg/m³ measured over three consecutive hours at locations representative of air quality over at least 100 Km² or an entire zone or agglomeration, whichever is the smaller. The volume must be standardised at a temperature of 293 °K and a pressure of 101,3 kPa.
Particulate Emission PM10	**DIRECTIVE: 01/80/EC** Solid fuels (O_2 content 6%): ≥ 500 MW: 50 mg/Nm³ < 500 MW: 100 mg/Nm³ Liquid fuels (O_2 content 3 %): All plants: 50 mg/Nm³ Gaseous fuel (O_2 content 3 %): As a rule: 5 mg/Nm³ **DIRECTIVE: 99/30/EC** 50 µg/m³ (Averaging period 24 hours) Not to be exceed more than 35 times a calendar year 40 µg/m³ (averaging period 1 year)	Gaseous: 20 mg/Nm³. This applies to PM of all sizes.	Gaseous: 150 µg m^{-3} (Average period 24 hours) 70 µg m^{-3} (Average period 1 year) Suspended particles measured as black smoke: 150 µg m^{-3} (24 hrs averaging period) 60 µg m^{-3} (1 year averaging period). Total Suspended Particles: 230 µg m^{-3} (24 hrs averaging period) 90 µg m^{-3} (1 year averaging period)	**DIRECTIVE: 99/30/EC** For 24 hour period, margin of tolerance is 50% on the entry into force of this Directive, reducing on 1 Jan 2001 and every 12 months thereafter by equal annual percentages to reach 0% by 1 Jan 2005. For calendar year 20% on the entry into force of this Directive, reducing on 1 Jan 2001 and every 12 months thereafter by equal annual percentages to reach 0% by 1 Jan 2005

Parameters	EU Standards	Equator Principles PPAH for Petrochemicals (based on WB and IFC standards)	Egyptian National Law 4/ 1994 and executive regulations)	Comments/notes
CO	**DIRECTIVE: 00/69/EC** Limit value: 10 mg/m³. Averaging period: Maximum daily 8 hour mean	Not included in the PPAH	30,000 $\mu g\ m^{-3}$ (Average period 1 hour) 10,000 $\mu g\ m^{-3}$ (Average period 8 hour)	
Noise	**DIRECTIVE: 02/49/EC** The Directive does not set any limit value, nor does it prescribe the measures to be used in the action plans, which remain at the discretion of the competent authorities.	Industrial, commercial location: 70 dB(A) Day time (7am – 10pm) 70 dB(A) Night time (10pm – 7 am)	Industrial Zone (heavy industries): 70 dB(A) Day time (7am – 6pm) 65 dB(A) Evening (6pm–10pm) 60 dB(A) Night (10pm–7am)	
Temperature of Marine Effluent		≤3 °C	Should not exceed 10°C above prevailing rate, with a maximum of 38°C	For PPAH value the effluent should result in a temperature increase of no more than 3 °C at the edge of the zone where initial mixing and dilution take place. Where the zone is not defined, use 100 m from the point of discharge.
pH of Marine Effluent		6 - 9	6 - 9	

Note

The legislation that has been described in this chapter is believed to be a comprehensive summary of the existing legislation that may be applicable to the EMethanex plant. However this information was not prepared by a legal expert, it is recommended that legal advice is sought for confirmation of the required compliance in all areas.

2.5 Methanex Requirements/Commitments

2.5.1 Methanex as Responsible Care Company

In 1996, Methanex was the first company to be globally verified under Responsible Care. It is at the core of the Company's corporate value system and its principles and ethical guidelines govern Methanex's approach to business practices. Responsible Care is well known and understood in the chemical industry, but is not as well known in other industries and in many of the markets where Methanex does business.

As Methanex continues to grow and pursue new business opportunities in a greater number of countries and regions around the world, it is apparent that many business and social best practices go beyond the traditional environmental, health and safety focus of Responsible Care. In 2004, Methanex initiated a process to formalize an enhancement to Responsible Care under the more globally-recognized banner of Corporate Social Responsibility.

Many of Methanex's social investment programs, such as those involving community outreach and education initiatives, have been in place for a number of years. In addition, well planned and consistently implemented employee engagement and development systems have made Methanex an employer-of-choice. In order to more effectively measure and track progress on a global scale, these and other programs have been formalized under a Corporate Social Responsibility policy. This is an important and obvious next step for Methanex in its continuing commitment to Responsible Care and all that it stands for.

Combined, these two ethics will serve Methanex as the banner under which it publicly reports its annual Environmental Health and Safety performance, as well as its commitment to initiatives and actions related to Emergency Preparedness, Corporate Governance, the Company's Code of Business Conduct and global Social Investment policy and practices.

Methanex aligns its business strategy of Global Methanol Leadership with a corporate value system based on trust, respect, integrity and professionalism. This fits extremely well with Methanex's global commitment to Responsible Care. Global standards that require the same level of performance in Responsible Care are set for all of Methanex's facilities worldwide.

2.5.2 Methanex Environmental Policy

Methanex is fully committed to reducing the impact its operations might have on the environment. The methanol production process is very clean, producing few solid or liquid wastes and all Methanex production facilities have effective waste control and handling systems. Methanol, is a clear liquid made primarily from natural gas. It represents a low long-term risk to the environment because it is soluble in water and readily biodegradable. However, methanol is flammable and can be toxic and must be handled and transported with care at all times. Methanex's Responsible Care culture ensures that environmental regulatory compliance is considered to be a minimum standard and that much more is done to protect people, the environmental and the communities in which the firm operates.

2.5.3 Methanex Environmental Standard for New Facility

This environmental standard applies to all Methanex proposed new facilities. It sets the criteria to be evaluated during initial site assessment and engineering design in order to ensure that the completed facility conforms to "Best Practicable" environmental technology and practice and is in compliance with Responsible Care Principles.

2.6 Egyptian Petrochemicals Holding Company (ECHEM) HSE Management System

On behalf of the Ministry of Petroleum, ECHEM is responsible for implementing the National Petrochemicals Master Plan which includes establishing a number of petrochemical plants before the year 2022. ECHEM is also responsible for provision of governance to operating companies (referred to as business units) such as the Egyptian Petrochemicals Company (EPC) and Sidi Krier Petrochemicals Company (SIDPEC).

ECHEM holds custodianship of the reputation of the Egyptian Petrochemicals Industry which includes HSE aspects.

ECHEM on behalf of the Ministry of Petroleum is the Competent Administrative Authority (CAA) and the controller of petrochemical projects in Egypt. The Ministry of State for Environmental Affairs (MSEA) Egyptian Environmental Affairs Agency (EEAA) is the regulator for such projects imposing laws, guidelines and standards and limits and conduct environmental monitoring inspections.

ECHEM is also the bridge between the project proponent and the EEAA. Environmental Impact Assessment studies are submitted to ECHEM and ECHEM sends them formally to the EEAA for review and recommendations. After sixty days EEAA will send their reply to ECHEM by registered letter. ECHEM together with the governorate where the project takes place will then give approval to start the project.

ECHEM recognizes that the protection of the health and safety of its employees and others involved in or affected by its activities, and the protection of the natural environment, are an integral part of the company's business performance and a prime responsibility of all the workforce and related companies at every level. The company is committed to achieve World Class HSE performance in accordance with good petrochemicals practice.

Specifically, ECHEM and its business units will:

- Comply with relevant legislation and approved codes of practice, improving on the performance standards they specify where it is reasonably practicable and co-operating fully with enforcement Agencies and non-statutory bodies of Egypt in undertaking its duties.
- Develop and maintain effective contingency plans where appropriate, in conjunction with authorities and emergency services.
- Assess the environmental, industrial hygiene and health and safety impacts of its activates and manage the associated risks.
- Consider the health and safety of others and the natural environment.
- Aim to make continuous improvement in its safety and environmental management systems so that accidents are reduced, pollution is prevented and environmental emissions, waste, and use of energy are continually reviewed [reduced?].
- Require our contractors and sub-contractors to demonstrate the same level of commitment improve standards of care for health, safety and the environment.
- Foster an understanding of health, safety and environmental issues relating to its business amongst staff, related companies, suppliers, contractors and communities local to its operations; and will seek to understand and consider their concerns.
- Establish a framework for regular review of HSE objectives and targets.
- Ensure compliance with the policy through a process of review and audit.

3 DESCRIPTION OF THE PROPOSED PROJECT

3.1 Schedule

A 33-month construction schedule is planned for this project with site preparation to begin in the first quarter of 2007 (subject to necessary approvals being in place); thereby allowing for the methanol plant to be commissioned in 2009. Therefore, the commercial operation of Phase I will be in 2010. Table 3-1 illustrates the anticipated schedule for the proposed project:

Table 3-1: Project Schedule

Task	Date
Detailed Engineering	Mid 2006
Engineering and Construction	33-months
Operation Start-up Phase I	2010
Operation Start-up Phase II	2015

3.2 Construction Materials, Equipment, and Activities

The construction scope will include general site grading, building of the access and service roads, construction of administrative, control and maintenance buildings, installation of the methanol process unit, steam generation and fresh raw water intake treatment and other utility systems, diesel emergency generators, a cooling water tower and other ancillary facilities. A crude/off-spec methanol tank will be constructed for storage of crude from letdown vessel as well as off-spec methanol from the shift tanks and other locations.

Furthermore, two methanol product tanks will be constructed and supplied with pumps to convey methanol product to jetty to load ships for exporting.

Site grading will be minimal due to the current level nature of the site. The general earth work will consist of cut and fill activities for grading of the site, construction of dikes, foundation and pavement sub-grade preparation and excavation and backfill for utilities and drainage facilities. Other major on-site activities will include erection of process vessels, acceptance and placement of major fabricated equipment items, construction of buildings, testing and commissioning of rotating equipment, vessels and piping.

3.3 Operational Activities

After the construction phase, the methanol plant will be pre-commissioned to prepare and test the facility for the initial plant start-up. Once commissioned the methanol plant will operate 24 hours a day, seven days a week. A maintenance building staffed with skilled labour is provided to support all maintenance activities for the facility. The major components of the methanol plant will be designed to have a life of more than 25 years.

3.4 Decommissioning Activities

Following the facility's 25 years lifespan a decommissioning plan will be developed which will be cognisant of relevant legislation and international best practice at the time and will meet the standards of a Responsible Care Company.

3.5 Process Description

The overall site plan of the facility is shown in Figure 3-1 (Appendix XII), which indicates the location of the facility in relation to Damietta Port and the Mediterranean shoreline. Furthermore, Figure 3-2 (Appendix XII) highlights the locations of the various project components and project-related facilities. A 3600 metric ton per day (MTPD) methanol plant is proposed for Egypt as the first EMethanex plant during phase I of the project. The plant will produce International Methanol Producers and Consumers Association "IMPCA" grade methanol from natural gas via the combined reforming methanol technology.

3.5.1 Process Chemistry

Methanol is produced by reacting hydrogen with carbon oxides (CO and CO2) in the presence of a catalyst. These reactants are made from natural gas (predominately methane) using the reforming process. The combined reforming process comprises, steam reforming and auto-thermal catalytic reforming.

In steam reforming natural gas and steam are catalytically converted into hydrogen and carbon oxides via the following chemical reactions:

$$CH_4 + H_2O \rightarrow CO + 3H_2$$
$$CO + H_2O \rightarrow CO_2 + H_2$$

The overall reaction is highly endothermic and requires heat to be supplied for the reaction to proceed. This heat is provided by combustion of fuel gas in the reformer furnace fire box. The principal reactions involved in auto-thermal catalytic reforming are those to complete the methane combustion and the partial oxidation of methane in the following reactions:

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$
$$CH_4 + O_2 \rightarrow CO + H_2 + H_2O$$

Both of these reactions are highly exothermic in that they release heat. In order to achieve the optimum reformer outlet gas composition for methanol synthesis the outlet temperature is controlled by regulation of the oxygen supply to the reactor. Methanol is synthesized from the auto-thermal reactor effluent gases in the presence of a selective copper based catalyst. The main reactions are:

$$CO + 2H_2 \rightarrow CH_3OH$$
$$CO_2 + 3H_2 \rightarrow CH_3OH + H_2O$$

These reactions are exothermic. This heat is removed through interchange of feed (reactant) gases into the reaction step.

3.5.2 Process Outline

The combined reforming technology includes four main process areas plus utilities and off-sites. These main areas listed below with their relevant sub-steps;

Natural Gas Preparation

- Natural Gas Conditioning
- Natural Gas Compression
- Natural Gas Saturation

Natural Gas Reforming

- Primary (or steam-methane) Reforming (with flue gas heat recovery)
- Auto-Thermal Reforming (with oxygen from the Air Separation Unit)
- Reformed Gas Cooling Train (including steam raising and heat recovery)

Methanol Synthesis

- Reformed Gas Compression
- Methanol Synthesis Loop

Methanol Distillation

- Dissolved Gas / Light Impurity Separation Step
- Methanol and Water Separation Step

Utilities

- Plant Steam System (including deaeration of boiler feed water and steam generation)
- Nile River Water Treatment (for fresh water cooling tower and boiler feed water)
- Air Separation Unit (oxygen, nitrogen and plant / instrument air)
- Effluent Treatment and handling
- Safety Systems (plant flare system, fire water system)
- Methanol Tankage and Storage

Off-sites

- Methanol Loading Facilities (including truck and ship loading)
- Nile River Water Intake System
- Effluent Discharge Line

A detailed description of the utilities and off-sites will be discussed in a separate section in this report and in particular in Section 3.6. An overview of the plant process areas is shown in Figure 3-3 (Appendix XII).

3.5.2.1 Natural Gas Preparation

The natural gas conditioning steps include mercury and sulphur removal by adsorption of the impurities onto fixed bed catalysts. The sulphur species are removed by a two stage process at medium temperature, whereby recycled hydrogen from the methanol synthesis loop is used to convert the sulphur species to hydrogen sulphide over a hydro-desulphurization catalyst. The hydrogen sulphide is then removed by being adsorbed onto a ZnO catalyst.

The ZnO vessels are arranged in a lead/lag way, such that once sulphur breakthrough is detected on the lead bed, this bed can be removed from the system and the catalyst replaced, without incurring any plant downtime.

Once the impurities are removed from the natural gas, the gas is compressed to the required pressure for the downstream process. Natural gas required for fuel in the primary reformer and process boilers is drawn immediately upstream of the compression step.
The synthesis gas reaction requires steam to react with the hydrocarbons to produce a mixture of carbon oxides and hydrogen. In order to add the steam in an energy efficient manner, the gas flows counter-current over a packed column with water heated by recovering energy from the methanol synthesis loop. The gas leaving this column is saturated with water/steam. Additional “live” steam is then added directly in order to control the correct ratio of gas to steam.

3.5.2.2 Natural Gas Reforming

Synthesis gas is generated by heating the steam and natural gas mixture and passing it over a nickel catalyst in the primary (steam-methane) reformer. The process gas exiting the primary reformer is then passed to an Auto Thermal Reformer (ATR), whereby oxygen, generated from the Air Separation Unit (ASU), is burnt in the presence of the partially reformed primary reformer exit stream producing a synthesis gas with very low methane content. The reforming reaction is endothermic and the heat required for the reaction is provided in the primary reformer by burning a mixture of natural gas and methanol synthesis gas. The heat for the ATR is provided by combustion of oxygen.

The primary reformer is fired from a mixture of natural gas fuel, and methanol synthesis loop purge gas, which is taken from the synthesis loop in order to prevent the build-up of inert materials in the loop, such as methane, etc. The waste flue gases are cooled, and energy is recovered from this gas stream into the steam system, by superheating high pressure steam and preheating the primary reformer feed streams.

The reformed gas stream exiting the ATR at high temperature is cooled to condense water in the gas stream. Energy is recovered from the process by generating steam in the reformed gas boilers (or waste heat boilers), and providing re-boil heat to the distillation system, and finally air/water cooling, to condense water in the gas stream. The recovered water, referred to as process condensate is collected and used to make-up the circulating water stream for the gas saturation step, described above.

3.5.2.3 Methanol Synthesis

Reformed gas is cooled prior to the compression step, whereby the gas is fed into the circulating methanol synthesis loop at around 80 barg. The mixture of carbon oxides and hydrogen pass over a copper based synthesis catalyst and react to form methanol and water.

The reaction is exothermic, and the heat of reaction is removed by transferring energy from the reaction to the circulating water for the gas saturation step, described above. Energy is also transferred to the synthesis gas feed inside this circulating loop. Only a portion of the feed gas is converted to methanol for each pass through the reactors, and the stream exit the converters is cooled/condensed to remove the liquid methanol and water mixture, before the un-reacted gases are recompressed and circulated back through the reactors, along with the fresh synthesis feed. In order to prevent a build up of impurities in this loop a purge gas stream is removed upstream of the compression stage. This purge stream is used as feed to the primary reformer fuel system.

3.5.2.4 Methanol Distillation

The mixture of liquid methanol and water is let-down in pressure from approximately 80 barg synthesis loop to around 5 barg. The flash gases given off in this letdown stage are collected and burnt as fuel in the primary reformer.

The liquid mixture is pumped to a distillation column system, in this case a three column system, whereby the first called the topping column removes any of the light impurities, which are collected and burnt as fuel in the primary reformer. Re-boil heat for this column is provided from cooling of the reformed gas stream.

The “topped” methanol stream from the base of the topping column contains methanol / water and is pumped into a high pressure refining column, whereby heat for the separation is provided by cooling of the reformed gas stream. In this column pure methanol is drawn from the top of the column while a mixture of methanol and water from the bottom is pumped to a third column called the recovery column (low pressure distillation column). In this third column pure methanol is again drawn from the top, while the remaining water is removed from the bottom of the column.

Heat for the second column comes from condensing the overheads from the high pressure refining column. The water removed from distillation is recovered by being added into the circulating water stream for the gas saturation stage as described above.

3.5.3 Natural Gas and Methanol Product Specifications

Plant Capacity:	3600 MTPD of methanol
Energy Efficiency:	<40 GJ per metric ton of methanol[3]
Gas Composition:	Refer to Table 3-2 below
Methanol Specification:	Refer to Table 3-3 below
Nile Water Limit:	600 m^3/h (maximum)

The plant will receive natural gas and Nile River water as the only two inputs across the plant battery limits. All necessary power, water and other utility requirements will be generated from inside the plant.

The only outputs from the process will be product methanol, treated waste water and gaseous emissions from combustion of fuel for the reformer and fired equipment (plant boilers generating HP steam).

The process employs licensed technology from Johnson-Matthey and Davy Process Technology, for the combined reforming, methanol synthesis and methanol distillation processes. This technology has been selected for the methanol production as it offers enhanced energy efficiency, lowers greenhouse gas emission intensity, economies of scale and simplicity of design when compared to competing technologies. Preliminary evaluation by an outside Independent Engineer (Nexant, 28 February, 2005) reviewed the combined reforming technology and concluded that a combined reforming plant with a capacity of 3,600 ton per day is viable and subject to proper engineering such a plant offered by JM-DPT should be able to satisfy the Project's commercial goals with respect to throughput, thermal efficiency and availability.

[3] Expected Guarantee figure to be confirmed once the final Process FEED heat and mass balances are complete. Final guarantee figure to be generated during EPC contract stage when the vendor equipment efficiency information is available for the actual selected equipment.

Table 3-2: Natural Gas Composition

COMPOSITION [Mole %]	Lean Gas	Rich Gas	Normal Composition[4]
Nitrogen	0.43	0.01	0.35
Carbon Dioxide	0.16	0.55	0.24
Methane	98.23	92.24	97.03
Ethane	1.07	4.09	1.67
Propane	0.09	1.87	0.45
I-Butane	0.01	0.41	0.09
N-Butane	0.01	0.43	0.09
I-Pentane	0.00	0.15	0.03
N-Pentane	0.00	0.15	0.03
Hexane(+)	0.00	0.10	0.02
TOTAL	**100**	**100**	**100**

Table 3-3: Other Gas Specifications

ITEM	Minimum	Maximum	Normal
Specific Gravity	0.56	0.62	0.57
Gross Heating Value [BTU/SCF][5]	980	1,180	1,020
Hydrogen Sulphide (H_2S) [p.p.m. - Vol.]		8	Seller to specify normal
Mercaptan (RSH) [mg/SCM][6]		7	Seller to specify normal
Total Sulphur [mg/SCM]		50	Seller to specify normal
Carbon Dioxide [mole %]		3.0 %	EGAS Gas Specification
Oxygen [mole %]		0.05%	
Mercury [microgram/SCM]		10	Seller to specify normal
Water Dew Point (@ 70 bar) [^oC]		0	
Hydrocarbon Dew Point (@ any Pressure) [^oC]		5	
Pressure [bar(g)]	28	70	50 to 60
Rate of Change of Pressure [bar/min]		0.3	
Temperature [^oC]	10	40	Seller to specify normal

[4] The "Normal Composition" is based on the typical ratio of lean gas to rich gas, which will be approximately 80% : 20% respectively, although occasional fluctuations from 100% lean to 100% rich may occur.
[5] "SCF" refers to "Standard Cubic Feet", namely cubic feet measured at 60oF and 1 atm (14.696 psia).
[6] "SCM" refers to "Standard Cubic Metres", namely cubic metres measured at 60^{o}F and 1 atm (14.696 psia).

Table 3-4: Methanol Product Specification

Test	Limit	Method
Appearance	Clear & free of suspended matter	IMPCA 003-98
Purity (wt % on dry basis)	Minimum 99.9	IMPCA 001-02
Acetone and Aldehydes (mg/kg)	Maximum 20	IMPCA 001-02
Colour Pt-Co	Maximum 5	ASTM D 1209-00
Water (wt %)	Maximum 0.05	ASTM E 1064-04
Distillation Range	Maximum 1.0 ºC to include	ASTM D 1078-03
at 760 mm Hg	64.6 ± 0.1 ºC	
Specific Gravity	0.7920 – 0.7926	ASTM D 891-00 or
20 ºC / 20 ºC		ASTM D 4052-02
Potassium Permanganate Time, test	Minimum 60	ASTM D 1363-01
at 15 ºC (minutes)		
Ethanol (mg/kg)	Maximum 10	IMPCA 001-02
Chloride as Cl- (mg/kg)	Maximum 0.5	IMPCA 002-98
Sulphur (mg/kg)	Maximum 0.5	ASTM D 3961-98
Hydrocarbons	Pass Test	ASTM D 1722-04
Carbonizable Substances (Sulphuric	Maximum 30	ASTM E 346-03
Acid Wash Test)		
Pt-Co scale		
Acidity as acetic acid (mg/kg)	Maximum 30	ASTM D 1613-03
Total Iron (mg/kg)	Maximum 0.1	ASTM E 394-00
Non Volatile Matter (mg/1000 ml)	Maximum 8	ASTM D 1353-03
Tri-methylamine (TMA) (ppb)	Maximum 30	ASTM E 346-03

3.6 Utilities

This section describes the Utilities and other facilities to be provided for the EMethanex Project in Damietta, Egypt. This section will describe the following:

- Methanol Storage and Loading
- Chemical Storage
- Cooling Water
- Raw Water Intake and Treatment
- Instrument and Plant Air
- Power Generation
- Steam Production
- Drains and Waste water Treatment

3.6.1 Methanol Storage and Loading

This area consists of one Crude/Off-specification Methanol Tank with pumps, two Methanol Shift Tanks with pumps, two Methanol Product Tanks with pumps, and equipment necessary to load ships and trucks.

3.6.1.1 Crude/Off-specification Methanol Tank

The crude/off-specification methanol tank is provided for storage of crude from the letdown vessel as well as off-specification methanol from the shift tanks and other locations. The tank is sized to hold 24 hours of methanol from the letdown vessel. The tank design is fixed roof with a nitrogen blanket. Two crude/off-specification methanol pumps are provided to pump crude methanol to distillation for reprocessing. Each pump is sized for 50% of the crude production rate with no additional margin. Plot space is provided for two future crude/off-specification methanol tanks of the same size.

3.6.1.2 Methanol Shift Tanks

Two methanol shift tanks are provided to receive product methanol from the refining and recovery columns. Each tank has a working capacity of 1800 tons, equivalent to 12 hours of production. After the purity is verified by laboratory analysis, the methanol product is transferred by the shift tank pumps to product storage. The pumps are sized to pump out the tank contents in 4 hours. Off-spec methanol is transferred back to the crude/off-specification tank for rework. The shift tanks include an internal floating roof to mitigate VOC emissions. The tanks are blanketed with nitrogen. Plot space is provided for four future methanol shift tanks of the same size.

3.6.1.3 Methanol Product Tanks

The two methanol product tanks have a working capacity of 55,000 tons each. The tanks include an internal floating roof to mitigate VOC emissions and are blanketed with nitrogen. Plot space is provided for two future methanol product tanks of the same size.

3.6.1.4 Methanol Ship Loading

Two 100% methanol loading pumps pump product from the methanol product tanks to the jetty to load ships at a rate of 2500 MTPH. Two loading arms, each sized for 1250 MTPH, are located at the jetty. A vapour recovery system is provided to reduce methanol emissions from ship loading. The recovered methanol is pumped back to the crude/off-specification methanol tank. Methanol slops receiver and methanol slops load-out pump are provided to gather methanol-containing drains from the ship loading areas and vapour recovery system. These are pumped back to the crude/off-specification methanol tank. Firewater will be pumped to fire monitors at the jetty from the main firewater pumps.

3.6.1.5 Methanol Truck Loading

Two 100% methanol truck loading pumps pump product from the methanol product tanks to the truck loading area at a rate of 30 MTPH. The trucks are loaded from the top via loading arm with a dip pipe to prevent static electric charges. Vapour recovery from the truck loading vent is provided to reduce methanol emissions. One covered truck loading station is provided with an annual loading rate of 20,000 MT. Additional plot space is provided for three future truck loading stations. A truck loading scale is sized for trucks with up to 20 m^3 capacity. Piping and automatic valves are provided to allow ship loading from one methanol product tank and truck loading from the other tank.

3.6.2 Chemical Storage

Storage facilities are provided for Caustic, Sulphuric Acid, and Diesel.

3.6.2.1 Caustic Storage

Liquid 50 wt% caustic is received in trucks and stored in caustic soda storage tank. The tank is sized for a minimum of three weeks of normal usage of one plant. Caustic soda supply pumps provide circulation of caustic through the tank and piping and provide forward flow to the neutralization vessels and the caustic soda dosing package. The dosing package dilutes the caustic and distributes it as needed to users including the topping column. The caustic soda storage tank is located in the demineralisation building and is curbed for spill containment. Tie-ins are provided for future plants.

3.6.2.2 Sulphuric Acid Storage

Liquid 93 wt% sulphuric acid is received in trucks and stored in sulphuric acid storage tank. The tank is sized for a minimum of three weeks of normal usage of one plant. Sulphuric acid supply pumps provide circulation through the tank and piping and provide forward flow to the neutralization vessels and the sulphuric acid dosing package. The dosing package distributes acid to users including waste water treatment and the cooling tower dosing package. The sulphuric acid tank is located in the demineralisation building and is curbed for spill containment. Tie-ins are provided for future plants.

3.6.2.3 Diesel Storage

Diesel is received in trucks and stored in an above ground diesel storage tank. The tank is of double-wall construction. The diesel is pumped via two 100% diesel pumps to shift tanks (8 hrs each) at the firewater pumps and the diesel emergency generators. Tie-ins are provided for future plants.

3.6.3 Cooling Water

3.6.3.1 Cooling Water Tower

Cooling tower will consist of approximately 8 cells. The design duty of the tower is approximately 300 MW with a supply water temperature of 29°C and a return temperature of 39°C. The cooling tower utilizes high efficiency packing and high efficiency drift eliminators. An automated chemical dosing system is provided to control the water quality.

Availability of make-up water is limited; therefore side-stream filtration is employed to reduce the suspended solids load in the system and to increase the number of cycles in the cooling tower system. Around 3% (to be confirmed) of the cooling tower circulation goes through the side stream filter. The primary source of cooling tower makeup water is filtered water. Other makeup water sources include boiler blow-down, the ASU chiller tower, and reject water from raw water filtration and demineralization. Blow-down from the cooling water tower is sent to the storm water catch pond. Online analyzers check the blow-down stream for pH and conductivity. If it is off-spec, it will held in one of the catch basins and either recycled for treatment or removed for off-site disposal. Plot space is provided for two future Cooling Water Towers of the same size.

3.6.3.2 Cooling Water Pumps

The side stream filtration equipment are supplied with cooling water from the cooling water circulation pumps, which are all electric driven. The turbo-alternator condensers and the other cooling water users required for black start are supplied by the utility cooling water pumps. These pumps are electric driven. During black start, one utility cooling water pump will be run via the emergency diesel generator to supply cooling water to one turbo-alternator condenser. All cooling water users will share a common return line.

3.6.4 Raw Water Intake and Treatment

Raw Water is supplied from the Nile River and is pumped to the plant and filtered. Filtered water is used for Potable Water, Fire Water, and feed to the Demineralization Package.

3.6.4.1 Raw Water Intake

Up to 600 m^3/h of water is supplied from the Nile River approximately 6 km from the plant. As the water enters the intake sump, it is chlorinated with chlorine vapour from chlorine dosing package for control of biological growth in the raw water equipment and piping. The water is screened via intake trash rack and rotating screens and is pumped to the plant via raw water lift pumps. Mud pump is located at the low point of the intake sump to remove sediment. Electricity is supplied from the plant. Raw water intake area diesel generator can run two pumps, lighting, and controls in the event that power from the plant is unavailable. The diesel tank supplied with the generator is sized for 24 hours at full rates and will be refilled by trucks. Dry powder fire protection package is provided for the entire raw water intake area.

3.6.4.2 Raw Water Treatment

Raw water treatment package provides filtration of the entire 600 m^3/h of raw water from the intake pumps. The package consists of bag filters, micro-filtration units, and support equipment for concentration of removed solids and for cleaning of the micro-filtration units. A small amount of water recovered from the solids concentration equipment is sent to the cooling tower as makeup water.

3.6.4.3 Filtered Water

Filtered Water exiting the raw water treatment package is stored in filtered water tank, which doubles as firewater storage. The nozzle for filtered water users is located at an elevation that ensures that there is always a minimum of 4 hours worth of firewater stored in the lower part of the tank. The storage capacity for filtered water in the upper section of the tank is sized for 14 hours based on the design raw water rate of 600 m^3/h. The primary use of filtered water is for cooling tower makeup. The water is supplied by filtered water pumps. Other filtered water users are the potable water tank, the demineralised water package, the ASU chiller tower, and utility hose stations. Plot space is provided for one future filtered water tank, also with firewater capacity.

3.6.4.4 Potable Water

Filtered water from the raw water treatment package is chlorinated via the potable water sterilization package and stored in potable water tank. Two potable water pumps provide potable water to the distribution header.

3.6.4.5 Fire Water

The lower portion of filtered water tank holds a minimum of 4 hours of water for fire fighting. Firewater is provided to the firewater ring mains and other firewater users via jockey pump and firewater pumps. The total peak firewater rate is 1818 m^3/h. The main firewater pumps are all diesel driven and the jockey pumps are electric. Tie-ins are provided for future plants.

3.6.4.6 Demineralised Water

The demineralised water package produces high quality boiler feed water (BFW) steam generation. The demineralised water production is with a quality suitable for approximately 110 barg steam production. The demineralization of filtered water is accomplished via reverse osmosis (RO) and ElectroDeionisation (EDI). It also includes all the associated equipment including pumps, pre-filters, and cleaning systems. Reject water from the RO and EDI equipment is sent to the cooling tower as makeup water. Water produced in the demineralised water package is stored in the demineralised water tank, along with turbine condensate (described below). The tank is sized for 24 hours based on the largest single turbine condensate steam.

3.6.4.7 Condensate Polishing

Turbine condensate streams from power generation, the syngas compressor /loop turbine, and the air separation unit are routed through condensate polishing and the demineralised water tank.

3.6.5 Instrument and Plant Air

The normal supply of instrument and plant air is from the air separation unit (ASU), which separates pure oxygen and nitrogen streams from the atmosphere and also generates plant and instrument air for use by the process.

The energy required by the ASU is generated in the plant steam system, where steam generated in the reformed gas boilers and high pressure process boilers, is used to drive the ASU compressors. The equipment described below provides a back-up supply of air when the ASU is not in operation.

3.6.5.1 Instrument Air

Two instrument air packages are provided. Each package, consisting of electric driven compressor and dryer can supply 1420 Nm^3/h of air dried to a dew point of -20^oC. A common instrument air receiver is located downstream of the dryers. The minimum air pressure at the users will be 7 barg. The system design pressure is 14 barg. Tie-ins are provided for future plants.

3.6.5.2 Plant Air

Plant air distribution is taken from the instrument air system downstream of the dryers and upstream of the instrument air receiver. A pressure regulator is provided and will shut off plant air users to ensure that the minimum pressure is maintained in the instrument air system.

3.6.6 Power Generation

All of the power required for the methanol complex is provided by the turbo-alternators. Backup and start-up power is supplied by the diesel emergency generators.

3.6.6.1 Turbo-Alternator

Each of the power generation packages (2 x 100%) is sized to produce up to 15 MW (HOLD) of electrical power at 6.6 kV, 3 phase, 50 Hz. The steam turbine is driven by medium pressure steam. The low pressure exhaust steam is condensed by cooling water in the turbo-alternator exhaust steam condenser and is pumped to the demineralised water tank using pumps.

3.6.6.2 Diesel Emergency Generators

Two skid-mounted diesel emergency generators will supply emergency power, and will be used for black start.

3.6.7 Steam Production

3.6.7.1 Package Boilers

Two package boilers will be provided. Each sufficient to allow operation of the plant, with steam provided at approximately 110 barg. Figure 3-4 (Appendix XII) shows the arrangement of the steam system for a combined reforming methanol plant.

3.7 Plant Effluent and Emissions

3.7.1 Liquid Effluent: Waste Streams during Operational Phase

All liquid effluents from the plant will be managed, including rainfall. Figure 3-5 (Appendix XII) illustrates the liquid effluent from one methanol plant.

3.7.1.1 Cooling Tower Makeup and Blow-down

The following streams are normally routed to the cooling tower basin as make-up water to supplement the normal makeup of filtered water:

- Filtrate from the raw water micro-filter backwash stream
- Reject water from reverse osmosis (RO) and ElectroDeionisation (EDI)
- Blow-down from the steam generators.
- IMicro filtration backwash, and
- ASU chiller tower.

Blow-down from the cooling tower goes to the main storm water catch pond.

3.7.1.2 Neutralization Vessels

Water streams that are free of organics and require pH adjustment are routed to the neutralization vessels. Streams include aqueous laboratory waste, regeneration water from the condensate polisher, ASU blow down, and wash water spills from the demineralisation building. In addition, intermittent flow from micro filter cleaning system during periodic cleaning, RO/EDI cleaning system,

The neutralization vessels operate in batch mode: one receives liquid from the various sources while the other neutralizes with caustic and sulphuric acid and discharges the final pH neutral stream to the storm water catch pond. The discharge stream is equipped with an online pH analyzer to verify the quality of the water.

3.7.1.3 Process Buildings

Drains from buildings housing compressors and the boiler feed water pumps are routed to the first flush pond. Drains include wash water and spills around the lube oil consoles, wash water from the remainder of the building, and hot drains from steaming of lines.

3.7.1.4 Methanol Storage Tanks

Methanol storage tanks including the crude/off-spec tanks, shift tanks, and product tanks are surrounded by containment berms to hold rainwater or spills. Methanol spills are managed for disposal or recovery. Clean rainwater is released for drainage to the storm water catch pond.

3.7.1.5 Truck Loading

The truck loading area is paved and curbed. Spills and rainwater drain into a local collection sump, in which oil (if present) is separated via weirs. The collected oil is removed manually for off-site disposal. The water is transferred to the first flush pond.

3.7.1.6 Waste water Treatment Package

Waste water intended for treatment is routed to a waste water tank. The liquid in the waste water tank contains traces of organics including methanol, ethanol, and butanol. It is fed to the waste water treatment package for biological treatment to remove the organics. The clean water discharge from the waste water treatment package is transferred to the storm water catch pond.

Online analyzers check the stream for pH, conductivity, and total organic carbon (TOC). If it is off-spec, it will be held in one of the catch basins and either recycled for treatment or removed for off-site disposal.

3.7.1.7 Sewage Treatment

Domestic waste is transferred via lift pumps from the control room and administration building to the sewage treatment package. Clean water exiting the treatment package is pumped to the storm water catch pond via treated waste water pumps.

3.7.1.8 Rainfall to Unpaved Areas

Rainfall to unpaved process areas is collected in local rainwater sumps and transferred to the storm water catch pond. Undeveloped portions of the plant (the future sites of EMethanex II) are graded such that rainfall does not run off outside the plant boundaries. Rainwater collected in these areas will be pumped to the storm water catch pond as its level allows.

3.7.1.9 First Flush Pond

The first inch of runoff water from paved areas in the methanol process, methanol pumps, and truck loading is collected in the first flush water pond. Free oil, if present, is collected via a system of weirs and is removed manually for off-site disposal. Small amounts of methanol, if present, are removed by sparging with plant air. If higher concentrations of methanol or other hydrocarbons are present, the contents of the first flush pond are transferred at a controlled rate to the waste water tank for treatment in the waste water treatment package. Online analysers check the water in the first flush pond for total organic carbon (TOC). After the water in the first flush pond is verified to be within effluent specifications, it is pumped out to the storm water catch pond via pumps. Rainwater in excess of one inch is diverted directly to the storm water catch pond based on high level in the first flush pond. In addition to rainfall, the first flush pond receives wash and spill water from the compressor and generator buildings.

3.7.1.10 Storm Water Catch Pond

The storm water catch pond serves as final check and release point for cooling tower blow-down, treated water effluents, and rainfall before it is pumped to the seawater outfall line. The catch pond is divided into two catch basins. All water streams flow through one basin. Online analyzers monitor the water for pH, conductivity, and total organic carbon (TOC). If the stream is within the effluent limits, it is pumped out to the seawater outfall line via storm water pumps. If it is off-spec, the inlet flow is switched to the other catch basin while the off-spec water is pumped back to the first flush pond for further treatment or removal for off-site disposal.

3.7.1.11 Seawater Outfall

The normal flow is made up of the streams from the neutralization vessels, treated domestic waste, waste water treatment effluent, cooling tower blow down, plant rainwater, effluent from first flush pond, and clean rainwater released from methanol storage tanks.

Table 3-5: Seawater Outfall Characteristics

Parameters	Process Effluent Only (No Rainwater) Flow range 110 to 150 m3/h		Process Effluent Plus Rainwater Peak flow 300 m3/h		Overall composition range		Maximum Level per Egyptian Law #4 of 1994
	MIN	MAX	MIN	MAX	MIN	MAX	
Specific Conductance, 25°C, µmhos	2,253	2,862	910	1,252	**910**	**2,862**	
Alkalinity, "P", as $CaCO_3$	-	-	-	-	**-**	**-**	
Alkalinity, "M", as $CaCO_3$	154	225	62	98	**62.4**	**225**	
Sulphur, Total as SO_4	613	790	248	346	**248**	**790**	
Chloride as Cl	232	417	94	182	**94**	**417**	
Phosphate, Total as PO_4	2.2	2.7	0.89	1.19	**0.9**	**2.7**	5
Nitrate, as NO_3	4.6	9.5	1.84	4.15	**1.8**	**9.5**	40
Silica, Total as SiO_2	22.0	25.2	8.89	11.01	**8.9**	**25.2**	
Calcium, Total as $CaCO_3$	415	711	168	311	**168**	**711**	
Magnesium, Total as $MgCO_3$	287	474	116	207	**116**	**474**	
Sodium as Na	216	285	87	124	**87**	**285**	
Aluminium, Total as Al	-	-	-	-	**-**	**-**	3
Iron, Total as Fe	0.4	0.5	0.17	0.22	**0.2**	**0.5**	1.5
Copper	0.2	0.3	0.09	0.13	**0.1**	**0.3**	1.5
Manganese, Total as Mn	0.0	0.0	0.02	0.02	**0.0**	**0.0**	1
Molybdenum, as MoO_4	-	0.7	-	0.30	**-**	**0.7**	
Potassium as K	20.7	47.4	8.38	20.74	**8.4**	**47.4**	

Parameters	**Process Effluent Only (No Rainwater)**		**Process Effluent Plus Rainwater**		**Overall composition range**		**Maximum Level per Egyptian Law #4 of 1994**
	Flow range 110 to 150 m3/h		**Peak flow 300 m3/h**				
	MIN	**MAX**	**MIN**	**MAX**	**MIN**	**MAX**	
Zinc, Total as Zn	3.0	3.4	1.21	1.50	**1.2**	**3.4**	5
Total Suspended Solids	6.4	7.3	2.59	3.21	**2.6**	**7.3**	60
TDS	1,510	1,726	610	755	**610**	**1,726**	2000
	Note 1	Note 2	Note 3	Note 3			

Notes:

1. Representative of 110 m^3/h normal effluent flow at normal raw water impurity levels
2. Representative of 150 m^3/h max effluent flow at design (maximum) raw water impurity levels
3. Used simplistic assumption that rainwater is pure water with no contaminants or suspended solids.
4. Figures in the above table are for one methanol plant only

Table 3-6: Liquid Effluent Summary

Effluent Description	Source	Equipment	To	Flow Type	Flow Rate (Normal) m3/h	Flow Rate (Design) m3/h	Temp. (oC)	Pressure (barg)
Filtered Water	Raw Water Treatment PKG	1M-3801	Cooling Tower Basin					
Micro filtration Backwash	Raw Water Treatment PKG	1M-3801	Cooling Tower Basin	Continuous	26	30	31	HOLD
Package Boiler Blow down	Package Boiler	1H-3201	Cooling Tower Basin	Continuous	1	1	127	1.5
Intermittent Package Boiler Blow down	Package Boiler	1H-3201	Cooling Tower Basin	Intermittent	NND	30	29-100	Atm.
HP Steam Drum Blow down	Blow down Drum	1V-0302	Cooling Tower Basin	Continuous	2.9	2.9	127.4	1.5
RO / EDI Reject	Demineralized Water PKG	1M-3901	Cooling Tower Basin	Continuous	7.6	13.44	31	HOLD
Air Separation Unit (ASU) Chiller Tower	ASU	1M-1501	Cooling Tower Basin					
Blow down Drum	Blow down Drum	1V-0302	Cooling Tower Basin					
Aqueous laboratory waste			Neutralization Vessel					
Wash water spills from demineralization building			Neutralization Vessel					
Micro filter Cleaning Stream	Raw Water Treatment PKG	1M-3801	Neutralization Vessel	Intermittent	HOLD	HOLD	HOLD	HOLD
RO / EDI Cleaning System	Demineralized Water PKG	1M-3901	Neutralization Vessel	Intermittent	HOLD	HOLD	HOLD	HOLD
Condensate Polishing Backwash (waste brine)	Demineralized Water PKG	1M-3901	Neutralization Vessel	Intermittent	0	HOLD	HOLD	HOLD
Air Separation Unit Blow down	ASU	1M-1501	Neutralization Vessel	Continuous	HOLD	HOLD	HOLD	HOLD
Drain from Building housing compressors			First Flush Pond - after oily water sump					
Drain from Boiler feed water pumps			First Flush Pond - after oily water sump					
Wash water and spills around oil consoles			First Flush Pond - after oily water sump					
Wash water from the remainder of process building			First Flush Pond - after oily water sump					
Hot drains from steaming of lines			First Flush Pond - after oily water sump					
Truck loading spills and rainwater drain			First Flush Pond - after oily water sump					
Runoff water from paved areas in the methanol process, methanol, pumps, and truck loading (1st inch)			First Flush Pond - after oily water sump					
Saturator Blow down	Saturator	1C-0201	Saturator blow down to wastewater (effluent) treatment	Continuous	2.9	14.5	45	5
Intermittent HP Steam Drum Blow down	HP Steam Drum	1V-0301 A/B	Intermittent blow down to wastewater (effluent) treatment	Intermittent	106.8	150.6	29-100	0.013
Process Condensate	Process Condensate Drum	1V-0401	Saturator	Intermittent	0	130	129	4
Waste Water Treatment Water Effluent	Waste Water Treatment PKG	1M-5601	Storm Water Catch Pond		2.9	14.5	45	5
Treated Domestic Waste	Sewage Treatment Plant	1M-5602	Storm Water Catch Pond	Continuous	0.5	0.63	HOLD	HOLD
Neutralization Vessel Effluent	Neutralization Vessel	1V-5502	Storm Water Catch Pond	Intermittent	0	HOLD	31	
Rainfall from Process Areas	First Flush Pond	1SU-5504	Storm Water Catch Pond	Intermittent	HOLD	HOLD	31	NA
Cooling Water Tower Blow down	Cooling Tower	1CT-4201	Storm Water Catch Pond	Continuous	100	126	29	
Clean rainwater from Methanol Storage Tanks	Methanol Storage Tanks	Crude, Shift, Product	Storm Water Catch Pond					
Rainfall to unpaved process areas (excess of one inch)	Process Areas		Storm Water Catch Pond					
Process Drains	Process Sump	1SU-1201	Crude Methanol Tank	Intermittent		40	31	4
Flare KO Drum Liquids	Flare KO Drum	1V-5701	Crude Methanol Tank	Intermittent		30	31	4
Seawater Outfall	Storm Water Catch Pond	1SU-5505	Seawater	Continuous	110	HOLD	31	
Raw Water Silt Return	Raw Water Mud Pump	1P-8403	Silt to River Nile	Intermittent	10		31	
Natural Gas Condensate	Natural Gas Liquid Drum	1V-0102	Mobile storage for transport to offsite treatment facility	Intermittent	HOLD	HOLD	31	Atm.
ATR Jacket Blow down	ATR	1R-0301	Grade	Intermittent		0.68	100	0.013

3.7.1.12 Raw Water Silt Return

The stream only occurs as required to remove river silt sediment that accumulates in the raw water intake sump. Stream routed to Nile River down stream of water intake location.

3.7.2 Solid Wastes

3.7.2.1 Construction Phase

During construction, solid waste will comprise domestic waste and construction waste from the plant area. Domestic waste quantities are expected to total approximately 1.5 ton/day during the peak construction (1500 personnel on site). Construction waste will depend on a range of variables that can not be defined exactly at this stage of the environmental impact study. However, it is expected to include:

- Soil (excavated or surplus);
- Packaging materials (imported and local plastic, cardboard, paper and pallets);
- Damaged products (plasterboard, bricks, tiles, etc.);
- Packing timber;
- Geotextiles;
- Paving materials;
- Electrical cable off-cuts;
- Concrete;
- Miscellaneous containers, paint cans, solvent containers, aerosol cans, adhesive, and lubricant containers; and
- Dredging activity at the methanol loading jetty will produce a large quantity of spoil which will be used as backfill across the site or disposed of at an offsite disposal facility in Damietta city.

As part of minimising waste, EMethanex will ensure that a solid waste management will be development as part of the environmental management plant (see Section 8). The plan will include sections on waste reduction, material reuse and material recycling with the objective of minimising the quantity of waste requiring disposal. The plan will emphasis on requiring international suppliers to take back certain containers and minimising the over-purchasing of materials which should lead to leftover waste.

These wastes will be segregated on site and will be transported to appropriate recycling, or reuse sites inside or outside the country. The remaining solid wastes will be transported to the landfill site at Damietta city "Shatta" for final disposal. This landfill accepts all types of solid wastes.

3.7.2.2 Operational Phase

A large industrial site such as the proposed Methanol plant, will typically generate a large quantity of domestic or "household" waste. This includes plastics, clean cardboard boxes from deliveries to stores, and food scraps in addition to process related solid wastes and other solid wastes.

The type and anticipated annual quantities of solid wastes during the operation phase of the project are detailed in Table 3-7.

Table 3-7: Estimated Solid Waste during Operation

Type of Waste	Waste Quantity (for each plant)	Reuse / Recycling / Disposal
Batteries	2 ton/year	Collected by contractor for recycling
Paper and cardboard	12 ton/year	Collected by contractor for recycling
Fluorescent tubes, lamps	1000 unit/year	Collected by contractor for disposal at the landfill in Shatta, Damietta
Glass	40 kg/year	Recycled
Drums	100 unit/year	Returned to suppliers for reuse
General refuse	75 ton/year	Collected by contractor for disposal
Plastics	0.6 ton/year	Recycled
Food / Organics	0.2 ton/year	Composted
Scrap Metals	52 ton/turnaround[7]	Collected by scrap metal merchant
Sludge from waste water treatment plant	6 ton/year	Collected by contractor for reuse
Catalyst waste	320 ton/turnaround	Returned to supplier

Furthermore, some additional solid waste will be generated during operation such as:

[7] Turnaround occurs once every 3 to 4 years when major maintenance and catalyst changeovers occur.

- miscellaneous containers, paint cans, solvent containers, aerosol cans, adhesive, and lubricant containers;
- castable refractory;
- mixed catalyst dust fines which suppliers do not take back; and
- solids generated from raw water treatment package during the filtration of river water intake. These solids will be collected for transport to an offsite disposal facility in Damietta city.

3.7.3 Hydrocarbon and Hazardous Wastes

Hydrocarbons and hazardous wastes and anticipated annual quantities during the operation phase of the project are detailed in Table 3-8.

Table 3-8: Proposed Hydrocarbon and Hazardous Wastes

Type of Waste	Waste Quantity (for each plant)	Reuse / Recycling / Disposal
Waste oil	22 kL/turnaround[8]	Collected by waste oil contractor
Hazardous waste – ceramic fibre	44 ton/turnaround	Collected by contractor for disposal at the landfill
Hazardous waste – toxic chemicals	0.5 ton/year	Reused in treatment process
Hazardous waste – solvents	0.1 ton/year	Collected by contractor for recycling

3.7.4 Air Emissions

3.7.4.1 Construction Phase

Dust emissions will be produced during construction activities related to excavation works both on and offshore. Heavy equipment and vehicle movements also give rise to dust emissions. Other gaseous emissions will include exhaust from vehicles and generators.

[8] Turnaround occurs once every 3 to 4 years when major maintenance and catalyst changeovers occur.

3.7.4.2 Operational Phase

The principles sources of potential air emissions to atmosphere are:

- Reformer flue gas from the primary flue gas stack. The natural gas fuel to the primary reformer is normally desulphurised and therefore SO_2 emissions will be zero. The burner selected for the reformer will be low NO_x, and hence NO_x content of the flue gases will be designed to be less than 300 mg/Nm^3. Furthermore, the reformer flue gases will have a particulate level of less than 100 mg/Nm^3. The effluent will consist of water (22.39 mol%), carbon dioxide (8.05 mol %), oxygen (1.64 mol %), nitrogen (67.86 mol %), and argon (0.07 mol%). The disposal method of the effluent (279,391 Nm^3/h) will be via flue gas stack to atmosphere at 30 meter height stack and 140 ^{o}C.
- Air Separation Unit (ASU) Vent. The effluent will consist of nitrogen (98.78 mol %), argon (1.18 mol%), and carbon dioxide (0.04 mol%). The disposal method of the effluent (105,000 Nm^3/h at 10 m/s) will be via flue gas stack to atmosphere at 30 meter height stack and 45 ^{o}C.
- Package boiler flue gas. The natural gas fuel to the package boiler is normally desulphurised and therefore SO_2 emissions will be zero. The NO_x content of the flue gases will be designed to be less than 300 mg/Nm^3. Furthermore, the boiler flue gases will have a particulate level of less than 100 mg/Nm^3. The disposal method will be via flue gas stack to atmosphere at 18.5 meter height stack.
- Cooling tower evaporation and drift loss in form of water vapour. This loss is continuous during the operation phase. It will be vented to the atmosphere at 18.5 meter height.
- ATR jacket vent. This vent is continuous during the operation phase at a rate of 710 Nm^3/h. This effluent is mainly steam vented to the atmosphere at a temperature of 100 ^{o}C.
- Dearator vent. This vent is continuous during the operation phase at a rate of 1500 Nm^3/h. This effluent is mainly steam vented to the atmosphere at a temperature of 109 ^{o}C.
- Intermittent blow down drum vent. It occurs during periods of intermittent blow down from the HP steam drum. This effluent is mainly steam vented to the atmosphere at a temperature of 100 ^{o}C at a rate of 13 Nm^3/h.
- Raw water intake area diesel generator exhaust. The composition of the exhaust is similar to the combustion products. Generators only runs during start-up, in the event that the main power supply to raw water intake area is lost, and once per week for test purposes. The exhaust is vented, 3.6 meter height, to atmosphere as the proposed disposal method.

- Package boiler intermittent blow down drum vent. Vent only occurs during periods of intermittent blow down from the package boiler drum. This effluent is mainly steam vented to the atmosphere at a temperature of 100 ^{o}C and 4.8 meter height.
- Degasser vent. The flow rate is estimated to be 124 kg/h at a temperature of 45^{o}C which will be vented to the atmosphere at 14 meter height. The effluent consists mainly of nitrogen and may contain traces amounts of H_2, CO, CO_2, or CH_4.
- Diesel emergency generator exhaust. The composition of the exhaust is similar to the combustion products. Generators only run during start-up weekly testing or on power failure. The exhaust is vented, 3.6 meter height, to atmosphere as the proposed disposal method.
- Fire water pumps diesel engine exhaust. These pumps are only run in case of fire and weekly testing (i.e. intermittent flow rate). The composition of the exhaust is similar to combustion products. The exhaust is vented to the atmosphere at 5.4 meter height.
- Crude/off-spec methanol tank vent. The main composition of this intermittent flow which occurs only during periods of ship loading is nitrogen, methanol and water. The effluent is vented to the atmosphere at 31^{o}C temperature and 13 meter height.
- Ship loading vent gas scrubber from vapour recovery package. The main composition of this intermittent flow which occurs only during periods of ship loading is nitrogen or air, and maximum 4wt% methanol. The effluent is vented to the atmosphere at 63^{o}C temperature and 13 meter height.
- Truck loading vent. The composition of this intermittent flow which occurs only during periods of truck loading is mainly oxygen, nitrogen, and maximum 33wt% methanol. The effluent is vented to the atmosphere at 31^{o}C temperature and 12 meter height.

The principles sources of potential air emissions to flare are:

- Natural gas liquid drum vent. Typical composition of this effluent is natural gas which will be vented to flare. The flow rate of the effluent is intermittent at temperature ranging from 10 ^{o}C to 45 ^{o}C with a design temperature of 31 ^{o}C. The effluent is vented to flare.
- Compressor seal gas losses from compressor seal systems. The composition will vary dependant on plant operation. Seal gas is typically the same composition as the compressor discharge gases. It consists of hydrogen (68.33 mol%), carbon monoxide (21.34 mol%), carbon dioxide (7.66 mol%), nitrogen (2.15 mol%), water (0.39 mol%), and argon (0.12 mol%). The effluent is vented to flare at a temperature of 160^{o}C temperature and flow rate of 450 Nm^3/h.

- Process condensate drum vent. The effluent consists of hydrogen (61.03 mol%), carbon monoxide (19.98 mol%), water (8.85 mol%), carbon dioxide (8.03 mol%), methane (1.94 mol%), nitrogen (0.1 mol%), and argon (0.07 mol%). The effluent is vented to flare at a temperature of 127^{o}C temperature and flow rate of 9 Nm^{3}/h.
- Flare for nitrogen purge. The effluent mainly consists of nitrogen (89 mol%), water (8 mol%), and carbon dioxide (3 mol%). The effluent is vented to flare, 50 meter height, at a temperature of 200^{o}C temperature and flow rate of 20 Nm^{3}/h.
- Recovery column reflux drum vent. It only occurs during periods of venting to control pressure in column. The composition of this intermittent flow is a mixture of nitrogen and methanol. The effluent is vented to flare a temperature of 71^{o}C temperature and flow rate of 360 Nm^{3}/h.
- Refining column reflux drum vent. It only occurs during periods of venting when gases can not be passed to fuel system. The composition of this intermittent flow is methanol, trace by-products. The effluent is vented to flare a temperature of 127^{o}C temperature and flow rate of 1076 Nm^{3}/h.

Table 3-9 summarises the emission quantities and characteristics at the plant.

Table 3-9: Air Emission Quantities and Characteristics for the Plant

Effluent Description	Source	Equipment	To	Flow Type	Flow Rate (Normal) Nm3/h	Temp. (oC)	Composition
Natural Gas Liquid Drum Vent	NG Liquid Drum	1V-0102	Vent to Flare	Intermittent	HOLD	10-45	Natural Gas
Compressor Seal Gas Losses	Compressor Seal Systems		Vent to Flare	Continuous	450	160	H_2O, CO, CO_2, H_2, CH_4, N_2, Ar
Process Condensate Drum Vent	Process Condensate Drum	1V-0401	Vent to Flare	Continuous	9	127	H_2O, CO, CO_2, H_2, CH_4, N_2, Ar
Recovery Column Vent	Recovery Column Reflux Drum	1V-1101	Vent to Flare	Intermittent	360	71	Nitrogen/Methanol
Refining Column Vent	Refining Column Reflux Drum	1V-1001	Vent to Flare	Intermittent	1076	127	Methanol, trace by-products
Flare	Flare	1FL-5701 Pilots & Nitrogen Purge	Vent to Flare		20	200	Nitrogen/Water/CO_2
Reformer Flue Gas	Primer Reformer	1H-0301	Via Flue Gas Stack to Atmosphere	Continuous	279,391	140	H_2O, CO_2, O_2, N_2, Ar, NO_x, PM
Package Boiler Flue Gas	Package Boiler	1H-3201A/B	Via Flue Gas Stack to Atmosphere	Continuous	197,100	140	H_2O, CO_2, O_2, N_2, Ar, NO_x, PM
ATR Jacket Vent	ATR Jacket	1R-0301	Vent to Atmosphere	Continuous	710	100	Steam

Effluent Description	Source	Equipment	To	Flow Type	Flow Rate (Normal) Nm3/h	Temp. (oC)	Composition
Intermittent Blow down Drum Vent	Intermittent Blow down Drum	1V-0303	Vent to Atmosphere	Intermittent	13	100	Steam
Air Separation Unit Vent	ASU	1M-1501	Vent to Atmosphere	Continuous	105,000 at 10m/s	45	Nitrogen/Argon/CO_2
Dearator Vent	Dearator	1V-4101	Vent to Atmosphere	Continuous	1500	109	Steam
Raw Water Intake Area Diesel Generator Exhaust	RWI Area Diesel Generator	1G-8401	Vent to Atmosphere	Intermittent	HOLD	HOLD	Combustion products
Cooling Tower Evaporation and Drift Losses	Cooling Tower	1CT-4201	Vent to Atmosphere	Continuous	382	31	water vapour
Package Boiler Intermittent Blow down Drum Vent	Package Boiler	1H-3201A/B	Vent to Atmosphere	Intermittent	HOLD	100	Steam
Degasser Vent	Degasser	1C-5601	Vent to Atmosphere	Continuous	124 kg/h	45	Nitrogen and traces H_2, CO, CO_2, or CH_4
Diesel Emergency Generator Exhaust	Diesel Emergency Generator	1G-5101 A/B	Vent to Atmosphere	Intermittent	HOLD	HOLD	Combustion products
Firewater Pump Diesel Engine Exhaust	Firewater Pump	1P-4402 A/D	Vent to Atmosphere	Intermittent	HOLD	HOLD	Combustion products
Crude/Off-spec. Methanol Tank Vent	Crude Methanol Tank Vent	1TK-2501	Vent to Atmosphere	Intermittent	13.2	31	Nitrogen/ Methanol/ Water

Effluent Description	Source	Equipment	To	Flow Type	Flow Rate (Normal) Nm3/h	Temp. (oC)	Composition
Ship Loading Vent Gas Scrubber	Vapour Recovery Package	1M-8003	Vent to Atmosphere	Intermittent	2758	63	Nitrogen or Air; Max. 4wt% Methanol
Truck Loading Vent	Truck Loading Spot		Vent to Atmosphere	Intermittent		31	Oxygen, Nitrogen, Methanol (Max. 33wt%

3.7.5 Noise

3.7.5.1 Construction Phase

Sources of construction noise include:

- Construction vehicles and plant;
- Construction camp noise;
- Pile driving; and,
- Other special localized activities.

3.7.5.2 Operational Phase

The methanol plant has a significant number of major noise sources, including:

- Compressors (Natural gas, Syngas, Main air "MAC" for ASU, and Air booster "BAC" for ASU);
- Turbines (Natural gas, Flue gas, Combustion air, Syngas, HP BFW pump, and Compressor steam for ASU);
- Air Coolers;
- Fans (Flue gas, and Combustion air);
- Primary reformer;
- Pumps (steam turbine condensate for ASU, MAC condensate, water chiller, HP LOX, LP LIN, LP saturator circulation, HT saturator circulation, process condensate, Topping column reflux, Topping column bottoms, Refining Column Reflux, Recovery column reflux, Fusel oil, Recovery column bottoms, Process sump, HP BFW, Start-up BFW, and Flare liquid transfer); and,
- Flares.

3.7.6 Process Flow Diagrams

Figures 3-7 and 3-8 (Appendix XII) are overall block flow diagram and process flow diagram and include gas conditioning, saturation, natural gas reforming, reformed gas heat recovery, methanol synthesis, methanol product refining, and air separation unit.

3.8 Labour Requirements (Construction and Operations)

Labour requirements during construction will peak at approximately 1500 labourers over the 36-month construction period. It is recognized that Egypt has a good supply of qualified trades people, engineers, architects, and other experienced construction and project management personnel. Every attempt will be made to recruit qualified local personnel wherever practical to do so. The construction labour will be accommodated in nearby settlements or newly constructed housing.

It is anticipated that the routine operation and maintenance of the methanol plant will require an estimated work force of 150 people. The work force will consist of administrators and supervisors, plant operators, mechanics and maintenance crews, security and service personnel. The majority of the employees are expected to be Egyptian citizens with some upper management, administrative and specialized engineering positions being filled by expatriate personnel.

4 DESCRIPTION OF THE EXISTING ENVIRONMENT – BASELINE DATA

Information pertaining to baseline conditions at the proposed EMethanex site in Damietta Port, Egypt was obtained through field observation, interviews, and literature review. Several site visits were performed during the current survey. A one-day site visit was conducted by team members on 15 March 2006 in order to initiate the onshore field assessment. The main purposes of this site visit were to perform a walkover for familiarization and to collect site specific data, and identify the exact locations for air and noise measurement points. A preliminary survey for the environmental baseline conditions across the site and within the area of potential influence was performed including a visit to the Khamsa village. Activities conducted during the second site visit (20-26 March 2006) included a terrestrial survey, noise measurements within the site and surrounding areas, air measurements for ambient air quality in addition to public consultation meetings.

The third site visit (27-29 March 2006) included installation of three groundwater piezometers, groundwater sampling and onsite measurements, in addition to public consultation meetings. The fourth site visit (17-19 April 2006) included an offshore marine assessment in the area of the proposed outfall and the freshwater intake on the Damietta Nile branch. Activities during this site visit included water and sediment sampling and onsite measurements in addition to public consultation meetings. The sixth site visit (28-30 May 2006) included an offshore marine assessment in the area of the proposed jetty, water and sediment sampling and onsite measurements in addition to the preparation for the public consultation meeting to be organized in Damietta. GPS coordinates and meteorological conditions for the monitoring locations were recorded during all the field visits.

A public forum was held in Damietta city on 08 June 2006 to demonstrate the project, EMethanex' commitment to the environment and to allow a forum for public comments and feedback.

4.1 Project Location

The proposed project involves the construction and operation of stand alone methanol plants. A two phase production plan will be used for the project implementation. The proposed plant will be located at Damietta Port on the Egyptian Mediterranean coast, 70 km west of Port Said. Figure 4-1 (Appendix XII) shows the general location of the proposed site. Neighbouring facilities include the SEGAS Liquefied Natural Gas (LNG) facility, sharing the northern boundary of the proposed methanol facility, and the UGD facility. The western and southern boundaries will be marked by the Port walls.

The eastern boundary will be along the existing Container terminal and shipping channel of the Port. Damietta Port (Figure 3-2 (Appendix XII)) has a shipping channel (300 m wide), dredged to 15 m, with two sheltering breakwaters: one to the west, 1,300 m and the other to the east, 600 m. This channel provides access to the main port with a turning area of 580 m (14.5 m water depth), and will allow for the turning of Methanol vessels with capacities of 30 000 Dead Weight Tonnes (DWT).

The geographical co-ordinates of Damietta port are:

- Longitude 31^{o} 45’ E; and,
- Latitude 31^{o} 28’ N.

4.2 Water

4.2.1 Groundwater

An extensive geotechnical investigation was carried out by COSMOS-E during the period of December 2005 to January 2006. Further interpretation of the field investigation results was conducted by AGIS Consult (2006). The assessment revealed that the main groundwater flow across the site is contained in the coastal sand aquifer, which mainly consists of silty sands with some pockets of silty clay and broken shells and mica. The soft clay, which underlies the upper silty sand, is considered to be an aquiclude. Borehole locations used for the investigation and geotechnical profiles are presented in Appendix XV. Groundwater was encountered in all boreholes at final depths ranging between 0.9 m and 2.9 m below natural ground levels. The levels were measured during the time of drilling and one day after finishing drilling in each borehole. The measured groundwater levels are likely to represent the approximate annual maximum, because the month of January, when the boreholes were tested is within the rainy season. The groundwater appears to be in hydraulic connection with the sea, as groundwater levels at the site respond to tidal fluctuations.

The collected groundwater samples were subjected to chemical analysis tests. Analyses revealed high concentrations of sulphate and chloride, consistent with the strong sea water influence. Furthermore, the groundwater characteristics indicate highly aggressive conditions which necessitates several precautionary measures for concrete mix design (COSMOS-E, 2006).

4.2.1.1 Site Specific Groundwater Quality Assessment

The field visit conducted on 27-29 March 2006 involved the installation of three monitoring wells using a rotary drilling method. Table 4-1 illustrates the location of the monitoring wells inside the project site.

Table 4-1: GPS Coordinates at Monitoring Wells

Monitoring Well Number	GPS Reading (UTM Coordinates)
W1	36 R E:381128.2 N:3480401.99
W2	36 R E:381457.52 N:3481209.37
W3	36 R E:381714.69 N:3480465.16

The well installation process included:

- Setting up drill rig.
- Preparing bentonite slurry to support the hole while drilling
- Start Drilling
- Installing the monitoring wells after finishing at a depth 8m from ground surface and performing well finishing
- Filling the well annulus with gravel for water filtering
- Installing the well cover and holding it in place using cement.

At each of the three locations, WorleyParsons Komex collected one groundwater sample for analysis (GW1, GW2, and GW3 from Wells 1, 2, and 3 respectively). Two additional (duplicate) samples were collected from Well 1 (GW4, and GW5), for QA/QC verification of the results. Groundwater sampling was performed during the field visit. Bailing of the well was first performed by WorleyParsons Komex using USEPA certified bailers.

Samples were collected, appropriately labelled and preserved in accordance to USEPA standard methods. Samples were then delivered in an ice box to the laboratory and analysed within the recommended holding time for each parameter, according to Standard Methods for the Examination of Water and Waste water (1992, 1998) and USEPA approved methods and accompanied by completed chain-of-custody forms and sent to appropriate laboratories for analysis.

Samples were analysed locally by the Central Laboratory for Environmental Quality Monitoring located in El Kanater (the laboratory has been awarded ISO/IEC 17025 by the Canadian Association for Environmental Analytical Laboratories), and El Fustat Central Water Quality Laboratory as well as internationally by Analytico Milieu B. V. (Netherlands).

4.2.1.2 Analysis Results for Groundwater Quality Assessment

Table 4-2 illustrates the analysis results for the groundwater samples collected from the three wells. The majority of the parameters analysed revealed similar ranges to those detected in previous studies at the Port area.

Relatively elevated TDS concentrations were detected, which are also associated with relatively elevated chloride and sulphate concentrations. It is recommended to conduct further analyses for these parameters during the construction phase.

Chemical Oxygen Demand (COD) measurements ranged from 2 650 mg/l in GW2 to 5 850 in GW3, while Biological Oxygen Demand (BOD) measurements have ranged from 8 to 16 mg/l.

No detection of Polychlorinated Biphenyls was recorded at the site. Chlorinated pesticides analysis revealed few occurrences of trace levels ranging from 0.028 to 0.081 µg/l, which may be related to agricultural activities taking place in neighbouring farmlands.

Table 4-2: Groundwater Analysis Results

Parameter	**Unit**	**GW1 (Well 1)**	**GW2 (Well 2)**	**GW3 (Well 3)**	**GW4 (Well 1)**	**GW5 (Well 1) (duplicate for GW4)**
Laboratory analyses						
Physicochemical Parameters						
Turbidity	NTU	1 221	539	476	596	597
Total Dissolved Solids (TDS)[9]	mg/l	162 278	132 274	192 244	154 402	151 590
Chemical Oxygen Demand (COD)	mg/l	4 650	2 650	5 850	4 450	4 435
Biochemical Oxygen Demand (BOD)	mg/l	16	8	14	11	11
Major Cations						
Magnesium (Mg)	mg/l	324.6	215.4	213.6	248.4	248.4
Major Anions						
Chloride (Cl)	mg/l	84 210	70 227	117 865	88 872	88 872
Nitrite (NO_2)	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2

[9] TDS concentrations are regarded to be relatively higher than the common ranges in the area. It is recommended to conduct further analysis during the construction phase monitoring.

Parameter	Unit	GW1 (Well 1)	GW2 (Well 2)	GW3 (Well 3)	GW4 (Well 1)	GW5 (Well 1) (duplicate for GW4)
Nitrate (NO_3)	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2
Phosphate (PO_4)	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2
Sulphate (SO_4)	mg/l	6 912	5 567	6 618	8 110	8 110
Heavy Metals						
Cadmium (Cd)	mg/l	<0.0005	<0.0005	<0.0005	0.002	0.002
Copper (Cu)	mg/l	<0.002	<0.002	<0.002	<0.002	<0.002
Nickel (Ni)	mg/l	0.01	<0.005	0.02	0.04	0.04
Lead (Pb)	mg/l	<0.005	<0.005	<0.005	<0.005	<0.005
Zinc (Zn)	mg/l	<0.005	0.08	<0.005	<0.005	<0.005
Mercury (Hg)	mg/l	<0.08	<0.08	<0.08	<0.08	<0.08
Microbiological Indicators						
Total Coliform	CFU/100ml	$61x10^{2}$	$8x10^{2}$	$3x10^{2}$	$16x10^{2}$	$16x10^{2}$
Fecal Coliform	CFU/100ml	$7x10^{2}$	$2x10^{2}$	$1x10^{2}$	$3x10^{2}$	$3x10^{2}$
Chlorinated pesticides						
alpha-BHC	µg/l	ND[10]	ND	ND	ND	ND
gamma-BHC	µg/l	ND	0.07	0.081	ND	ND
beta-BHC	µg/l	ND	ND	ND	ND	ND
delta-BHC	µg/l	ND	0.028	0.04	0.055	0.056
heptachlor	µg/l	ND	ND	ND	ND	ND
aldrine	µg/l	ND	ND	ND	ND	ND
heptachlor epoxid	µg/l	ND	ND	ND	ND	ND
4,4'-DDE	µg/l	ND	ND	ND	ND	ND
dieldrin	µg/l	ND	ND	ND	ND	ND
endrin	µg/l	ND	ND	ND	ND	ND
4,4'-DDD	µg/l	ND	ND	ND	ND	ND
endosulfane II	µg/l	ND	ND	ND	ND	ND
4,4'-DDT	µg/l	0.062	ND	ND	ND	ND
endrin aldehyde	µg/l	ND	ND	ND	ND	ND
methoxychlor	µg/l	ND	ND	ND	ND	ND
endosulfane sulfate	µg/l	ND	ND	ND	ND	ND
endrin keton	µg/l	ND	ND	ND	ND	ND
Polychlorinated Biphenyls (PCBs)						
PCBs	µg/l	ND	ND	ND	ND	ND
Total Petroleum Hydrocarbons (TPH)						
TPH (C10-C16)	µg/l	<15	62	37	--	NA[11]
TPH (C16-C22)	µg/l	<10	28	11	--	NA
TPH (C22-C30)	µg/l	33	47	<10	--	NA

[10] ND = Not Detected
[11] Not Applicable. GW5 sample was not analyzed for TPH.

Parameter	Unit	GW1 (Well 1)	GW2 (Well 2)	GW3 (Well 3)	GW4 (Well 1)	GW5 (Well 1) (duplicate for GW4)
TPH (C30-C40)	µg/l	17	19	<15	--	NA
TPH sum (C10-C40)	µg/l	64	160	54	<50	NA

4.2.2 Surface Water (Freshwater)

4.2.2.1 Site Specific Freshwater Quality Assessment

A survey was conducted at the proposed intake location on 19 April 2006. Water and sediment quality was assessed at a number of locations and a total of five water samples and five sediment samples were collected. The water samples were collected using a Niskin bottle and sediments were collected using Van Veen grab sampler. On-site water analysis for temperature, pH, DO, TDS, conductivity, and salinity was conducted using a pre-calibrated YSI 566 Multi-probe instrument.

Samples were collected, appropriately labelled and preserved in accordance to USEPA standard methods. Samples were then delivered in an ice box to the laboratory and analyzed within the recommended holding time for each parameter, according to USEPA approved methods and accompanied by completed chain-of-custody forms and sent to appropriate laboratories for analyses.

Samples were analyzed locally by the Central Laboratory for Environmental Quality Monitoring located in El Kanater (the laboratory has been awarded ISO/IEC 17025 by the Canadian Association for Environmental Analytical Laboratories), and National Research Centre Chemistry Lab of Suez Canal University as well as internationally by Analytico Milieu B. V. (Netherlands).

Zooplankton samples were collected from the proposed locations using a plankton net (55 µm mesh diameter). Samples were then immediately preserved in 4% formalin, after collection. The samples were subjected to detailed microscopic analysis and identified into the main zooplankton groups. Qualitative phytoplankton analysis was conducted at each location following sampling and preservation using a plankton net sampler of 20µm-mesh size.

GPS coordinates and meteorological conditions for the monitoring locations at the freshwater intake were recorded during all the field visits. Table 4-3 illustrates the GPS coordinates and meteorological conditions at the freshwater intake.

Table 4-3: Meteorological data, GPS reading at freshwater intake location (Nile Branch)

Location	Local Time	GPS Reading	Meteorological Information							
			Wind Direction	Max 3 sec Gust m/s	Average Wind m/s	Temp ^oC	Wind Chill ^oC	Humidity %	Heat Index %	Dew Point %
MF1	10:50	N: 31 24 30.2 E: 31 45 13.7	N	1.8	1.2	27.5	25.1	34	24	9.6
MF2	11:15	N: 31 24 24.2 E: 31 45 14.7	N	1.7	0.8	29.7	30.1	33.6	30.2	11.5
MF3	11:55	N: 31 24 20.1 E: 31 45 07.3	N	3.1	1.9	28.6	29.7	34.5	25.3	7.3
MF4	12:16	N: 31 24 28.6 E: 31 45 06.8	N	3.4	2.4	23.8	25.8	32.5	24.6	7.5
MF5	13:00	N: 31 24 52.5 E: 31 45 14.1	N	2.2	1.2	27.8	25.9	33.2	25	7.3

4.2.2.2 Analysis Results for Freshwater Quality Assessment

Freshwater analysis results are presented in Table 4-4. The results revealed trace levels for most of the metals analysed, with values reaching up to 0.193 mg/l for Iron. Focus is given to BOD (reaching 8.0 mg/l in MF3), COD (reaching 23 mg/l in MF2), and Ammonia (reaching 1.07 mg/l in MF1). Upon review of Law 48/1982 and its executive regulations (Decree 8/1983), these three specific parameters were found to exceed the allowable levels for freshwater to which industrial discharges are permitted (6 mg/l for BOD, 10 mg/l for COD, and 0.5 mg/l for Ammonia). Although there is no discharge from the facility to the Nile River, except for the raw water silt return, it is important that these parameters be monitored during early construction phases as well as during the operation phases. The details of the monitoring program are presented in section 8.

Table 4-4: Freshwater Analysis Results

Parameter	Unit	MF1	MF2	MF3	MF4	MF5
Sampling time		10:50	11:15	11:55	12:16	13:00
Depth of the water column	m	10	4.5	5.75	0.75	6.5
Sample depth	m	0.5 - 1.0 m below surface				
Onsite measurements						
Temperature	^oC	26.1	27.25	26.9	27.07	27.05
Conductivity	mS/cm	0.429	0.440	0.432	0.434	0.433
Dissolved Oxygen (DO)	mg/l	6.23	6.26	6.32	5.5	6.36
Total Dissolved Solids (TDS)	g/l	0.272	0.275	0.271	0.271	0.272
Free chlorine	mg/l	0.08	ND	ND	0.01	ND

Parameter	Unit	MF1	MF2	MF3	MF4	MF5
pH		Discarded[12]				
Laboratory analyses						
Total Alkalinity	mg/l	177	179	180	180	178
Carbonate (CO_3)	mg/l	0	0	0	0	0
Bicarbonate (HCO_3)	mg/l	177	179	180	180	178
Hydroxide Alkalinity	mg/l	0	0	0	0	0
Total Hardness	mg/l	156	150	144	146	150
Total Suspended Solids (TSS)	mg/l	39	11	12	13	12
Ammonia (NH_3)	mg/l	1.07	0.53	0.71	1.25	0.35
Biochemical Oxygen Demand (BOD)	mg/l	6	6	8	4	4.4
Chemical Oxygen Demand (COD)	mg/l	15	23	14	15	16
Calcium	mg/l	30	29	30	30.5	29
Potassium	mg/l	20	18.8	16.6	15	16
Magnesium	mg/l	15	16	15.6	16.2	17
Sodium	mg/l	36	36	35	34.3	35.2
Sodium Adsorption Ratio (SAR)		1.34	1.33	1.29	1.25	1.28
Chloride (Cl)	mg/l	43	41	43	41	42.3
Nitrite (NO_2)	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2
Nitrate (NO_3)	mg/l	3.68	3.78	3.20	3.85	3.95
Phosphate (PO_4)	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2
Sulphate (SO_4)	mg/l	30.54	28.41	27	27	29
Cyanides (total)	µg/l	<1.0	<1.0	<1.0	<1.0	<1.0
Sulphides		Discarded[13]				
Silica		Discarded[14]				
Fluoride		Discarded[15]				
Trace Metals						
Arsenic (As)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium (Cd)	mg/l	0.005	0.007	0.008	0.004	0.007
Cobalt (Co)	mg/l	0.007	<0.005	0.008	0.007	0.015
Chromium (Cr)	mg/l	0.004	0.004	0.002	0.004	0.01
Copper (Cu)	mg/l	<0.002	<0.002	<0.002	<0.002	<0.002
Iron (Fe)	mg/l	0.193	0.183	0.193	0.19	0.193
Manganese (Mn)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel (Ni)	mg/l	0.029	0.033	0.073	0.04	0.052

[12] pH readings for locations MF1 through MF5 were discarded due to instrument malfunction. It is recommended that pH analysis be included in the monitoring program during construction phase
[13] Discarded for locations MF1 through MF5, due to instrument malfunction at the laboratory. It is recommended that these parameters be included in the monitoring program during the construction phase.
[14] Same as Above
[15] Same as Above

Parameter	Unit	MF1	MF2	MF3	MF4	MF5
Lead (Pb)	mg/l	<0.005	<0.005	<0.005	<0.005	<0.005
Zinc (Zn)	mg/l	<0.005	<0.005	<0.005	<0.005	<0.005
Mercury (Hg)	mg/l	<0.08	<0.08	<0.08	<0.08	<0.08

4.2.2.3 Analysis Results for Nile Sediment Quality Assessment

The analysis results for sediments from the freshwater intake are presented Table 4-5. Data for trace metals and phosphorus are presented as average ± standard deviation of triplicate analysis.

Table 4-5: Analysis results for Nile Sediment

Parameter	Units	MF1	MF2	MF3	MF4	MF5
Dry matter						
Dry matter	%	20.0	21.2	75.5	60.4	61.0
Phosphorus analysis						
Total Phosphorus	mg/g dw[16]	1.5 ± 0.07	1.55 ± 0.06	1.6 ± 0.13	1.56 ± 0.09	1.55 ± 0.11
Trace metals analysis						
Aluminium	µg/g dw	48.5 ± 1.94	46.3 ± 3.24	52.3 ± 4.18	49.3 ± 2.96	48.5 ± 3.20
Arsenic	µg/g dw	2.9 ± 0.11	2.45 ± 0.20	3.06 ± 0.24	2.57 ± 0.18	2.36 ± 0.12
Barium	µg/g dw	36.4 ± 1.38	37.5 ± 3.00	39.5 ± 2.37	36.4 ± 2.55	33.5 ± 2.35
Boron	µg/g dw	33.1 ± 1.66	33.4 ± 2.34	32.5 ± 1.95	33.6 ± 2.35	30.4 ± 1.82
Cadmium	µg/g dw	1.57 ± 0.05	1.69 ± 0.12	1.8 ± 0.09	1.89 ± 0.13	1.93 ± 0.12
Cobalt	µg/g dw	15.56 ± 0.59	15.7 ± 1.26	15.93 ± 0.96	16.4 ± 1.15	17.5 ± 1.23
Chromium	µg/g dw	25.4 ± 1.02	25.01 ± 1.75	33.5 ± 1.68	22.6 ± 1.24	22.8 ± 1.50
Copper	µg/g dw	8.2 ± 0.31	9.28 ± 0.74	15.6 ± 0.94	11.6 ± 0.81	10.45 ± 0.73
Iron	µg/g dw	5080 ± 229	5002 ± 300	5700 ± 399	5520 ± 276	5560 ± 334
Lead	µg/g dw	13.22 ±	13.34 ±	16.65 ±	15.6 ±	15.4 ±

16 "dw" is equivalent to dry weight analysis

Parameter	Units	MF1	MF2	MF3	MF4	MF5
		0.50	1.07	1.00	1.09	1.08
Manganese	µg/g dw	463 ± 23.2	467 ± 32.7	489 ± 29.3	495 ± 34.7	468 ± 32.8
Mercury	µg/g dw	0.84 ± 0.03	0.86 ± 0.07	0.95 ± 0.06	0.86 ± 0.06	0.83 ± 0.06
Molybdenum	µg/g dw	0.633 ± 0.02	0.645 ± 0.05	0.731 ± 0.04	0.645 ± 0.05	0.623 ± 0.04
Nickel	µg/g dw	15.7 ± 0.60	16.9 ± 1.20	18 ± 1.08	18.9 ± 1.30	19.3 ± 1.35
Silver	µg/g dw	4.8 ± 0.18	4.73 ± 0.30	5.1 ± 0.31	5.21 ± 0.35	4.68 ± 0.33
Zinc	µg/g dw	33.75 ± 1.30	36.48 ± 2.50	40.5 ± 2.40	38.92 ± 2.60	33.85 ± 2.60
Microbiological and Parasites analysis						
Plate Count 22˚C	CFU/g	4.70E+04	4.63E+04	6.33E+04	3.20E+04	3.40E+04
Plate Count 37˚C	CFU/g	1.33E+04	2.47E+05	2.33E+04	4.80E+04	3.60E+04
Pseudonomas aeruginosa	CFU/g	40	67	23	56	20
Faecal colifrom	CFU/g	9	5	9	7	6
E.Coli	MPN/g	36.7	16.7	36.7	20	20
Total Petroleum Hydrocarbons (TPH)						
TPH (C10-C16)	mg/kg dw	< 60	< 45	UDL[17]	UDL	UDL
TPH (C16-C22)	mg/kg dw	84	51	UDL	UDL	UDL
TPH (C22-C30)	mg/kg dw	210	110	UDL	UDL	UDL
TPH (C30-C40)	mg/kg dw	170	48	UDL	UDL	UDL
TPH sum (C10-C40)	mg/kg dw	480	210	< 50	< 50	< 50

4.2.2.4 Analysis Results for Freshwater Biota

Phytoplankton

Freshwater samples were collected for both quantitative and qualitative analyses. The results of quantitative analyses for freshwater samples revealed total phytoplankton counts ranging from 5.72E+06 to 1.10E+07 cells/litre. In comparison to the marine samples, freshwater samples revealed higher abundance of phytoplankton, which is commonly due to the availability of nutrients as well as the suitability of physicochemical parameters. Results are conforming with previous studies conducted by *Halim, Y.(1960)* (biological analysis report, 2006).

[17] UDL: Under Detection Limit

Zooplankton

Zooplankton analyses for freshwater samples revealed that Rotifera was the most dominant group, contributing 48 to 72% of total zooplankton density. *Brachionus calyciflorus , Brachionus angularis,* and *Polyarthra vulgaris* all revealed a relatively high dominance within Rotifera group, in addition to *Synchaeta oblonga*, which are considered as eutrophic indicators. The occurrence of such indicators gives a sign of probable eutrophication, due to an increase in nutrients (particularly N and P) which results in phytoplankton blooms that further constitute food sources for zooplankton. The results of Zooplankton analyses for freshwater samples are conforming with previous studies by *Helal, H.A (1981)* (biological analysis report, 2006).

Icthyoplankton

Fish eggs, *Cyprinidae, and Cichilidae* were recorded in freshwater samples. The results showed a more or less homogenous distribution, which could be attributed to the localized area of sampling and its proximity to floated cages for fish farming. In general, the results did not reflect stressful conditions or pollution impacts on fish larvae, however ecotoxicologixcal studies were not completed.

Sediment infauna

The abundance of benthic organisms was very low in the sampled sediments from the five freshwater locations. This could be attributed to the nature of the sediments being composed mainly of very fine clay particles.

Protozoa

Protozoan analysis in fresh water samples revealed three major phyla of protozoa (*Ciliophora, Rhizopoda and Heliozoa).* Protozoa were mainly dominated by *Arcella sp, Carchesium sp, Epistylis sp, Centropyxis sp and Difflugia sp*. No parasitic protozoa were identified in the fresh water samples. The results conform to the findings of *El-Bassat* (2000) results for the same fresh water area (biological analysis report, 2006).

4.2.3 Seawater

4.2.3.1 Desk Study

A data collection study completed in December 2000 by "ufisa Soluziona Servicios Professionales´ and an enhanced field survey by WorleyParsons Komex in January/February 2001 provided some of the necessary background data from which to address the baseline conditions. These baseline conditions were further enhanced with a field survey by WorleyParsons Komex in April/May 2006.

Site Description

The proposed outfall site falls within a restricted area where fishing is prohibited, thus meeting the EEAA criteria for discharge conditions. The major features in the study area are the breakwaters to the east and west of the Port entrance and the dredged channel (approximately 15 m) approach, which cuts through the shallow near shore waters. Routine maintenance dredging (annual) is conducted within the channel (active during the January 2001 survey). The western breakwater is in the vicinity of the proposed outfall location (approximately 1200 m to the east). The western breakwater is 1300 m long at an angle of 10^{o} (from N) and is constructed of large concrete rip-rap.

Bathymetry

The bathymetric data presented is based on the WorleyParsons Komex field survey in April/May 2006. Water depths are reported in metres below chart datum, which is taken as the Lowest Low Water (Alexandria Port). Bathymetric data are reported in Table 4-6. The distance from the shoreline is based on the plot plan shoreline. Distances between the station locations and the shoreline should be taken as approximate.

Table 4-6: Bathymetric Data (April 2006)

Location	GPS Reading (UTM Coordinates)	Water Depth (m)	Distance from the Shoreline (m)
MO1	N: 31 29 53.7 E: 31 44 55.7	8.28	1 184
MO2	N: 31 29 58.9 E: 31 44 10.6	7.92	2 520
MO3	N: 31 29 36.9 E: 31 43 51.2	8.1	2 480
MO4	N: 31 30 50.2 E: 31 43 43.2	11.34	4 221
MO5	N: 31 30 50.2 E: 31 43 43.2	11.34	4 221

Coastal Sediments

The shoreline material on the North African coast in the vicinity of the Nile River delta are generally composed of fine sand, coarse sand (with many shell fragments), and muddy sand to the east of the eastern breakwater (Admiralty Chart data). This coastal area is described as the Nile Fan, which is a sloping depositional area extending seaward for many kilometres off the Nile River delta. The sea bottom in the immediate area of Damietta Port is relatively free of any significant features or landforms, providing a relatively smooth bottom with low frictional resistance. The grab samples at locations in the vicinity of the proposed outfall ports were predominantly fine, silty sands and coarse shell fragments. At the control station (MO5) the sediment sample was predominantly coarse shell fragments and fine sands.

Salinity and Temperature

The surface water salinity and the seasonal variation, in the Damietta Port as described in the Oceanographic Atlas of the North Atlantic Ocean, is presented in Table 4-7. Although the location is within the vicinity of the mouth of the River Nile, there is little apparent variation in salinity in the coastal Mediterranean Sea.

Table 4-7: Salinity Data, Damietta Port

Time of Year	Salinity
January – March	39
April – June	38.75
July – September	38.75
October – December	39

Source: Soluziona ingeniera / ALATEC

The surface water temperature and monthly variation in the Damietta Port area, as described in the Oceanographic Atlas of the North Atlantic Ocean, are presented in Table 4-8. The surface water temperatures are the coolest from January through March and warmest in August.

Table 4-8: Monthly Surface Water Temperatures

Month	Maximum Temperature (°C)	Average Temperature (°C)	Minimum Temperature (°C)
January	18.9	17.8	15.6
February	18.9	16.7	14.4
March	17.8	16.7	14.4
April	20	17.8	15.6
May	23.3	21.1	17.8
June	25.6	23.3	20.0
July	27.8	25.6	23.3
August	28.9	26.7	24.4
September	27.8	25.6	23.3
October	25.6	24.4	22.2
November	23.3	22.2	18.9
December	22.2	18.9	15.6

The maximum surface water temperature during the summer is 28.9 °C, while the minimum surface water temperature during winter is 14.4 °C. During the field investigations in April 2006, a number of temperature readings were recorded at stations MO1 to MO5 along the proposed outfall routes. The temperature ranged from 19.7 to 20 °C.

There is minimal stratification in the coastal waters, and the water column remains well mixed (2001). Wind and wave action mix the shallow waters thoroughly.

Density

The ambient water density is calculated from the temperature and the salinity of the water. Surface water densities reported by ufisa / ALATEC (2000) are given in Table 4-9. The variations in density are most likely a result in of the variations in the temperature as there is little variation in the salinity throughout the year. It is anticipated that the density will vary little with depth in the area of the proposed discharge. Wind and wave action are expected to thoroughly mix the water through the entire water column in the area of the proposed discharge.

Table 4-9: Surface Water Density

Month	Density (kg/m^3)
February	1 028
May	1 028
August	1 025
November	1 027

Source: ufisa / ALATEC

Tides

The tides in the Damietta Port area are semi diurnal (i.e. two highs and lows every 24 hours). The maximum amplitude of the tidal range is 0.65 meters. Currents generated from the tidal action are expected to be minimal. The minimum water depth above the terminus of the outfall was used for dilution modelling. The minimum water depth reduces the potential for dilution and should provide the most conservative estimate for dilution.

Winds, Currents, and Waves

Wind patterns will generate surface waves, currents and affect the rate of heat transfer from the water surface. Maximum wind speeds measured in the area of Damietta Port reach over 20 m/s (ufisa / ALATEC). Wind generated currents in the area of Damietta Port generally flow from the west. An average current velocity on the order of 0.35 m/s (0.7 knots). The frequency of this current is in the order of 40 %. The rate of heat transfer from the surface of the water to air is a minimum under low wind conditions. An arbitrary wind speed of 2 m/s was chosen for modelling purposes. This is a typical breeze and can be a very common occurrence any time of the year. The wind speed has been used to select a surface heat exchange coefficient, as described by Adams, *et al*. (1981). The prevailing winds will also generate waves. An analysis of predicted maximum wave heights was performed by ufisa / ALATEC, and is given in Table 4-10. The largest waves are predicted to be aligned parallel to the shoreline, aligned with the prevailing west north west winds.

Table 4-10: Significant Wave Heights from WNW

Return Period (years)	Significant Wave Height (m)
1	4.6
2	5.0
5	5.5
10	5.9
20	6.3
50	6.8
100	7.2
200	7.5
500	8

Source: Ufisa / ALATEC

4.2.3.2 Site Specific Seawater Quality Assessment

Offshore surveys have been conducted at the proposed outfall route, in addition to the proposed jetty location. Water and sediment quality has been assessed at a number of locations. A total of eleven water samples and nine sediment samples have been collected. The water samples were collected using Niskin bottle and sediments were collected using Van Veen grab sampler. On-site water analysis for temperature, pH, DO, TDS, conductivity, and salinity was conducted using YSI 566 Multi-probe instrument.

GPS coordinates and meteorological conditions for the monitoring locations at the jetty and outfall locations were recorded during all the field visits. Table 4-11 shows the GPS coordinates and meteorological conditions at these locations.

Table 4-11: GPS Meteorological data, GPS Reading at Jetty and Outfall Locations

Location	Time	GPS Reading	Meteorological Information							
			Wind Direction	Max 3 sec Gust m/s	Average Wind m/s	Temp ^{o}C	Wind Chill ^{o}C	Humi-dity %	Heat Index %	Dew Point %
MJ1	10:30	N: 31 28 00 E: 31 45 07	Not Measured	2.3	1.2	25.3	25.7	65	25.9	26.2
MJ2	12:00	N: 31 28 03 E: 31 45 07	Not Measured	4.4	2.2	23.9	24.2	75	25.6	19.8
MJ3	16:00	N: 31 27 58 E: 31 45 05	Not Measured	3.8	1.7	24.6	25.3	72	26.3	20
MJ4	16:00	N: 31 27 58 E: 31 45 05	Not Measured	3.8	1.7	24.6	25.3	72	26.3	20
MJ5	17:15	N: 31 27 56 E: 31 45 04	Not Measured	5.6	2.8	23.9	24.0	75	25.3	19.8

MJ6	17:15	N: 31 27 56 E: 31 45 04	Not Measured	5.6	2.8	23.9	24.0	75	25.3	19.8
MO1	16:45	N: 31 29 53.7 E: 31 44 55.7	SSE	6.4	5.4	19.5	19	77.5	19.4	15.3
MO2	14:00	N: 31 29 58.9 E: 31 44 10.6	SSE	4.6	3.7	20	19.7	70.5	19.7	14.3
MO3	13:00	N: 31 29 36.9 E: 31 43 51.2	SSE	5.2	4.7	20.9	19.6	71.5	21	15.6
MO4	15:00	N: 31 30 50.2 E: 31 43 43.2	SSE	5.5	4.5	19.7	19.7	75.2	19.7	15.2
MO5	15:30	N: 31 30 50.2 E: 31 43 43.2	SSE	5.5	4.5	19.7	19.7	75.2	19.7	15.2

Samples were collected, appropriately labelled and preserved in accordance to USEPA standard methods. Samples were then delivered in an ice box to the laboratory and analyzed within the recommended holding time for each parameter, according to USEPA approved methods and accompanied by completed chain-of-custody forms and sent to appropriate laboratories for analyses.

Samples were analyzed locally by the Central Laboratory for Environmental Quality Monitoring located in El Kanater (the laboratory has been awarded ISO/IEC 17025 by the Canadian Association for Environmental Analytical Laboratories), and National Research Centre Chemistry Lab of Suez Canal University as well as internationally by Analytico Milieu B. V. (Netherlands).

Zooplankton samples were collected from the proposed locations using a plankton net (55 µm mesh diameter). Samples were then immediately preserved in 4% formalin, after collection. The major zooplankton groups were subjected to detailed microscopic analysis. Qualitative phytoplankton analysis was conducted each location following sampling and preservation using a plankton net sampler of 20µm-mesh size.

4.2.3.3 Analysis Results for Seawater Quality Assessment

Analysis results for seawater samples are presented in Table 4-12. In general, the results compare well with data from previous studies in the region, with variations that could be related to site conditions or seasonal factors.

Chemical oxygen demand (COD) and nitrate has revealed a relatively elevated range of measurements at locations MO1 through MO5 (outfall assessment points), thus exceeding the values recorded at locations MJ1 through MJ6 (jetty assessment points) as well as the common ranges for seawater in the region. It is therefore strongly recommended that COD and nitrate be monitored during early construction phases. A higher level of TSS was detected in samples MJ1 through MJ6, which could be attributed to construction activities inside the port.

Table 4-12: Seawater Analysis Results

Parameter	**Unit**	**MO1**	**MO2**	**MO3**	**MO4**	**MO5**	**MJ1**	**MJ2**	**MJ3**	**MJ4**	**MJ5**	**MJ6**
Sampling date		18 April, 2006					28 May, 2006					
Sampling time		16:40	14:00	13:00	15:00	15:30	10:30	12:00	16:00	16:00	16:45	17:00
Sample depth (below water surface)	m	1 m	1 m	1 m	1 m	6 m	4 m	6 m	1 m	5 m	1 m	5 m
Onsite measurements												
Temperature	^oC	19.78	19.96	19.90	19.78	19.49	26.13	27.65	26.6	25.64	26.81	25.66
Conductivity	mS/cm	50.75	51.62	51.35	51.49	51.36	52.29	53.34	52.95	52.08	53.16	52.37
Dissolved Oxygen (DO)	mg/l	8.12	8.3	8.38	8.26	7.66	8.2	7.9	8.7	8.1	7.8	8.02
Total Dissolved Solids (TDS)	g/l	36.6	37.15	36.89	37.17	37.3	33.28	33.34	33.40	33.45	33.41	33.62
Chlorine	mg/l	0.01	0.01	0.01	0.02	0.02	ND	ND	ND	ND	ND	ND
pH		Discarded[18]					7.65	7.68	7.8	7.8	7.88	7.74
Laboratory analyses												
Total Alkalinity	mg/l	143	144	138	133	137	135	140	126	125	128	129
Carbonate (CO_3)	mg/l	13	14	11	14	19	24	19	15	19	20	22
Bicarbonate (HCO_3)	mg/l	130	130	127	119	118	111	121	111	106	109	109
Hydroxide Alkalinity	mg/l	0	0	0	0	0	0	0	0	0	0	0
Total Hardness	mg/l	7086	7228	7324	6852	7330	6121	6486	6332	6343	6359	6364
Total Suspended Solids (TSS)	mg/l	55	43	23	34	13	625	608	611	645	649	652
Ammonia (NH_3)	mg/l	0.53	0.35	0.71	0.53	0.71	0.440	0.515	0.375	0.265	0.370	0.390
Biochemical Oxygen Demand (BOD)	mg/l	3.6	3.6	3.2	4.4	4.4	4.5	4.9	3.6	4.2	4.6	4.7
Chemical Oxygen Demand[19] (COD)	mg/l	470	430	475	570	585	23.5	22.5	24	26.8	27	27.2

[18] Discarded for locations MO1 through MO5, due to instrument malfunction. It is strongly recommended that these parameters be included in the construction phase monitoring
[19] COD and Nitrate levels in samples MO1 through MO5 are regarded to be relatively higher than the common ranges from previous seawater analyses in the area. It is highly recommended to repeat the analysis during the construction phase monitoring.

Parameter	Unit	MO1	MO2	MO3	MO4	MO5	MJ1	MJ2	MJ3	MJ4	MJ5	MJ6
Calcium	mg/l	950	890	900	980	970	540	536	532	548	544	545
Potassium	mg/l	1610	1570	1550	1500	1410	593	615	598	605	601	606
Magnesium	mg/l	850	911	943	916	985	1159	1250	1215	1208	1212	1210
Sodium Adsorption Ratio (SAR)		51.10	51.29	49.96	50.76	49.47	63.89	62.61	63.91	63.85	63.86	63.88
Chloride (Cl)	g/l	20.0	19.8	19.9	20.2	20.14	20.8	21.2	20.9	21.1	21.2	21.2
Nitrite (NO_2)[20]	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2	0.002	0.001	0.006	0.008	0.008	0.008
Nitrate[19] (NO_3) [20]	mg/l	9.00	8.75	9.27	9.30	<0.2	0.048	0.052	0.063	0.095	0.089	0.081
Phosphate (PO_4) [20]	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2	0.054	0.060	0.098	0.075	0.085	0.079
Cyanides (total) [21]	µg/l	<1.0	<1.0	<1.0	<1.0	<1.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Sulphate (SO_4)	g/l	1.100	1.17	1.0	1.17	1.18	3.45	3.51	3.4	3.4	3.43	3.46
Sulphides	mg/l	Discarded[18]					0.330	0.360	0.295	0.330	0.325	0.336
Silica	mg/l	Discarded[18]					1.1	1.3	1.13	1.15	1.21	1.27
Fluoride	mg/l	Discarded[18]					1.8	1.75	1.9	1.65	1.77	1.82
Heavy metals												
Arsenic (As) [20]	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.0026	0.0023	0.00245	0.00211	0.0021	0.00223
Cadmium (Cd)	mg/l	0.002	0.003	0.005	<0.0005	<0.0005	0.00185	0.00196	0.0021	0.00189	0.00198	0.00221
Cobalt (Co)	mg/l	0.005	<0.005	0.008	0.007	0.011	0.0037	0.0039	0.00407	0.00418	0.00411	0.00421
Chromium (Cr)	mg/l	0.068	0.068	0.063	0.069	0.066	0.0536	0.0599	0.0637	0.0689	0.0658	0.0671
Copper (Cu)	mg/l	<0.002	<0.002	<0.002	<0.002	<0.002	0.0063	0.0059	0.0067	0.0071	0.0068	0.0069
Iron (Fe)	mg/l	0.176	0.183	0.182	0.18	0.175	0.22	0.233	0.215	0.245	0.238	0.243
Manganese (Mn)	mg/l	0.01	0.01	<0.01	<0.01	<0.01	0.0445	0.0486	0.0399	0.0434	0.0416	0.0428

[20] Samples MO1 through MO5 were analysed using an instrument with higher detection limit than samples MJ1 through MJ6.
[21] Samples MO1 through MO5 were analysed using an instrument with lower detection limit than samples MJ1 through MJ6

Parameter	**Unit**	**MO1**	**MO2**	**MO3**	**MO4**	**MO5**	**MJ1**	**MJ2**	**MJ3**	**MJ4**	**MJ5**	**MJ6**
Nickel (Ni)	mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	0.0289	0.0316	0.0304	0.0326	0.0328	0.0332
Lead (Pb)	mg/l	0.071	0.011	0.036	0.04	<0.005	0.0226	0.0246	0.0226	0.0281	0.0241	0.0279
Zinc (Zn)	mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	0.0895	0.0956	0.1074	0.116	0.11	0.115
Mercury (Hg) [20]	mg/l	<0.08	<0.08	<0.08	<0.08	<0.08	0.00069	0.00074	0.00069	0.00071	0.00073	0.00077

Table 4-13: Analysis Results for Seabed Sediment Assessment

Parameter	Units	MO1	MO2	MO3	MO4	MO5	MJ1	MJ2	MJ3	MJ4
Dry matter	%	73.8	77.9	72.6	81.8	82.9	54.4	37.3	68.1	71.9
Total Phosphorus	mg/g dw	1.35 ± 0.06	1.38 ± 0.04	1.28 ± 0.08	1.26 ± 0.08	1.27 ± 0.06	1.2 ± 0.06	1.26 ± 0.06	1.31 ± 0.07	1.3 ± 0.06
Aluminum	µg/g dw	34.5 ± 1.38	37.3 ± 1.87	38.4 ± 2.11	40.1 ± 2.65	35.9 ± 1.76	38.5 ± 1.75	39.6 ± 1.8	37.6 ± 1.8	42.6 ± 2.1
Arsenic	µg/g dw	2.15 ± 0.11	1.93 ± 0.12	1.98 ± 0.10	1.87 ± 0.11	1.57 ± 0.07	1.63 ± 0.06	1.75 ± 0.07	1.58 ± 0.06	1.87 ± 0.08
Barium	µg/g dw	30.47 ± 0.91	30.68 ± 1.84	28.59 ± 1.72	27.95 ± 1.40	28.43 ± 1.28	26.5 ± 1.3	27.9 ± 1.6	30.4 ± 1.5	32.6 ± 1.62
Boron	µg/g dw	27.11 ± 0.81	27.3 ± 2.18	25.45 ± 1.78	24.8 ± 1.24	25.3 ± 1.14	24.5 ± 1.1	26.3 ± 1.2	23.6 ± 1.1	26.8 ± 1.4
Cadmium	µg/g dw	1.18 ± 0.05	1.11 ± 0.06	1.07 ± 0.06	1.18 ± 0.05	1.2 ± 0.06	1.26 ± 0.05	1.31 ± 0.06	1.4 ± 0.06	1.37 ± 0.05
Cobalt	µg/g dw	12.22 ± 0.37	12.27 ± 0.74	11.45 ± 0.69	11.21 ± 0.56	11.47 ± 0.52	11.6 ± 0.4	12.3 ± 0.5	10.7 ± 0.4	12.64 ± 0.5
Chromium	µg/g dw	20.33 ± 0.85	20.57 ± 1.03	20.08 ± 0.80	19.45 ± 0.88	18.97 ± 0.85	19.5 ± 0.75	20.6 ± 0.82	21.6 ± 0.82	22.6 ± 0.88
Copper	µg/g dw	4.9 ± 0.15	6.1 ± 0.37	6.5 ± 0.39	5.9 ± 0.30	5.8 ± 0.26	5.1 ± 0.2	4.6 ± 0.2	5.5 ± 0.23	5.82 ± 0.22
Iron	µg/g dw	4066 ± 203	4114 ± 234	4016 ± 201	3990 ± 219	3879 ± 176	3654 ± 205	3879 ± 226	3754 ± 212	3865 ± 220
Lead	µg/g dw	10.37 ± 0.31	10.45 ± 0.63	9.75 ± 0.59	9.52 ± 0.48	9.74 ± 0.44	10.25 ± 0.4	11.26 ± 0.5	11.63 ± 0.5	12.9 ± 0.6
Manganese	µg/g dw	380 ±	383 ±	365 ±	357 ±	355 ±	395 ±	405 ±	410 ±	435 ±

Parameter	Units	MO1	MO2	MO3	MO4	MO5	MJ1	MJ2	MJ3	MJ4
		19.0	21.1	23.7	16.4	17.0	18	21	22	20
Mercury	µg/g dw	0.7 ± 0.02	0.66 ± 0.04	0.64 ± 0.04	0.71 ± 0.04	0.73 ± 0.03	0.58 ± 0.022	0.54 ± 0.02	0.62 ± 0.028	0.71 ± 0.033
Molybdenum	µg/g dw	0.525 ± 0.02	0.495 ± 0.03	0.482 ± 0.03	0.532 ± 0.03	0.548 ± 0.02	0.613 ± 0.02	0.638 ± 0.025	0.667 ± 0.03	0.697 ± 0.04
Nickel	µg/g dw	11.8 ± 0.40	11.1 ± 0.57	10.7 ± 0.64	11.8 ± 0.60	12 ± 0.55	12.6 ± 0.5	13.35 ± 0.6	14.3 ± 0.7	15.6 ± 0.7
Silver	µg/g dw	3.77 ± 0.12	3.83 ± 0.19	3.65 ± 0.20	3.57 ± 0.18	3.85 ± 0.17	4.15 ± 0.18	4.26 ± 0.21	4.56 ± 0.22	4.92 ± 0.24
Zinc	µg/g dw	28.9 ± 1.10	29.6 ± 1.60	28.1 ± 1.69	29.37 ± 1.50	30.86 ± 1.50	30.3 ± 1.4	33.6 ± 1.6	29.6 ± 1.4	36.5 ± 1.8
Microbiological and Parasites analysis										
Plate Count 22˚C	CFU/g	1.60E+04	6.60E+03	9.30E+03	4.00E+03	4.60E+03	2.0 E+02	1.5 E+02	2.0 E+02	2.5 E+02
Plate Count 37˚C	CFU/g	2.72E+06	9.90E+03	9.90E+03	2.92E+06	2.70E+06	3.0 E+02	3.5 E+02	4.5 E+02	4.0 E+02
Pseudonomas aeruginosa	CFU/g	Nil	Nil	5	Nil	Nil	1	3	2	5
Faecal colifrom	CFU/g	3	4	1	2	3	1	2	2	1
E.Coli	MPN/g	3.2	6.7	2.3	2.5	2.7	1.2	2.4	2.3	1.4
Total Petroleum Hydrocarbons (TPH)										
TPH (C10-C16)	mg/kg dw	UDL	UDL	UDL	UDL	UDL	<15	<30	UDL	UDL
TPH (C16-C22)	mg/kg dw	UDL	UDL	UDL	UDL	UDL	10	27	UDL	UDL
TPH (C22-C30)	mg/kg dw	UDL	UDL	UDL	UDL	UDL	29	52	UDL	UDL
TPH (C30-C40)	mg/kg dw	UDL	UDL	UDL	UDL	UDL	32	52	UDL	UDL
TPH sum (C10-C40)	mg/kg dw	<50	<50	<50	<50	<50	72	130	<50	<50

4.2.3.4 Analysis Results for Sea Sediment Quality Assessment

The analysis results for seabed sediment quality are presented in Table 4-13. Data for trace metals and phosphorus are presented as the average ± standard deviation of triplicate analysis. In general, seabed sediment quality compares well to previous similar analyses made in the region.

4.2.3.5 Analysis Results for Marine Biota

Phytoplankton

The phytoplankton species can be classified according to size into many classes. The most common classification divides the phytoplankton species into two main categories: smaller or larger than 20 µ in size. To detect the two classes, two different methods were designed. The first method is the sedimentation method to detect the small and more abundant species (quantitative method). The second method is the net plankton 20 µm pore size method (qualitative method). Sub-samples from the collected qualitative samples were mixed together to obtain replicate samples representing the studied area. The combination of the two techniques allows for the overview of the least abundant species (collected qualitatively by the net) and also the abundance of dominant species (collected quantitatively in 1 litre bucket).

The results of quantitative analyses at locations MO1 through MO5 revealed a total count of 2.10E+05 to 8.30E+05 cells/litre, with the highest dominance for the Bacillariophytes group (ranging from 1E+05 to 7.1E+05 cells/litre). The most dominant species from the Bacillariophytes group were *Skelatonema costatum* and *Nitzschia closterium*. The results of quantitative analyses at locations MJ1 through MJ6 revealed a higher occurrence of phytoplankton. A total count of 4.00E+05 to 3.28E+06 cells/litre was detected, with the highest dominance for Bacillariophytes (ranging from 2.50E+05 to 2.11E+06 cells/litre). The most dominant species from the Bacillariophytes group were *Leptocylindericus minimus, Pseudonitzschia lineola, and Skelatonema costatum*). In general, the results have indicated normal standing crop of phytoplankton, compared to previous studies in the area , especially those conducted by *Dowidar (1984)).* No indication of pollution was detected (biological analysis report, 2006).

Zooplankton

Zooplankton analyses at locations MO1 through MO5 revealed total counts ranging from 7950 to 19950 organisms/m^3. Copepoda was the most dominant group, with counts ranging from 36 to 57% of the total zooplankton density. Such dominance of Copepoda could be attributed to the fact that, in general, Copepoda species prefer oceanic waters (open waters) as their habitats. The relatively low abundance of Protozoa (2 to 8% of the total zooplankton density) could also be explained by the fact that many Copepoda species use protozoa as food source.

The results are also regarded to fall in the common ranges for the region, and are conforming with previous studies, especially *Abdel-Aziz, N.E. (1997) and Nour El Din, N.M. (1987)* (biological analysis report, 2006).

On the other hand, Zooplankton analyses at locations MJ1 through MJ6 revealed lower occurrences (ranging from 1200 to 3400 Org.m^{-3}). Copepoda represented the most dominant species, with an average occurrence of 71.3% of the total zooplankton density. The relatively lower detection of zooplankton at locations MJ1-MJ6 could be partially attributed to the presence of large fish shoals using zooplankton as a food source, or to the relatively lower exchange of water related to the site being more or less like a closed bay.

Icthyoplankton

Fish larvae were seldom recorded at locations MO1 through MO5, with only few detections of fish eggs, *Mugilidae, and Sparadae* at location MO1. The scarcity of fish larvae recording at these locations could be attributed to the tendency of most species to aggregate near the shoreline, where food sources are more available.

Relatively higher occurrences of fish larvae were detected in samples from locations MJ1 through MJ3, with dominant recordings being mainly fish eggs, *Clupeidae, Mugilidae,* and *Sparadae*. Large shoals of different fish species were also noticed during the sampling program, especially at locations MJ1 & MJ2. Samples from MJ4 and MJ5 revealed only the detection of fish eggs, while no detection of icthyoplankton was recorded at MJ6.

The results are regarded to conform with normal occurrences in the area as well as previously published studies (El-Rashidy, 1987 & Ettewa 1988) (biological analysis report, 2006).

Sediment infauna

Seabed sediment samples at the studied locations were populated by different groups of benthic organisms such as *hydroids, bivalve, polychaete, Gnathostomulids, gastrotricha, amphipoda, copepda, nematode, foraminiferida, ostracoda, and spinculida*. Results are presented for three different grain size factions of sediment (1 mm, 0.5 mm, and 0.05 mm).

Samples from locations MO1 through MO5 revealed a total number of organisms ranging from 75 to 353 organisms/200 cm^3. Samples MO4 and MO5 are replicate samples from the same location for QA/QC purposes. The results indicate high similarity in diversity (10 species recorded at MO4 and 9 at MO5) as well as abundances (total benthic counts of 330 and 353 organisms/200 cm^3 at MO4 and MO5 respectively), which are also the highest abundances among the sampled locations. Samples from locations MJ1 through MJ4 revealed a relatively higher recording of benthic organisms (134 to 756 organisms/200 cm^3).

In general, densities of meiobenthic organisms in coastal water are ranging from 100 to 1000 organisms/100 cm^3. Such numbers vary according to season, water depth as well as the grain size distribution of sediments (Hulings, 1971 a, b and 1974; Vitello and Triki, 1978). In the Mediterranean Sea, lower densities of sediment infauna are detected, which could be related to the oligotrophic nature of the sea (Theil, 1978). The results of benthic organisms analysis at the surveyed locations (MO1-MO5 and MJ1-MJ4) are regarded to conform with the normal trend of meiofauna in this type of sediment, and with common ranges for the Mediterranean Sea. No sign of pollution indicators was recorded at the studied sites. It is recommended that sediment infauna analysis be associated with grain size distribution as specified in the monitoring program, in order to aid in the comparison of sediment infauna within the different grain size fractions (biological analysis report, 2006).

<u>Protozoa</u>

"The description of protozoa is mainly according to the specific characters of the genus, concerning the latero-dorsal kinetics, the arrangement of the dorsal argentophilic network, the number of frontal ventral cirri and the form of the macronucleus; in addition to the following where applicable: morphology, nuclear division, cyst form, floating form, and the ex-cystment. The identification was also based on living and stained preparations" (biological analysis report, 2006).

In marine samples MO1 through MO5, protozoa were mostly represented by ciliates. The recorded genera were *Aspidisca sp, Euplotes vannus, Holosticha diademata, Protocruzia sp and Uronema sp*. Samples MJ1 through MJ4 have revealed the dominance of *Aspidisca sp, Protocruzia sp,* and *Uronema sp*, in addition to the presence of *Euplotes vannus.* No parasitic protozoa were identified. The composition of protozoa did not reflect any source of pollution in the area. Results are also conforming with previous studies in the region (unpublished reports for *El-Serehy*) (biological analysis report, 2006).

4.2.3.6 Thermal Dispersion Model

WorleyParsons Komex conducted a thermal discharge model for the proposed outfall from the Egyptian Methanex Methanol Company S.A.E. (EMethanex) plant to be built within Damietta Port, Egypt. The CORMIX model was used to determine the predicted temperature differential between the discharge effluent and the receiving environment. The modelled effluent temperature and discharge location are based on Egyptian Law, while the predicted effluent plume temperatures were compared to the more stringent World Bank environmental protection criteria. The complete model report is presented in Appendix X.

Egyptian law for the discharge of effluent to the marine environment is outlined in "Annex (1) of Law Number 4 of 1994, The Environment Law." Under the law, discharge is not permitted except at a distance of 500 m from the shoreline, and must not affect fishing zones, bathing zones or natural reserves, and the discharge must not exceed 10 degrees over the prevailing receiving water temperature. The Presidential Decree Law No 93 for 1962 Concerning Drainage of Liquid Wastes, additionally states that discharges should not be warmer than 40 °C.

Criteria pertaining to marine discharges are outlined in the "Pollution Prevention and Abatement Handbook" (The World Bank Group, 1998). Petrochemical manufacturing guidelines within the handbook state that the temperature of the effluent plume must be within 3 degrees of the receiving environment temperature at the boundary of the zone of initial mixing and dilution (ZIMD). For a single port diffuser the ZIMD extends 100 m radially from the point of discharge. For multi port diffusers, this has been interpreted as 100 m from the diffuser mid point.

The effluent plume was modelled at the design effluent flow rate for the following conditions:

- Single port diffuser using the minimum summer (August) and minimum winter (February) water column density, along with the three terminus depths; and
- 16 port diffuser, using the worst case (February) scenario for water column density and three terminus depths.

The results indicate that the temperature of the effluent plume is predicted to cool rapidly, with little variation in the predicted temperatures and path of the effluent plume between the two seasons and terminus depths. The effluent plume is predicted to be less than 3 °C above the ambient temperature within 3 m of the terminus and less than 1.0 °C above the ambient temperature at the ZIMD, for all scenarios.

4.2.4 Natural Hazards

4.2.4.1 Surface Water

The nearest sources of surface water to the site are the branch of the Nile channelled into Damietta Port and the Mediterranean Sea.

4.2.4.2 Flash Flood Hazards

Three approaches have been taken to study the possibility of flash-flood hazards on the proposed project location. The first approach was to search for previous flash flood incidents. This approach revealed no such incidents.

The second approach was to study the possibility of flash-flood occurrence through detecting the elements, which impose a flash-flood hazard. The first element was rainfall - rainfall data for the past thirty years were studied, suggesting that the location has never been subject to severe rainfall. The second element was gradient - flash-floods usually occur in areas of steep gradients, trapped between sharp mountainous areas and the sea. There are no steep gradients in the area. A third approach was also covered, where recent satellite images for the location were examined, the images indicated no flash-flood routes. The project site and surrounding areas are thus not expected to be subject to any flash-flood hazards.

4.2.4.3 Seismicity

Seismic activity in Egypt is influenced mainly by the northward movement of the African plate into the plates of the European landmass. The East African rift rises through Mozambique, Kenya and Ethiopia to then branch into a rift along the Red Sea and along the Gulf of Aden. The Red Sea rift then branches into the Gulf of Suez and the Gulf of Aqaba. The Red Sea rift is a zone of plate separation, where the African and Arabian plates are forced apart. This is a zone of shallow seismic activity (Youssef, 2001). Earthquakes in Egypt can reach a magnitude of up to 7.3 Ms (http://iisee.kenken.go.jp).

It is the northern part of the rift that is important for determining Egyptian seismic hazard, which is considered low – moderate along the northeastern margin of the African plate. Youssef 2001 identifies five areas of hazard in Egypt:

1. The delta region and the Mediterranean fringe
2. The areas surrounding the Red Sea, Gulf of Suez and Gulf of Aqaba junction
3. The areas surrounding Lake Nasser in the south
4. Southwest Cairo (the area of Dahshour, where the earthquake of 12 October 1992 killed or injured 7000 and destroyed 1000 schools)
5. The Gulf of Aqaba Dead Sea rift

For this particular study area, the delta region and the Mediterranean fringe is of concern. Historical damage indicates that the area is vulnerable to earthquakes originating locally and offshore in the eastern Mediterranean basin. The maximum intensity is from VI to VIII. Intensity is highest where the subsoil is of poor quality, providing insecure foundation (i.e. the unconsolidated deposits of the Nile Delta) and is lowest where there is limestone ridge (Youssef, 2001). Secondary hazards of concern include mainly seismic waves (tsunamis), which can result from even distant offshore earthquakes in the Mediterranean.

4.3 Air and Climate

4.3.1 Climate and Meteorology

4.3.1.1 Temperature

The summer season in the area is prolonged, hot and dry, with little cloud cover. The winter period is short and mild with most of the rain falling during winter. The temperature for Damietta is typical for the Mediterranean region. The average annual minimum air temperature is 17.5 ^{o}C, the average maximum air temperature is 22.5 ^{o}C. In an average climatic year in Damietta, the number of days, with minimum temperatures below the average, is shown in Table 4-14.

Table 4-14: Minimum temperatures in Damietta Port

Minimum Temperature	No. of Days
0^{o}C	0 – 5 Days
5^{o}C	0 - 5 Days
10^{o}C	60-90 Days

In an average climatic year in Damietta, the number of days with maximum temperatures above the average is shown in Table 4-15. Table 4-16 provides details of the meteorological parameters for Damietta. Appendix V provides 30 years of meteorological data for Damietta.

Table 4-15: Maximum temperatures in Damietta Port

Maximum Temperature	No. of Days
35^{o}C	0 –5 Days
40^{o}C	0 –5 Days
45^{o}C	0 –5 Days

Table 4-16: Regional Meteorological Parameters, Mean Values

Month **Meteorological Element**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Maximum Air Temperature (°C)	18.2	18.5	20.3	23.1	26.4	29.2	30.6	30.9	29.3	27.3	23.6	19.7
Highest maximum air temperature (°C)	26.5	31.9	35.8	38.8	45.6	40.8	39.5	38.6	37.9	36.1	35.4	28.5
Date (yy/dd)	87/18	52/28	31/16	93/17	41/10	33/30	34/16	36/15	39/29	51/6	41/7	62/3
Lowest Maximum air temperature (°C)	10.6	8.8	10.3	15.3	19.5	23.8	26.0	27.0	23.5	20.3	15.1	11.9
Date (yy/dd)	74/23	92/24	83/6	94/3	87/1	90/4	69/15	68/24	70/30	65/30	94/29	71/22
Minimum air temperature (°C)	8.6	9.0	11.0	13.6	16.8	20.0	21.4	21.6	20.2	18.4	15.1	10.7
Highest minimum air temperature (°C)	17.0	15.6	17.6	21.7	23.4	24.8	25.8	26.4	25.0	24.4	23.2	17.7
Date (yy/dd)	85/14	68/29	61/17	94/20	64/30	65/13	89/16	78/3	86/24	63/18	66/4	71/2
Lowest minimum air temperature (°C)	1.5	0.7	3.8	4.6	9.5	7.0	16.9	16.3	14.7	11.4	6.8	3.7
Date (yy/dd)	53/14	34/17	49/5	49/19	65/5	93/3	49/26	49/22	49/30	59/21	48/28	31/31
Relative humidity (%)	76	75	73	71	71	71	72	76	75	75	76	76
Highest relative humidity (%)	100	100	100	100	100	100	100	100	100	100	100	100
Date (yy/dd)	s.d	s.d	s.d	s.d	s.d	s.d	s.d	s.d	s.d	s.d	s.d	s.d
Lowest relative humidity (%)	26	24	20	16	13	21	24	25	31	29	25	31
Date (yy/dd)	85/1	71/28	75/22	66/14	65/26	95/7	94/3	63/18	66/22	77/10	95/5	80/4
Amount of Rainfall (mm/month)	26	19.7	13.0	4.6	1.5	0.2	Trace	Trace	0.4	7.1	15.7	24.0
Highest amount of Rainfall (mm/month)	37.0	29.0	44.3	31.8	15.8	8.5	Trace	Trace	18.0	35.0	55.0	40.1
Date (yy/dd)	32/28	93/13	91/22	86/1	61/6	79/4	34/21	42819	57/30	37/27	53/5	93/22
Dry temperature (°C)	12.9	13.4	15.3	18.1	21.0	24.5	25.8	26.0	24.5	22.4	18.4	14.6
Highest dry temperature (°C)	17.1	17.5	19.4	22.0	25.1	28.2	29.2	29.9	28.4	26.2	22.6	18.8
Lowest dry temperature (°C)	9.8	9.9	11.3	14.0	16.5	19.9	21.3	21.4	20.2	18.4	15.3	11.5
Pressure on mean level sea	1018.5	1017.0	1015.3	1013.6	1021.6	1011.2	1008.4	1008.5	1012.5	1015.6	1015.4	1018.2
Highest pressure on mean sea level	1032.5	1029.9	1028.8	1026.3	1024.4	1019.4	1016.4	1016.3	1028.3	1024.8	1028.4	1028.8
Date (yy/dd)	92/4	89/3	923	83/20	95/8	90/5	79/11	72/24	92/28	91/27	88/14	63/26
Lowest pressure on mean sea level	929.9	997.9	1000.8	993.6	999.4	1000.1	999.7	1001.8	1003.6	1001.5	1000.5	999.3
Date (yy/dd)	69/21	86/5	93/6	71/11	92/7	88/11	95/2	77/7	67/8	69/9	76/24	62/18
Number of days fog	0.2	0.1	0.1	0.0	0.0	0.0	0.03	0.0	0.1	0.03	0.2	0.1

Source: The Egyptian Meteorological Authority – Climate Directory

Remarks: -The data cover an area of 50 km^2

Trace = amount of rainfall < 0.1 mm.

4.3.1.2 Winds

In winter, there is no predominating wind direction in any part of the region, but winds from between N and W are most frequent. In April and May the sea breeze predominates, and winds from between NW and NE exceed all others. It is during this season that the Khamasin, a variety of the Scirocco is most prevalent. The Khamasin occasionally reaches gale force, but is usually moderate to strong.

Near the Egyptian coast, gales are mainly confined to the period of October to May, and are most frequent from December to February.

In the summer, the persistent NW or N winds are most evident. Wind speeds are mainly moderate but may increase to fresh or strong occasionally.

4.3.1.3 Rainfall

Rainfall is seasonal and nearly all falls in winter. On the N African coast most rain fall is associated with W or NW winds. Local flooding near the coast may result after heavy thunderstorms in winter, but serious situations are rare.

In the dry season, from June to September inclusive, there is often no rain in any part of the region. The average annual rainfall in Damietta is approximately 115 mm. The number of days in the climatic year in which rainfall exceeds the average is shown in Table 4-17.

Table 4-17: Number of Days with above average Rainfall

Rainfall	No. of Days
0.1 mm	40 Days
1 mm	20-25 Days
5 mm	5-10 Days

4.3.2 Air Quality

4.3.2.1 Site Specific Air Quality Assessment

The project site is located adjacent to Damietta Port, which is situated within the Nile River delta. Damietta Port is situated on the Mediterranean coast, approximately 70 kilometres west of Port Said in Egypt, as shown by Figure 4.1. The air quality data presented are based on the WorleyParsons Komex field survey in March 2006. As part of the air quality assessment for the project site, 24-hour active sampling for two locations was conducted, in addition to 1-hour active sampling within the neighbourhood.

The parameters monitored included CO, SO_2, and NO_2 and Thoracic Particulates (PM10). The methods and equipment used for air quality assessment are as follows:

- Thoracic Particulate (PM10): PM10 High Volume Sampler –GMW – USA. EPA method, Appendix J Reference method FR
- Nitrogen Oxides (NO_x): Nitrogen Oxides (NO_x) Analyzer, Model ML8840-Monitor lab. Inc USA. EPA reference method RFNA. 0280-042
- Sulphur Dioxide (SO2): Sulphur Dioxide (SO2) Analyzer, Model ML8850-Monitor lab. Inc. USA. EPA method EQSA-0779-039.
- Carbon Monoxide (CO): Carbon Monoxide (CO) Analyzer, Model ML8850-Monitor lab. Inc USA. EPA Reference method RFCA – 0388-60

GPS coordinates were recorded at each monitoring location using a hand-held unit as well as recordings of weather conditions where a hand-held Meteorological Kit was used to provide Wind Speed, Maximum Wind, Average Wind, Temperature, Wind Chill, Humidity, Heat Index and Dew Point (Table 4-18).

Table 4-18: Meteorological Conditions at the Air Sampling Locations

Location	GPS Reading (UTM Coordinate)	Meteorological Information						
		Average Wind m/s	Max Wind m/s	Temp °C	Wind Chill °C	Humidity %	Heat Index °C	Dew Point °C
AM1	36 R E:380949 N:3480267	0.8	2.5	22.5	22.9	46	22.2	11.2
AM2	36 R E:380298 N:3481664	1.4	3.5	19.8	19.7	81	19.6	16.6
AM3	36 R E:383949 N:3482281	2.8	5.3	19.5	18.7	55	18	13

4.3.2.2 Analysis Results for Air Quality Assessment

The results of the ambient air sampling and measurements are presented in Table 4-19. In conclusion, all the analysis results for air quality are compliant with the allowable levels as per Law 4/1994.

Table 4-19: Concentration of Ambient Air Pollutants at Project Locations[22]

Sampling Period	NO_2 (ppm)	CO (ppm)	SO_2 (ppm)	PM10
Max. 1h	0.006 – 0.008	0.4 – 1.1	0.004 – 0.006	---
Max. Averag-8hrs	---	0.375-0.7	---	---
Avg.-24hrs	0.004 – 0.007	---	0.002 – 0.005	32 - 44 μg/m3

Furthermore, additional gases (NH_3, CH_4, Methanol, Propane, and Butane) related to the proposed project activities were measured at the same monitoring locations using ambient air Analyzer, Miran 1B2 – USA. Table 4-20 presents the average concentrations of additional pollutant gases in Damietta.

Table 4-20: Average Concentrations of Additional Pollutant Gases[23]

Sampling Site	Methane ppm	Propane ppm	Methanol ppm	Butane ppm	Ammonia ppm
AM1	9.5	0.7	0.2	Nil	0.3
AM2	5	Nil	Nil	Nil	Nil
AM3	4	Nil	Nil	Nil	Nil

4.3.2.3 Air Dispersion Model

An air dispersion model was used to encompass the cumulative impacts of both the sources attributed to the proposed facility as well as existing sources falling within the same project area. The model predicts the concentrations of pollutants of concern at different distances and heights down wind of the stacks with respect to a reference point on the site.

The results of the air dispersion model will be included in this part of the report. The full model can be reviewed in Appendix VIII.

[22] Energy and Environment Research Center / Tabbin Institute for metallurgical Studies (E2RC/TIMS) Analysis Report – March 2006
[23] Energy and Environment Research Center / Tabbin Institute for metallurgical Studies (E2RC/TIMS) Analysis Report – March 2006

4.3.3 Noise Assessment

4.3.3.1 Site Specific Noise Assessment

Two methodologies were applied to acquire data to produce a noise model of the proposed facility site and its surrounding areas. Ten-minute average Leq readings were recorded using a hand-held sound level meter (Type 2) and ISO Tech sound level calibrator. The sound level meter (Type 2 for remote locations that do not require 24-hour measurement) was used as a measurement tool for identifying the exact locations for the 24-hour noise measurement. The sound level meter was calibrated before and after each sound measurement to verify reliability and precision.

The type of sound level meter and calibrator used to perform the baseline noise survey were:

- ISO-TECH SLM-1353 Integrating Sound Level Meter, Range 30-130 dB, Data-logger.
- ISO-TECH SLC-1356 Sound Level Calibrator.

The second methodology required a Type 1 sound level meter (Precision Grade) for 24-hour monitoring. The sound level meters are capable of recording the referenced noise level noise parameters with 10-minutes averaging. The kit used is as follows:

- B & K 2238 Mediator, Integrating Sound Level Meter, compliant with IEC 1672 Class 1 standard.
- B & K 4231 Sound Level Calibrator, compliant with IEC 942 Class 1 standard.
- B & K 4198 Outdoor Weatherproof Microphone Kit.

The weather conditions at the monitoring locations were recorded using a Hand Held Meteorological kit: Nielsen-Kellerma, made in USA and the GPS coordinates were identified using GPS 12, 12 channels, GARMIN Olathe, KS.

A hand-held GPS unit was used to identify the location of each monitoring point. The weather conditions using a hand-held Meteorological Kit provided Wind Speed, Max 3 sec Gust, Average Wind, Temperature, Wind Chill, Humidity, Heat Index and Dew Point (Table 4-21) Location remarks and unusual noise sources were identified at all measuring locations.

Table 4-21: GPS Coordinates and Meteorological Conditions at the Monitoring Locations

Location	GPS Reading	Meteorological Information

	(UTM Coordinates)	Average Wind m/s	Max Wind m/s	Temp °C	Wind Chill °C	Humidity %	Heat Index °C	Dew Point °C
NM1	36 R E:381197 N:3480206	3.7	4	24.5	24.2	45.2	24.2	11.3
NM2	36 R E:380787 N:3480619	2.7	3.1	20	20.4	49.5	18.7	9.5
NM3	36 R E:381297 N:3481023	1.4	1.9	13.5	13.6	73.3	13.2	8.9
NM4	36 R E:380977 N:3480938	3.8	5.7	20	21	52	18.3	10.5
NM5	36 R E:381580 N:3480013	3.6	5.2	21.9	19.6	49.8	21.1	10.4

4.3.3.2 Analysis Results for Noise Assessment

WorleyParsons Komex conducted a baseline noise assessment in March 2006. Table 4-22 outlines the monitoring locations and the average noise levels recorded. The measured levels within the site boundary ranged from 59 dBA at location NM3 to 62.5 dBA at location NM5. Comparing the measured noise levels with the noise limits of the EEAA for Industrial zones (heavy industries – 70dBA) shows that the measured levels at property line locations, Locations NM3 to NM5, are below the limits set by Law 4/1994 during day time.

As for the sound levels at neighbouring area, two measurements were performed. The measured levels were found to range from 50.7 dBA at NM1 to 53 dBA at NM2. Comparing the measured noise levels with the noise limits of the EEAA for dwelling zone on a public road (55 dBA) shows that the measured levels, Locations NM1 and NM2, are below the limits set by Law 4/1994 during day time.

Table 4-22: Average Noise Levels at Locations

Location	Calibration at start (dB)	10 minute average Leq (dBA)	Calibration after reading (dBA)	Remarks
NM1	94.0	50.7	OK	Near dwelling area on the public road
NM2	94.0	53	OK	Near dwelling area on the public road
NM3	94.0	59	OK	Western Boundary

Location	Calibration at start (dB)	10 minute average Leq (dBA)	Calibration after reading (dBA)	Remarks
NM4	94.0	60	OK	Eastern Boundary near the Container Terminal
NM5	94.0	62.5	OK	Western Boundary

4.3.3.3 Noise Levels Modelling

The recorded noise levels together with EMethanex facility anticipated noise levels have been used in developing a plant noise model. The noise model demonstrates predicted noise levels at the facility boundaries and nearest residential area.

With the information on noise sources, facility layout and meteorological data (mostly provided by EMethanex), WorleyParsons Komex has accomplished the prediction of future noise levels using the SoundPlan software tool, an industry standard. The software is able to model point, line and area noise sources along with the screening effects of barriers and buildings and the effects of ground absorption, which allows an accurate detailed acoustic model to be created. Average site weather information has been used for the predictions, which have been calculated using the ISO 9613 standard “Acoustics – Attenuation of sound during propagation outdoors”. The results of these predictions are presented in the form of acoustic maps with contour lines of equal noise levels (isophones) at 5 decibel (dB) intervals. The results have been calculated without considering any obstacles outside the facility (vegetation, buildings, etc) and assuming a worst case wind direction toward the receptor.

The main conclusions from the noise models are:

- The noise pressure level will not exceed 70 dB (A) outside the facility boundaries
- The nearest residential area and some of the buildings of the port authorities are located in areas where noise pressures between 45 and 50 dB(A) are predicted. It is important to note that no consideration has been made for any obstacles between the source and receptors, which would reduce sound pressure. This could be quantified if the building heights and location are considered in the model.

The details of the noise model are presented in Appendix IX.

4.4 Land

4.4.1 Surrounding Geology and Soils

4.4.1.1 Desk Study

An extensive geotechnical investigation was carried out by COSMOS-E during the period of December 2005 to January 2006. The fieldwork comprised drilling ten boreholes (BH) to depths ranging between 35 meters to 50 meters below the natural ground surface. The boreholes were advanced using both percussion and rotary drilling technique. The borings used drilling mud slurry to prevent side collapse. Steel casing was advanced to the base of the soft clay layer.

Standard Penetration Testing (SPT) was performed using a split spoon tool, in addition to retrieving disturbed samples for classification testing. The collected undisturbed samples were subjected on site to pocket penetrometer testing to verify their stiffness before carrying out further laboratory testing (unconfined compression test, consolidated – untrained triaxial test). The pocket penetrometer test results are shown on the borehole logs.

4.4.1.2 Site Specific Soil Quality Assessment

The field visit conducted on 27-29 March 2006 involved the installation of three monitoring wells using a rotary drilling method. Table 4-23 illustrates the location of the monitoring wells inside the project site.

Table 4-23: GPS Coordinates at Monitoring Wells

Monitoring Well (Piezometer) Number	GPS Reading (UTM Coordinates)
W1	36 R E:381128.2 N:3480401.99
W2	36 R E:381457.52 N:3481209.37
W3	36 R E:381714.69 N:3480465.16

The well installation process included:

- Setting up drill rig.
- Preparing bentonite slurry to support the hole while drilling

- Begin Drilling
- Installing the wells after finishing at a depth 8m from ground surface and performing well finishing
- Filling the well annulus with gravel for water filtering
- Installing the well cover and holding it in place using cement.

At each of the three locations, WorleyParsons Komex collected one surface and one subsurface soil sample for analysis. Samples were collected, appropriately labelled and preserved in accordance to USEPA standard methods. Samples were then delivered in an ice box to the laboratory and analysed within the recommended holding time for each parameter, according to US EPA approved methods and accompanied by completed chain-of-custody forms and sent to appropriate laboratories for analysis. Samples were analysed locally by the Central Laboratory for Environmental Quality Monitoring located in El Kanater (the laboratory has been awarded ISO/IEC 17025 by the Canadian Association for Environmental Analytical Laboratories), and National Research Centre Chemistry Lab of Suez Canal University as well as internationally by Analytico Milieu B. V. (Netherlands).

4.4.1.3 Analysis Results for Soil Quality Assessment

Table 4-24 presents the results of soil quality analyses at the three monitoring wells. The results revealed organic matter ranging from 1.9 to 3.2 % based on dry weight. pH concentrations were approximately 8.5.

Elevated nitrate concentrations were recorded in the shallow sample from W1. This could be attributed to the fact that the Well W1 is much closer to agricultural land than the other wells. The same effect was reflected in the detection of pesticides in soil samples from Well 1. Well1 also exhibited the highest magnesium concentration (292.2 mg/kg in the surface sample), in comparison with Wells 2 and 3.

Table 4-24: Soil Analysis Results

Parameter	Unit	W1S (Well 1)	W1B (Well 1)	W2S (Well 2)	W2B (Well 2)	W3S (Well 3)	W3B (Well 3)
Laboratory analyses							
Dry matter	% (w/w)	95.3	98.3	97.6	95.1	89.4	74.3
pH	---	8.42	8.6	8.54	8.51	8.77	8.37
Nitrate (NO_3)	mg/kg dw	29.0	12.0	6.0	15.0	4.4	2.2
Nitrite (NO_2)	mg/kg dw	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2

Parameter	Unit	W1S (Well 1)	W1B (Well 1)	W2S (Well 2)	W2B (Well 2)	W3S (Well 3)	W3B (Well 3)
Phosphate (PO_4)	mg/kg dw	389.0	427.5	365.0	370.0	379.5	379.5
Magnesium (Mg)	mg/kg dw	292.2	156.0	135.6	93.6	93.6	159.6
Heavy Metals							
Cadmium (Cd)	mg/kg dw	14	17	14	13	13	2
Copper (Cu)	mg/kg dw	75	109	112	169	33	67
Nickel (Ni)	mg/kg dw	20	38	22	ND[24]	17	7
Lead (Pb)	mg/kg dw	83	52	ND	24	38	28
Zinc (Zn)	mg/kg dw	81	137	119	182	119	251
Mercury (Hg)	mg/kg dw	ND	ND	ND	ND	ND	ND
Microbiological Indicators							
Total Coliform	CFU/g	12.5	1	1.5	3	130	5
Faecal Coliform	CFU/g	3	1	1.5	3	25	2
Organic matter							
Organic matter	%(w/w) dw	2.0	3.2	2.0	2.5	1.9	2.6
Chlorinated pesticides							
alpha-BHC	µg/kg dw	ND	ND	ND	ND	ND	ND
gamma-BHC	µg/kg dw	7.65	6.2	ND	ND	ND	ND
beta-BHC	µg/kg dw	38.85	ND	ND	ND	ND	ND
delta-BHC	µg/kg dw	23.75	ND	ND	10	ND	ND
heptachlor	µg/kg dw	4.25	ND	ND	ND	ND	ND
aldrine	µg/kg dw	58	73	ND	ND	ND	16
heptachlor epoxid	µg/kg dw	ND	ND	ND	ND	ND	ND
4,4'-DDE	µg/kg dw	ND	ND	ND	ND	ND	ND
dieldrin	µg/kg dw	ND	ND	ND	ND	ND	ND
endrin	µg/kg dw	ND	ND	ND	ND	ND	ND
4,4'-DDD	µg/kg dw	ND	ND	ND	ND	ND	ND
endosulfane II	µg/kg dw	ND	ND	ND	ND	ND	ND
4,4'-DDT	µg/kg dw	ND	ND	ND	ND	ND	ND
endrin aldehyde	µg/kg dw	ND	ND	ND	ND	ND	ND
methoxychlor	µg/kg dw	ND	ND	ND	ND	ND	ND
endosulfane sulfate	µg/kg dw	ND	ND	ND	ND	ND	ND
endrin keton	µg/kg dw	ND	ND	ND	ND	ND	ND
Polychlorinated Biphenyls (PCBs)							

[24] ND = Not Detected

Parameter	Unit	W1S (Well 1)	W1B (Well 1)	W2S (Well 2)	W2B (Well 2)	W3S (Well 3)	W3B (Well 3)
PCBs	µg/kg dw	ND	ND	ND	ND	ND	ND
Total Petroleum Hydrocarbons (TPH)							
TPH (C10-C16)	mg/kg dw	<15	--	<15	<15	70	--
TPH (C16-C22)	mg/kg dw	30	--	19	12	72	--
TPH (C22-C30)	mg/kg dw	120	--	29	90	16	--
TPH (C30-C40)	mg/kg dw	55	--	17	210	<15	--
TPH sum (C10-C40)	mg/kg dw	200	<50	67	320	160	<50

4.5 Ecology and Biodiversity

4.5.1 Terrestrial Ecology and Biodiversity

4.5.1.1 Methodology

The onshore terrestrial ecology survey was approached using three methodologies; as there were three areas of investigation. The first: a survey of the proposed facility location; the second: for the area surrounding the proposed site; and the final methodology was utilized to survey the anticipated route of the proposed pipeline. Onsite surveying was performed through a perimeter scan, followed by four transects across the width of the proposed facility site completing a ‘W’ shape. Throughout this process a team of WorleyParsons Komex qualified personnel conducted a thorough walk-over, to monitor for flora, fauna and biodiversity, covering all pre-defined transects. The walk-over aimed at identifying and recording existing flora and fauna (including tracks), soil surface nature (natural and man made), in-addition to major human activities. The findings were analysed to reveal the presence, if any, of sensitive/important vegetation types and faunal habitats (including possible migratory species). Presentation of the findings of this survey included digital photography and GPS readings and have been coordinated with available information from the recent ecological surveys.

The area around the proposed facility location was covered using the same technique by conducting radial transects in addition to line transects radiating from the proposed facility location. One of these line transects was the route of the proposed water pipeline as well as the existing gas pipeline which was conducted in a slightly different approach where the team members walked on either side of the projected pipeline route, following the survey methodology; therefore covering the specific areas which would be disturbed by the installation of the water pipeline. Another line transect was the route of the proposed outfall (onshore) which was conducted using the same approach for the water pipeline.

The project Site

The project site is scrub land almost void of vegetation. The soil is composed of silt, sand and clay in different proportions. Shell fragments are abundant in the top soil. Construction debris and other unidentified solid components were found among soil components. Almost no terrestrial sensitive receptors were observed inside the site. A few mammal tracks (e.g. dogs and wolves) as well as some bird tracks were seen in addition to low vegetation cover on site. Some rodent burrows were found as well as some mammal fecal droppings, but no animals were seen apart from some birds including crested lark and gulls. Some floral species were observed but vegetation is very poor within the site boundaries and most were desiccated specimens.

The Surrounding Area

The surveyed surrounding area, an arc-shaped belt of 5 km radius, is the deltaic agricultural lands surrounding the facility's suggested site. It is bounded from the north by the Mediterranean and from the south and east by the Damietta Nile branch. Most of the area is cultivated agricultural land with a complex network of irrigation and drainage canals. A less sophisticated, rather simpler network of tarmac roads is also present throughout the area. The two towns of Damietta (Old and New Damietta) are at the borders and a number of urbanized clusters forming small villages are also scattered within the borders of the area.

4.5.1.2 Biodiversity Features

The Lower Nile (North) and the Upper Nile (South) have plants that grow in abundance. The Lower Nile plant is the Egyptian lotus, although it is not nearly as plentiful as it once was, and is becoming quite rare. Several hundred thousand water birds winter in the delta, including the world's largest concentrations of little gulls and whiskered terns. Other birds in the delta include grey herons, Kentish Plovers, shovelers and cormorants. Also found are egrets and ibises (wikipedia 2006).

Groups of animals found in the delta include frogs, turtles, tortoises, mongoose, and the Nile monitor. Nile crocodiles are no longer found in the Nile Delta. Fish found in the delta include the striped mullet and sole.

4.5.1.3 Vegetation

Since the construction of the Aswan High Dam, the Nile delta is no longer subject to annual flooding, and large papyrus (*Cyperus papyrus*) swamps have gradually disappeared. Papyrus is now largely absent from the delta. Vegetation consists of *Phragmites australis*, *Typha capensis*, and *Juncus maritimus*, with some small sedge. The large Manzala coastal lagoon supports beds of *Ceratophyllum demersum*, *Potamogeton crispus*, and *P. pectinatus* around the southern shore as well as dense phytoplankton. Other typical species found here are *Najas pectinata*, *Eichhornia crassipes*, and *Cyperus* and *Juncus* spp. that grow along lake shores (Hughes and Hughes 1992). The salt tolerant *Halocnemum* spp. and *Nitraria retusa* grow in marshes along the Mediterranean coast.

Urban Flora

KShaltout (2002), in his study on urban flora in the delta, identified the plant communities of the urban habitats in the Nile Delta region, Egypt. Twenty-five vegetation groups were recognized: the hygronitrophilous communities (the moist and fertile stands) inhabit the wet refuse areas (*Echinochloa stagnina-Eichhornia crassipes* group), mesonitrophilous communities inhabit the dry refuse areas, motor roads and railways (*Pluchea dioscoridis, Cynodon dactylon, Panicum repens* and *Phragmites australis* groups), mesic-dry subnitrophilous communities occur on sandy soils (*Hordeum murinum, Alhagi graecorum* and *Desmostachia bipinnata* groups) and the dry thermophilous communities of new anthropogenic habitats with coarser texture of sandy and infertile soil along the railways and motor roads at the borders of the Nile Delta (*Zygophyllum album* and *Cornulaca monacantha* groups.)

Ruderal Flora

Like other Egyptian cultivated lands, the Damietta province is irrigated by the River Nile through a network of canals and drained by a similar network of drains. These canals and drains represent a different type of habitat for different types of floral species. The degree of infestation is affected by environmental factors, including water transparency, depth of water, physicochemical water quality, water currents and air temperature. El-Gharably *et al*. (1982)

In his study on Damietta province ruderal vegetation, Mashaly *et al*. (2001) identified four major vegetation groups of ruderal flora along the canals and drains in Damietta Province. The recognized vegetation groups were namely: group A dominated by *Cynodon dactylon*, group B dominated by *Phragmites australis*, group C codominated by *Arthrocnemum macrostachyum- Phragmites australis* and group D dominated by *Phragmites australis*.

Date-palm trees are common in the area, particularly to the west of the proposed site. There are no trees on the proposed site.

4.5.1.4 Birds

There are about 150 resident breeding birds in Egypt. These resident birds of Egypt belong mainly to two zoogeographical regions consisting of Palaearctic and Ethiopian. They are mostly song and water birds confined to the Nile Valley, the Delta and to some of the western Oases. However, more importantly, Egypt is a migration corridor which attracts as much as 320 additional species of birds due to its geographic position as an Africa-Europe-Asia bridge. Millions of birds of different species pass through the country on their way from Scandinavia, Eastern Europe, the Balkens, Siberia and Central Asia to eastern and southern Africa each autumn, and on their way back each spring (Brunn and Bahaa el Din, 1994).

The Nile Delta with its many Mediterranean wetlands (lakes, lagoons and marshes) is an important winter area and resting spot for many migratory species. Lake Manzala, which is the closest wetland to the proposed site, is being reclaimed for agricultural land, but it continues to offer opportunities for spotting Shelducks, Shovellers and Coots during the winter. There are also a number of shorebirds such as the Avocets. Wigeons, Shovellers, Pochards, Boots and Whiskered Terns could be seen in the area.

Water birds can be seen along the coast and in nearby Lakes, while introduced species such as Avadavat occur in reedbeds. Rüppell's and Subalpine Warblers are commonly seen in the spring, and the Moustached Warbler (*Acrocephalus melanopogon*) can be found in the winter. In the spring seven species of lark can be found breeding in on the Mediterranean Coast including Dupont's Lark (*Chersophilus duponti*), Thick-billed Lark (*Ramphocoris clotbey*) and Lesser Short-toed Lark (*Calandrella rufescens*). Cream-coloured Courser (*Cursorius cursor)* is a fairly common summer breeding visitor. Other species include Mediterranean Gull (*Larus melanocephalus*).

Amongst bird species found in the area, there is a number of species of African origin such as the Senegal Coucal *Centropus senegalensis,* Senegal Thick-knee *Burhinus senegalensis,* and Black-Shouldered Kite *Elanus caeruleus.* Other typical species such as common Bulbul *Pycnonotus barbatus,* Graceful Warbler *Prinia gracilis,* Painted Snipe *Rostratula beneghalensi* could be found in the area (Hoath, 2003.)

These species are found along the Mediterranean coast. The proposed site may be an occasional feeding area for some of these birds, but is not thought to be a breeding area. None of these species were observed during the field assessments in Damietta.

4.5.1.5 Mammals

According to Hoath (2003), typical mammals of the area would include the Egyptian mongoose *Herpestes ichneumon,* Striped Weasel *Poecilictus libyca,* Nile Kusu *Arvicanthis niloticus,* and the endemic Flower's shrew. Also, the African outposts of predominantly western Asiatic distributions, the Swamp cat and the Bandicoot Rat can are typical deltaic species.

A few incidental sittings of mammals were noted in the area including a weasel and a number of rats. Rats are reported as being prevalent across the site. Although the site is not currently in use, the high activity surrounding it (public road, port activities) reduces the numbers of wild animals on the surrounding area. A number of domestic farm animals are grazed in the area.

The following list includes all mammals which occur or have occurred in Egypt and are rated as Critically Endangered (CR), Endangered (EN) or Vulnerable (VU) in the 1996 IUCN Red List of Threatened Animals.

Critically Endangered:

- Northern Pygmy Gerbil Species (*Gerbillus floweri*). (Endemic to Egypt.)

Endangered:

- Flower's Shrew (*Crocidura floweri*). (Endemic to Egypt.)
- Jerboa Species (*Allactaga tetradactyla*).
- Nubian Ibex (*Capra nubiana*).
- Slender-horned Gazelle (*Gazella leptoceros*).

Vulnerable:

- Dugong (*Dugong dugon*).
- Horseshoe Bat Species (*Rhinolophus euryale*).
- Horseshoe Bat Species (*Rhinolophus mehelyi*).
- Lesser Horseshoe Bat (*Rhinolophus hipposideros*).
- Northern Pygmy Gerbil Species (*Gerbillus bonhotei*). (Endemic to Egypt.)

None of the species were observed or have been reported across the proposed site.

4.5.1.6 Insects and Reptiles

Many species of insects live in the Nile delta. Beetles, mosquitoes, flies, and fleas are especially numerous; the ichneumon - Egyptian mongoose - (*Herpestes ichneumon)*, a parasitic insect, occurs in the delta. Insects and reptiles found in the area may include:

- Spiders (Clubionidae) and pseudoscorpions (*Halominniza aegyptiaca litoralis*);
- Beetles such as *Ochthebius auratus* and *Anacaena* sp;
- Mosquitoes (*Bezzia* sp.);
- Flies (*Musca domestica*);
- Snakes; and,
- Lizards.

4.5.1.7 Endangered Species of Egypt

The list below details the IUCN red list of endangered species for Egypt (2006). None of these species were observed or reported as being present on the proposed site.

Acacia pachyceras var. najdensis	
Acinonyx jubatus	Cheetah (E)
Acinonyx jubatus ssp. hecki	Northwest African Cheetah (E)
Addax nasomaculatus	Addax (E)
Aegypius monachus	Black Vulture (E)
Alcelaphus buselaphus	Common Hartebeest (E)
Alcelaphus buselaphus ssp. buselaphus	Bubal Hartebeest (E)
Allactaga tetradactyla	
Ammotragus lervia	Barbary Sheep (E)
Ammotragus lervia ssp. ornata	Egyptian Barbary Sheep (E)
Aquila clanga	Greater Spotted Eagle (E)
Aquila heliaca	Imperial Eagle (E)
Balearica pavonina	Black Crowned-crane (E)
Capra nubiana	Nubian Ibex (E)
Chlamydotis undulata	Houbara Bustard (E)
Circus macrourus	Pale Harrier (E)
Crex crex	Corn Crake (E)
Crocidura floweri	Flower's Shrew (E)
Crocidura religiosa	Egyptian Pygmy Shrew (E)
Dracaena ombet	
Eliomys melanurus	
Emberiza cineracea	Cinereous Bunting (E)
Equus africanus	African Ass (E)
Falco naumanni	Lesser Kestrel (E)
Fennecus zerda	Fennec Fox (E)
Gallinago media	Great Snipe (E)
Gazella dorcas	Dorcas Gazelle (E)
Gazella gazella	Mountain Gazelle (E)
Gazella leptoceros	Sand Gazelle (E)
Geochelone sulcata	African Spurred Tortoise (E)
Gerbillus bonhotei	
Gerbillus floweri	
Glareola nordmanni	Black-winged Pratincole (E)
Hyaena hyaena	Striped Hyaena (E)

Hystrix cristata	Crested Porcupine (E)
Jaculus orientalis	
Larus leucophthalmus	White-eyed Gull (E)
Medemia argun	
Numenius tenuirostris	Long-billed Curlew (E)
Oryx dammah	Sahara Oryx (E)
Oryx leucoryx	Arabian Oryx (E)
Panthera leo	Lion (E)
Papio hamadryas	Chacma Baboon (E)
Pipistrellus ariel	
Rhinolophus euryale	Mediterranean Horseshoe Bat (E)
Rhinolophus hipposideros	Lesser Horseshoe Bat (E)
Rhinolophus mehelyi	Mehely's Horseshoe Bat (E)
Rhus glutinosa ssp. abyssinica	
Serinus syriacus	Syrian Serin (E)
Testudo graeca	Common Tortoise (E)
Testudo kleinmanni	Egyptian Tortoise (E)
Tetrax tetrax	Little Bustard (E)
Torgos tracheliotus	Lappet-faced Vulture (E)
Vulpes cana	Afghan Fox (E)
	Dog Fox (E)
Vulpes rueppelli	Rueppell's Fox (E)

4.5.2 Marine Ecology and Biodiversity

4.5.2.1 Subtidal

Other important species that may be found along the coastline of the site include:

- *Portunus pelagicus* (crab);
- *Marsupenaeus japonicus* (Penaeid shrimp – commercially important) – mainly found in deeper inshore waters;
- *Metapenaeus monoceros* (shrimp). Adults found offshore, juveniles inshore, but mainly brackish;
- *Metapenaeus stebbing*i (shrimp). Commercially important. Juveniles occur in shallow coastal waters, adults - further offshore. Reproduction April – September; and,
- *Callinectes sapidus* (English/American Blue crab).

4.5.2.2 Fish

The proposed outfall location is situated in a no-fishing zone, as annotated on the Admiralty Charts for this area. Local fish reported in the area include:

- *Striped Mullet*;
- *Atherinomorus lacunosus* (Hardyhead silverside);
- *Bream;*
- Parexocoetus mento *(flying fish), Abundant in the area but not commercially important; and,*
- *Upeneus moluccensis* (goat fish), Commercially important.

Mediterranean Sea Fisheries

The fishing grounds used by Egyptian vessels are located on the continental shelf in front of the Nile Delta. These grounds are used to support prosperous export-oriented fisheries for shrimp, demersal species, and sardine for domestic consumption.

This situation was drastically altered by the construction of the Aswan High Dam, which has largely reduced the flow of nutrients carried by the Nile to the sea. Recently, the situation has partially improved, probably as a result of greater discharges of enriched drainage water from the Nile Delta.

During the period 1986-1995, landings from the Mediterranean fluctuated between 33 000 ton and 54 600 ton, reaching a peak in 1994. More than 60% of fish are landed at: Damietta, Port Said and Alexandria. In 1995, landings comprised more than 30 fish and prawn species. Sardines account for the bulk of the catch (about 20%), mullet 9%, shrimp and crabs 11%.

4.5.2.3 Marine Mammals

Dolphins (*Delphinus delphis*) are reported to be a frequent inhabitant of the Mediterranean Sea (communication with local fishermen). Other marine mammals that migrate through Egyptian Mediterranean coastal waters, include:

Balaenoptera physalus	Fin Whales
Balaenoptera musculus	Blue Whale
Steno bredanensis	Rough-toothed dolphin
Tursiops truncatus	Atlantic bottlenose dolphin
Pseudorca crassidens	False Killer Whale
Orcinus orca	Killer Whale
Grampus griseus	Risso's Dolphin

4.5.2.4 Endangered Marine Species

There are no reported nationally or internationally endangered species along the shoreline of the proposed site. However, endangered species are reported in the eastern Mediterranean including the Mediterranean Monk Seal (*Monachus monachus*) and the Hawksbill turtle (*Eretmochelys imbricata*).

Dolphins are reported as frequent in the area. The peak breeding season for the common dolphin is spring (56% of the sexually mature female population lactate in the spring-summer period). The gestation period is 10-11 months.

4.5.3 Sensitive Habitats

The proposed site is not a nationally or internationally recognised area for nature or conservation. However, the Mediterranean Sea in its entirety is protected by international legislation such as the Barcelona Convention.

The nearest Site of Scientific Importance (International Bird Area) is Lake Manzala, which is the largest of Egypt's wetlands covering an area of 770 km^2 (location $31^o03'$-$31^o31'$ N; $32^o49'$-$32^o18'$E). Manzala is Egypt's most important wetland for wintering waterbirds holding a total of 233,900 birds in winter (1989/1990). Lake Manzala is approximately 25 km south-east from the proposed site. The Mediterranean shore of Lake Manzala is a potential site for breeding of endangered marine turtles (e.g. Loggerhead, *Caretta caretta*). The Swamp Cat (*Felis chaus*) is still known to occur in good numbers in this region.

4.5.4 Species of Commercial Importance

There are no reported species of commercial importance on the proposed site. Commercial fishing occurs beyond the area of influence. The Port and shallow inshore waters of the Mediterranean are no fishing zones. Within the region, there is a fishing industry that depends upon sardines (20%), mullet (9%), shrimp and crabs (11%).

4.6 Human Environment

4.6.1 Population

Table 4-25 indicates that the majority of the population in the Damietta Governorate reside in rural areas, and that the population is relatively equally gender based. The population of Damietta accounts for 1.54% of the national Egypt population.

Table 4-25: Population of Damietta

Egyptian Statistical Year Book – June 2003

Central Agency for Public Mobilisation & Statistics.

Population (1996 Census*)	913,555
Rural	662,977
Urban	250,578
Female	446,326
Male	467,229
population in public institutions	1902
number of public institutions	63

The national census is usually made every 10 year and the 1996 census is the latest up-to-date.

4.6.2 Total Units and Vehicles by Sector

Table 4-26 provides statistics for the total number of units (buildings) in the Damietta governorate. The majority of building units are in the rural areas (double the number in the urban regions). The governorate is predominantly rural.

Table 4-26: Total Units - Egyptian Statistical Year Book – June 2003

Central Agency for Public Mobilisation & Statistics

	Total units in urban areas (1996)	**Total units in rural areas (1996)**
Habitation	69,958	153,334
Work	2766	3290
Habitation & work	710	1438
Public institution	127	80
Others	28,823	42,728
Total	102,384	200,870

Table 4-27 provides a statistical breakdown of the vehicles used in Damietta.

Table 4-27: In-movement licensed vehicle

Egyptian Statistical Year Book – June 2000

Central Agency for Public Mobilisation & Statistics

In-movement licensed vehicle (1999 – source: general traffic Department))	
Lorry and truck	10167
School Bus	14
Tourism Bus	27
Private Bus	54
Public Bus	70
Taxi	4126
Private cars	12021
Tractors	114
Motorcycles	17959
Commercial & temporary	387
Public sector	1066
Government	385
Governorate	1189
Total	47579

There are a relatively high number of vehicles in the area – predominantly larger vehicles used for distribution (trucks). Motorcycles are the most used form of transport for many of the residents of Damietta.

4.6.3 Economic Activities: Egypt

Table 4-28 describes the income and employment statistics for Egypt. The population is rising at a level of 1.72%, with a net migration rate of – 0.35 migrants/1000 population.

Table 4-28: Income and Employment

Population:	68,359,979
Age Structure: (15-64):	61% of total (approx. 50:50, M:F)
Inflation rate (consumer prices):	3.7%
Labour force by occupation:	40% Agriculture 38% Services 22% Industry

Unemployment Rate:	11.8% (1999 estimate)
Exports:	USD 4.6 billion
Imports:	USD 15.8 billion

4.6.4 Damietta Port Capacity

Location:	The port of Damietta is situated near the eastern branch of the River Nile estuary, approx 70km W of Port Said, 250km E of Alexandria.
General overview:	The port handles exports of agricultural products, fertilisers and furniture. Imports include cement, grain and general cargo.
Traffic figures:	Approx 1,500 vessels and 9,000,000t of cargo handled annually. Container terminal has an annual handling capacity of 500,000teu.
Max size:	Max LOA 250m, max draft: 12.8m, container and bulk vessels 12.5m, general cargo vessels 11.0m.
Largest vessel handled:	Container 55,889dwt; general/bulk 39,537dwt; general cargo 65,000dwt.

4.6.5 Agricultural and Grazing Areas

The surrounding area beyond the perimeter wall of Damietta Port is currently public land. This land is used by local farmers who are settled in the vicinity of the site and also graze their animals (cattle) on the local irrigated land, beyond the main road to the west of the site. There is a neighbouring permanent village to the west of the public road.

Land use in the Damietta governorate is shown in Table 4-29. Local land use is predominantly agricultural, with large irrigated areas. There are many small holdings, with few owners possessing areas greater than 50 feddan (21 ha).

Table 4-29: Distribution of Agricultural Land Owners and Area
Egyptian Statistical Year Book – June 2000
Central Agency for Public Mobilisation & Statistics

Distribution of agricultural land owners and area (1995) (Feddan)		
	Area	Owners
Less than -one Feddan (0.42 ha)	7930	17165
1-	8960	6732

2-	11310	4877
3-	10304	3066
4-	9548	2209
5-	13401	2149
10-	16197	1247
20-	14167	524
50 -	7205	104
Over 99-	5785	38
Total area	**104,807**	**38111**

4.6.6 Historical/ Archaeological Importance

4.6.6.1 Damietta, the City and the Port

The City of Damietta was known as *Kaftoud* during the Hebrew stage, later known as *Tim Any* or *Tamit* in ancient Egypt, *Tamyatish* in the Roman period and *Tamiati* in the Coptic period. Currently, the city is known as Damietta, which is a corruption of Tamiati, used in the Coptic period. The City lies between Lake Manzala and the Nile, on the Mediterranean Sea, and around 210 km from Cairo. The Port lies on the West Side of the Damietta branch of the River Nile.

4.6.6.2 Ancient History

In ancient times, the River Nile had seven branches, namely, Pelusiac, Tanitic, Mendesian, Phatnitic (Bucolic), Sebennytic, Bolbitine and Canopic. In the Pharaonic stage, there were only five branches. Farming activities, which used to take place during this stage turned the marshes and borders into Savannas. The Hyksos (Second Intermediate Period) used the Eastern Delta as capital to their country. At that age, the delta was known as the Land of Goshen.

4.6.6.3 Recent History

All the seven Branches of the River Nile, mentioned above, with time became filled with silt, except for two; namely, the Damietta and the Rosetta branches, which continue to flow till present. The slightly inland position of the Port of Damietta affords protection from the sea, thus making a secure shelter for ships. However, it was often cut off from the sea because of the sandbars accumulating in the Nile Branch mouths, which causes larger ships to anchor offshore and to unload cargoes using skiffs.

During the Arab stage, Damietta was also known as a port of great importance. However, during the rule of Mamluk Sultan Baybers I, attacks by crusaders (1223) led the Sultan to destroy Damietta and its fortifications and build a new Damietta, 6.4 km inland at the current site. The attacks also led the Sultan to block the Damietta branch of the Nile.

Damietta was also considered an important port during the following Mamluk period (1250 – 1517), it was also the main exporter of rice to the Ottoman Empire. However, Ottoman decrees banned trade with Europeans through Damietta and Suez ports, as a result, an illegal trade started to take place, where French, Venetian and Rugasans loaded ships to the Ottoman empire, then changed course to European countries. The Mamluks and Ottomans used the city as a place for banishment.

Aly Bey al-Kabir and Mohammed Bey Abu-al-Dahab used the port to supply their forces during their attempts to conquer Palestine and Syria in the 1770s. Aly Bey and his successive Qazdughli amirs started encouraging European trade in Damietta. This was in agreement with the plans of the Greek Catholics and Maronites to increase European trade, thus making Damietta the major Egyptian commercial centre at that time. In 1776 the total number of ships arriving to Damietta was 80 of which 60 were Turkish, and the remaining 20 were European.

Twelve of the European ships were French, while four were Ragusan, two were Venetian and two were English, which reflects that French trade was overwhelming other European trade. Following that year, European trade through Damietta kept on expanding.

During the last few decades of the eighteenth century, European wars seriously impacted European trade in Damietta. French trade dropped from 30 to 40 ships, in peacetime, to only 27 ships in 1781, and this number continued to decline as the European wars persisted. Moreover, the import/export activities through Damietta started to become unbalanced, where its imports reached 10,565,190 *medins*[25] through the period 1786-1798, whereas it exports were only 982,914 *medins* through the same period.

The death of Mohamed Beck Abu-al-Dahab (1775), the misrule and tyranny of Ibrahim Beck and Murad Beck (ruled prior to the French invasion of 1798) as well as the French invasion, which took place in 1798, all caused the port to lose its fortunes and destroyed European trading through the port.

In 1819, the construction of the Mamdouhiyah Canal also caused Damietta City to lose most of its importance as a trading centre. This lasted till the period, when Mohamed Ali ruled, where he encouraged trade with European countries, and again, Damietta became a major trading centre, especially for agricultural goods with Istanbul and Syria.

[25] *Currency at that time*

4.6.6.4 General

Most of the historical (ancient history) remains of the delta have not survived the shifting of the Nile, the Mediterranean rains and the repeated ploughing of the fields[26]. The City and the Port thus have almost no ancient archaeological importance.

The closest remains related to the site are located in the provinces near Damietta city. These archaeological sites include Tell El-Deir (31° 25'N 31° 42'E) in Kafr Saad, Tell Shata (31° 24'N 31° 52'E), and Tell El-Gasseh (31° 22'N 31° 50'E)

4.6.6.5 Archaeological Locations in the Study Area

During the Mamluk era, the city was destroyed, and was later rebuilt in the Ottoman stage. Some buildings related to this stage (Ottoman) still exist, and are often in a good condition. In general, the city has a number of fine mosques. An ancient mosque from the Fatimid period still exists, in a deteriorating condition, in the old Damietta town. The mosque (Abu El-Maati mosque) is surrounded by a cemetery, which occupies an enormous area.

[26] *The Nile Delta – The Past (http://interoz.com/egypt/delta2.htm)*

5 DESCRIPTION AND ANALYSIS OF PROJECT ALTERNATIVES

5.1 Statement of Need

Egypt's rich resources include crude petroleum, natural gas, refined petroleum products, ore, and construction materials. The project will allow Egypt to utilize and add value to the proven large Egyptian reserves and natural gas. It will have beneficial effects on employment and generate foreign exchange revenue for the country.

The project company was registered in March 2005 and is currently owned by the public sector Egyptian Petrochemicals Holding Company "ECHEM" (24%) and Methanex Cooperation "Methanex" (76%), Canadian private sector company. The sponsors have entered into a joint venture to design, finance, construct, own, operate and maintain a 1.3 million tones per annum methanol production facility to be located on Egypt's Mediterranean Coast in a tax Free Zone inside Damietta Port. The project entails technology transfer through the participation of a leading private sector company. The proposed project is designed for export production of methanol and is strategically located in Damietta Port.

Natural gas for the project will be supplied by the Egyptian Natural Gas Holding Company "EGAS" under a long-term Gas Supply Agreement "GSA". Methanex or its affiliates will purchase all of the methanol, as AA grade methanol, produced by the project under a long-term volume offtake agreement "MSA" for export primary to the European markets. Negotiations in relation to the GSA and MSA are currently being finalized.

5.2 Consideration of Alternatives and Justification for the Preferred Alternative

5.2.1 The "No Action" Alternative

The "No-Action" Alternative (not constructing the facility) is not a feasible alternative, as it would lead to loss of investment of around US$ 600 million as well as expected employment of approximately 150 Egyptian staff (during operations) for 25 years. The project would produce during Phase I an estimated 3,600 metric tons per day of methanol from a feedstock of natural gas, to be exported to foreign markets. The "No-Action" Alternative would also result in loss of export opportunities of goods manufactured in Egypt.

From an environmental perspective, the proposed facility is to be constructed in a designated Zone for petrochemical industries within Damietta port. Should the "No-Action" Alternative be selected, the proposed project location would remain designated for other petrochemical industrial activity.

5.2.2 Alternative Sites

ECHEM proposed four alternative sites to evaluate and identify the most suitable site for the project. These sites were the following:

- Idku site is located on the Mediterranean Sea (northern boundary with approximate length of 3.5 km) 45 km east of Alexandria. The total area of the site is approximately 600 Feddans (250 Hectares).
- Gamasah site is located 155 km east of Alexandria and 35 km west of Damietta, on the Coastal International Road. The total area of the site is approximately 2500 Feddans (1050 Hectares).
- Damietta ECHEM site is located to the east of Damietta Port on a navigational channel that is connected to the port.
- Damietta Port site is located in an industrial zone, within Damietta Port Authority "DPA" premises.

An environmental and economical evaluation of these sites was performed according to the following criteria:

- Environmental Considerations;
- Permits;
- Required Plot Size (for 3 Phase Expansion);
- Land Expansion Opportunities;
- Land Rental;
- Site Constructability-
- Natural Gas Pipelines;
- Location to Cooling Water;
- Cooling Water Piping (Sea Water Cooling Tower);
- Site Clearance and Backfill to +2.5m above MSL;
- Access to the Marine Terminal;
- Marine Terminal Works;

- Marine Terminal and Site Preparation Costs;
- Marine Terminal Annual Maintenance Costs;
- Marine Terminal Annual Port Operating Costs; and
- Differentiator Annual Operating Costs (Phase 1).

WorleyParsons Komex was involved in the site selection process for the proposed methanol facility (January, 2005), during which the Damietta port site was chosen as the optimum location. Site selection was based on a screening criteria that focused on lowering the potential impacts from the project. For example, due to the nature of the industrial zone and the existing baseline conditions, the proposed site location is expected to induce lower impacts on fauna, flora, birds, local fishing, local tourism, archaeological aspects, and near habitation. Additionally, the amount of dredging required for the project implementation at the proposed site was regarded to be relatively low for the jetty and medium for the outfall. The details of the site selection are presented in Appendix VI.

5.2.3 Alternative Design and Technologies

5.2.3.1 Alternative Port Layout

For the port basin and related berthing facilities, four alternatives were investigated for the port layouts. These alternatives are the result of a "brainstorming" session which involved nautical experts, port planners and a port structural engineer.

Alternative 1

In alternative 1, both berths are located at the eastern side of the basin. To minimize the dredging works in the Phase 1 of the project, the berth is situated as close as possible to the entrance of the port basin. Figure 5- 1 shows the first phase development and Figure 5- 2 illustrates the second phase development of the project. For the phase 2 development, the port basin has to be extended with about 200 meter. In terms of construction cost, it should be considered that, in case of the extension of the basin, the Phase 1 slope protection has to be removed.

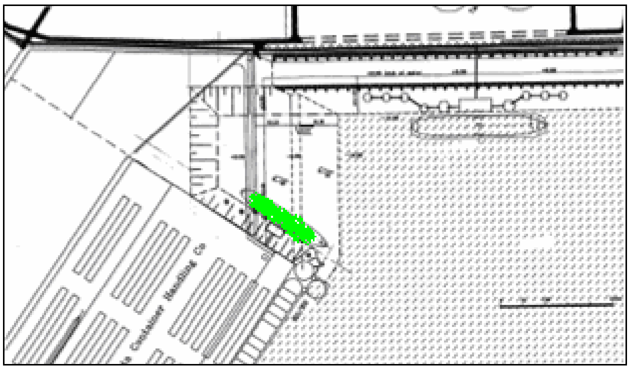

Figure 5- 1: Alternative 1 – Phase 1

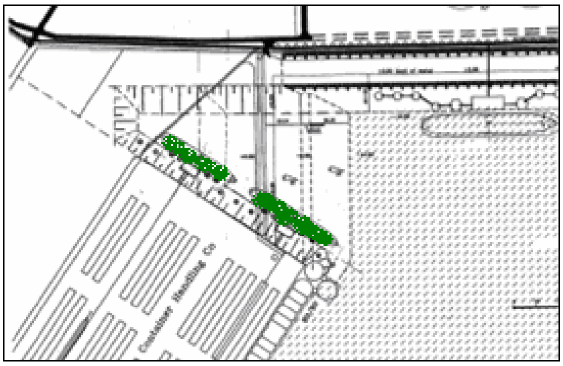

Figure 5- 2: Alternative 1 – Phase 2

<u>Alternative 2</u>

The first phase development of alternative 2 is similar to the first phase of alternative 1. Alternative 2 differs from alternative 1 by shifting the second phase berth from the east side of the basin to the west side. The main advantage of this alternative is the reduction of the extension of the basin from 200 meter to 150 meter required in phase 2.

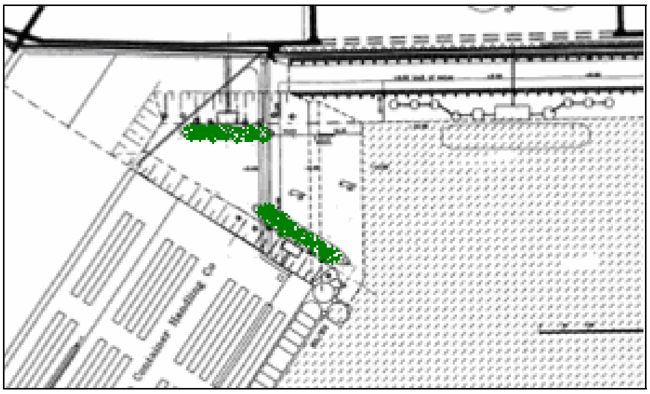

Figure 5- 3: Alternative 2 – Phase 2

The berth has been located as much as possible to the north to reduce the dredging costs. In the master plan for phase 2, this location will have to be designed taking into account the SEGAS operations.

<u>Alternative 3</u>

In terms of layout, Alternative 3 is similar to Alternative 1 and differ in terms of berthing facility. Whereas alternative 1 and 2 would use a platform, the berthing facility of alternative 3 consists of a wharf. The main advantage of a wharf is the flexibility of mooring and related loading/unloading activities. However for liquid products, this advantage is reduced as the location of loading/unloading is fixed by the location of the loading arms and manifold on the vessel. In this alternative, a mooring dolphin has been placed at the port side of the berth to reduce the required quay length.

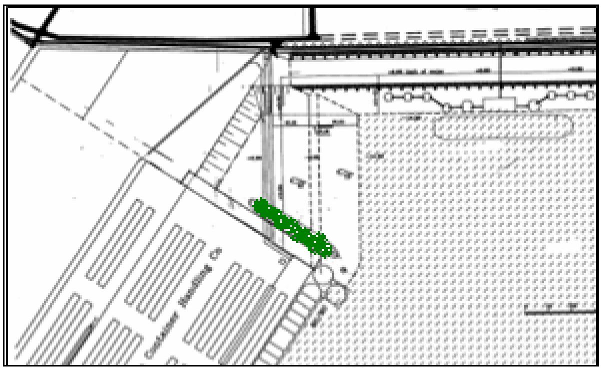

Figure 5- 4: Alternative 3 – Phase 1

Figure 5- 5: Alternative 3 – Phase 2

<u>Alternative 4</u>

The main feature of this alternative is a centrally-located finger pier in the port basin. The main advantage is that the finger pier provides berthing possibilities at two sides, and thus various supporting facilities, such as marine structures, electrical, mechanical, etc., can be shared. In phase 1, the majority of these structures have to be built. Also, the basin has to be dredged to the greatest dimensions and slope protection has to be implemented for the full basin. In phase 2, only 4 dolphins will be added and additional loading arms will be placed on the platform. A finger pier is a commonly used solution, e.g. in the Port of Rotterdam many of the chemical and oil products ports are served with a finger pier.

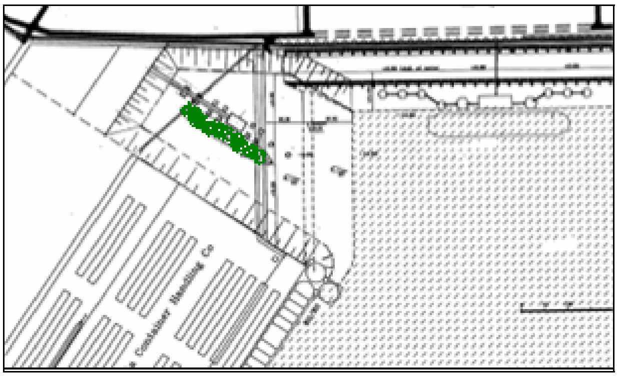

Figure 5- 6: Alternative 4 – Phase 1

Figure 5- 7: Alternative 4 – Phase 2

Alternative 1 phase 1 had been selected for EMethanex berth while alternative 2 phase 2 had been selected for future berth. This preferred option was chosen following evaluation of the different criteria including: construction cost, nautical aspects, logistics aspects, safety, hydrometric aspects, civil engineering, phase development construction impact, and operation flexibility.

5.2.3.2 Alternative Berth Design

For the berth design, the following three alternatives were investigated:

- Cellular cofferdam (straight web sheet piles cells);
- Jetty on piles with rear sheet piles or front sheet piles or natural slopes; and
- Diaphragm wall with rear wall or anchors.

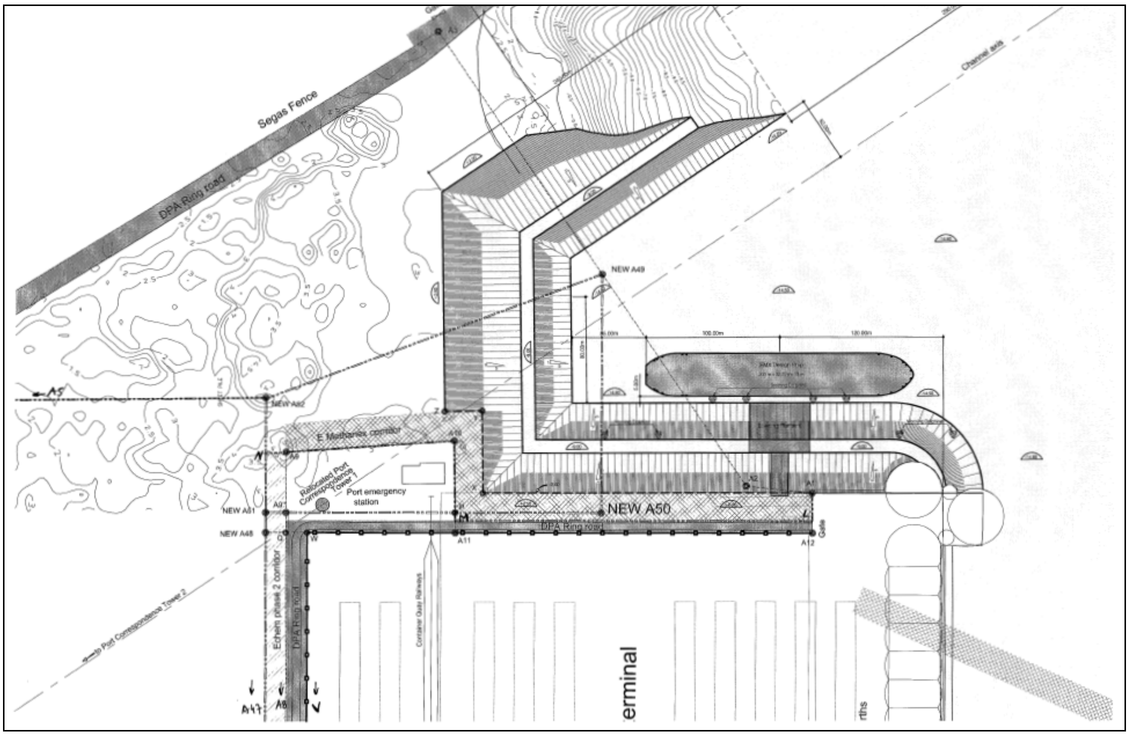

Figure 5- 8: Selected Berth Design

The jetty alternative that has been selected for the Methanol project is illustrated in Figure 5- 8. This selection was achieved after technical evaluation of the different criteria including the work phase and in service phase together with the financial evaluation of all alternatives.

5.2.3.3 Alternative Water Intake

A methanol plant requires cooling of process and utility streams. This can be achieved by a mix of air cooling (forced/induced draft air cooled heat exchangers) and water (shell and tube heat exchangers). The alternative water intake for the methanol plant located at Damietta is from either Sea Water or Fresh Water (Nile Water). These two alternatives were studied to determine the best economic mix of air and water cooled exchangers, and to a lesser extent the degree of cooling achievable within the process. The results for studying both alternatives could be summarized in the following:

- The seawater alternative would require the construction of a sea water intake and associated pumping facilities located in the right of way or on the beach adjacent to the UGDC site.
- The freshwater alternative requires the construction of a freshwater intake and pipeline from the Nile branch to the site. It is proposed that this pipeline will run along the existing gas pipeline corridor.

The freshwater alternative is the preferred option which allows for the combined use of a freshwater cooling tower and aerial fin fans thereby significantly reducing the predicted noise levels on site and eliminating any impacts of salt water drift to nearby vegetation or equipment and facilities located inside Damietta Port. Economically, the capital expenditure for the freshwater alternative is at least US$15 million cheaper than the seawater alternative

6 ENVIRONMENTAL IMPACT ANALYSIS

6.1 Environmental Assessment Process

The purpose of an Environmental Impact Assessment (EIA) is to examine, analyse and assess the planned project activities. The EIA should assist in ensuring environmentally sound and sustainable development by providing all the environmental information necessary to determine the environmental acceptability of a proposal.

The description of the existing conditions in section 4 provides a multidisciplinary analysis of the ecosystem of Mediterranean coast at Damietta and the onshore location of the proposed development. This baseline knowledge permits the identification of the main socio-environmental concerns that may be associated with the project aspects (activities) pertaining to the development of the onshore facilities and the offshore outfall in the Mediterranean. The interaction between the project aspects and the environmental and social baseline conditions forms the basis of this Environmental Impact Assessment (EIA).

This EIA was commissioned to assess the effects on water, atmospheric environment, land, ecology and biodiversity, and human environment due to the development of:

- A Methanol plant in the Port of Damietta;
- Associated utilities of the Methanol plant;
- Off-sites facilities (methanol loading facilities, Nile River water intake system, and effluent discharge line); and
- Construction and operational phases of the Methanol loading jetty.

The EIA forecasts changes (positive and negative) that may occur to the environment, and demands a baseline understanding of the natural driving forces at the proposed project location. The early identification of impacts that may occur in the area reduces the risk of future adverse environmental effects, and permits the proposal of mitigation guidelines to avoid, reduce or remedy significant adverse effects.

The EIA also acknowledges potential socio-economic impacts, which predicts the effect on people and communities occurring as a result of the onshore/offshore development.

In this section, key biological, physical, and human components are selected from the baseline information. The impacts on each of these “Valued Ecosystem Components” from the various project aspects are considered and finally evaluated using a significance ranking process.

6.2 Valued Ecosystems Components

Valued Ecosystem Components (VECs) are, by definition, ecosystem components that are considered to be important or valuable and that merit detailed consideration in the EIA process (Treweek, 1999). To aid in the EIA, the concept of VECs has been used as a tool to highlight important receptors (individuals or groups) which could be affected (positively or negatively) by the key project aspects.

The VECs have been selected following the identification of the pathways linking environmental components of concern with project activities, and are fundamental to the process of the EIA. The VECs have also been selected following consultation with the EEAA and other relevant statutory authorities in the area, and also based on the expertise of the project team.

In order to establish a framework for analysis of impacts that may arise from this coastal development, the project team formulated a list based on literature searches, site assessment, Egyptian regulations/guidelines (Law 4) and VECs that could be affected.

Table 6-1 presents a list of the VECs that are deemed significant in terms of environmental and social importance. Each of these VECs will be evaluated in terms of the operational aspects of the project, and relevant mitigation measures will be recommended to ensure that all negative impacts are reduced and/or avoided.

Table 6-1: Valued Ecosystems Components

Category	**VEC**	**Why it is important**
Water	Groundwater Quality	• Sustainability issues and local use
	Surface Water (Freshwater) Quality	• Sustainability issues, local use, and health implications for all users
	Seawater Quality	• Sustainability issues and local use
Air and Climate	Air Quality	• Implications for local residents. • Contribution to global warming

Category	VEC	Why it is important
Land	Topography and Landscape	• Land form changes • Utilisation of non-renewable resources • Importance to local community • Use of unsustainable disposal methods
Ecology and Biodiversity	Marine Ecology and Biodiversity	• Importance to biodiversity value (International, National and Regional) • Use to community
	Terrestrial Ecology and Biodiversity	• Importance to biodiversity value (International, National and Regional) • Use to community
Human Environment	Socio-Economic Activities	• Employment opportunities (positive impact) • Community welfare (positive impact)
	Community Health and Safety	• Importance to local community as part of community safety
	Noise pollution	• Importance to local community
	Agriculture	• Socio-economic importance • National and Community value
	Light pollution	• Importance to local community

6.3 Environmental Aspects

An environmental aspect is an element of an operation or facility's activities, products, or services that can or does interact with the environment. The key environmental aspects associated with the proposed methanol plant are presented in Table 6-2.

Table 6-2: Environmental Aspects

Project Component	Environmental Aspect
Site Preparation	Creation of Access Road
	Transport and Equipment Use
	Purchasing of supplies and services
	Staffing
Construction Activities	Excavation and earthworks for Methanol plant construction

Project Component	Environmental Aspect
	Dredging at Methanol Loading Terminal (Jetty)
	Transport and use of vehicles and site machinery
	Marine Traffic (dredgers and vessels)
	Construction of marine outfall pipeline
	Construction of freshwater intake pipeline
	Waste disposal
Operation Activities	Methanol plant equipment start-up
	Operation of Methanol Plant
	Operation of Methanol Loading Jetty
	Operation of freshwater intake
	Operation of marine outfall
	Road operation
	Routine operation of Methanol transporters (Marine Traffic)
	Maintenance Dredging
	Use of machinery and equipment
	Waste disposal
Accidental (Non-routine) Events	Ship collision / accidents
	Fire and Explosion
	Spills and leaks
	Inappropriate waste disposal

Following the selection of the environmental aspects, the potential impacts resulting from the proposed methanol plant can be predicted. An environmental impact is a change to the environment and such change can be positive or negative.

6.4 Predicted Impacts

Environmental impacts are caused by environmental aspects and can have a direct impact on the environment, contribute indirectly to a larger environmental change, or be cumulative. This section reviews each of the VECs potentially affected and discusses the predicted impacts that may result from the environmental aspects listed above.

6.4.1 Water

6.4.1.1 Groundwater Quality

Groundwater is a major VEC that needs to be preserved and monitored during the construction and operation of the proposed facility. The groundwater is in hydraulic connection with the sea, in addition to being a water resource that may be used by the community and other facilities in the Port.

Groundwater quality may be affected during construction activities and eventually during operation activities. It may also affected by the occurrence of non-routine events. Impacts could result from the following environmental aspects:

- Waste disposal during construction activities;
- Waste disposal during operation activities;
- Accidental (non-routine) events: spills and leaks which may include seepage from improperly protected storage location, surface discharge of liquid wastes, fuel spillage, and spills and leaks from container vehicles. This can result in contaminated substances reaching groundwater resources.
- Accidental (non-routine) events: inappropriate waste disposal. Accidental event that may contribute to groundwater contamination is mainly attributed to seepage of contaminants from accumulation of solid wastes.

Appropriate mitigation measures discussed in section 7 need to be implemented and monitored.

Groundwater resource:

The Nubian Sandstone aquifer located under the Western Desert is considered an important groundwater source. The volume of groundwater entering the country from the Libyan Arab Jamahiriya is estimated at 1 km^3/yr. Internal renewable groundwater resources are estimated at 1.3 km^3/yr, bringing total renewable groundwater resources to 2.3 km^3/yr. The main source of internal recharge is percolation from irrigation water in the Valley and the Delta. The total actual renewable water resources of the country is thus 58.3 km^3/y.

Groundwater extraction in 2000 was 7.043 km^3 comprising:

- 6.127 km^3 from the Nile Basin (seepage waters),
- 0.825 km^3 from the eastern and western deserts, i.e. mainly the Nubian Sandstone aquifer,

- 0.091 km^3 from shallow wells in Sinai and on the north-western coast.

No groundwater abstraction is proposed for the Methanol facility in Damietta Port.

6.4.1.2 Freshwater Quality

Freshwater for the operation activities will be supplied from the Nile River at approximately 6 km from methanol plant. In addition to potable water supplies, water will be also required for cooling tower, machinery and equipment adding to the resource demand.

It will be a major priority to protect existing freshwater users and to ensure that this increased demand is sustainable and will not negatively impact on the supplies in the short or long term for regional communities and terrestrial ecology.

Freshwater quality may be affected during construction activities and eventually during operation activities. It may also be affected by the occurrence of non-routine events. Impacts could result from the following environmental aspects:

- Construction of freshwater intake pipeline. This construction activity can contribute to re-suspension of bottom sediment, and potentially blow-down of general litter and wastes from human activities to freshwater.
- Operation of freshwater intake pipeline. The impact occurs only as required to remove river silt sediment that accumulates in the raw water intake sump. Stream routed to Nile River down stream of water intake location.
- Accidental (non-routine) events: spills and leaks and ruptures of the pipe and/or screen.

Freshwater resource

According to the FAO water report for the year 2005, the Egyptian territory comprises the following river basins:

- The Northern Interior Basin, covering 520 881 km2 or 52 percent of the total area of the country in the east and southeast of the country. A sub-basin of the Northern Interior Basin is the Qattara Depression.
- The Nile Basin, covering 326 751 km2 (33 percent) in the central part of the country in the form of a broad north-south strip.
- The Mediterranean Coast Basin, covering 65 568 km2 (6 percent).
- The Northeast Coast Basin, a narrow strip of 88 250 km2 along the coast of the Red Sea (8 percent).

The River Nile is the main source of water for Egypt, with an annual allocated flow of 55.5 km^3/yr under the Nile Waters Agreement of 1959. Internal surface water resources are estimated at 0.5 km^3/yr. This brings total actual surface water resources to 56 km^3/year.

All drainage water in Upper Egypt, south of Cairo, flows back into the Nile and the irrigation canals; this amount is estimated at 4 km^3/yr. Drainage water in the Nile Delta is estimated at 14 km^3/yr. Treated domestic wastewater in 2001/02 was estimated at 2.97 km^3/yr. There are several desalination plants on the coasts of the Red Sea and the Mediterranean to provide water for seaside resorts and hotels and total production in 2002 was estimated at 100 million m^3. Estimates of the potential of non-renewable groundwater in the eastern and western deserts, mainly from the Nubian Sandstone aquifer, vary from 3.8 km^3/yr to 0.6 km^3/yr.

Total water extraction in 2000 was estimated at 68.3 km^3. This included 59 km^3 for agriculture (86 percent), 5.3 km^3 for domestic use (8 percent) and 4.0 km^3 for industry (6 percent). 4.0 km^3 were used for navigation and hydropower.

Reuse of agricultural drainage water, returned to the rivers, in irrigation amounted to 4.84 km^3/yr in 2001/02. Of the 2.97 km^3/yr of treated wastewater, 1.5 km^3/yr is reused for irrigation, while the rest is pumped into main drains where it mixes with drainage water and is then used for irrigation. Treated wastewater is usually used for landscape irrigation of trees in urban areas and along roads.

The abstraction from the Nile Branch for the Methanol plant will be 0.00526 km^3/yr. This equates to 0.13 % of the total abstraction from industrial use (based on 2000 data).
Table 6-3 presents the water availability and use in Egypt (FAO, 2005)

Table 6-3: Water availability and water use in Egypt (2000)

Water input	**million m^3/yr**	**Water use**	**million m^3/yr**
Renewable surface water resources	56 000	Agriculture	59 000
Renewable groundwater resources	2 300	Domestic	5 300
Reuse of agricultural drainage water (return flow to rivers)*	4 840	Industry	4 000
Reuse of groundwater (seepage from agriculture)*	6 127		
Reused treated wastewater	2 971		
Desalinated water	100		

Water input	million m^3/yr	Water use	million m^3/yr
Use of fossil groundwater (non-renewable water)	825		
Total	**73163**	**Total**	**68 300**
		Navigation and hydropower	4 000

*Note *: Total water returning from agriculture was about 18 km^3, of which about 12 km^3 was return flow to rivers and 6km^3 seepage to groundwater*

6.4.1.3 Seawater Quality

Seawater quality may be affected during construction activities and eventually during operation activities. It may also affected by the occurrence of non-routine events. Impacts could result from the following environmental aspects:

- Dredging at methanol loading terminal (Jetty);
- Marine traffic (dredgers and vessels);
- Construction of marine outfall pipeline;
- Operation of methanol loading jetty;
- Maintenance dredging;
- Operation of marine outfall;
- Routine operation of methanol transporters (marine traffic);
- Accidental (non-routine) events: ship collision/accidents; and
- Accidental (non-routine) events: spills and leaks.

Dredging at Methanol Loading Terminal (Jetty)and Marine Traffic

During the construction phase, it is highly probable that turbidity will increase within the water column. This will predominantly be due to the dredging activity, but will also be due to the increase in marine traffic. The dredging will re-suspend particulate matter from the sediment into the water column. In certain cases this may cause an increase in the BOD of the water column and an overall reduction in the dissolved oxygen concentration. Other contaminants that may be present in the sediment may also be released into the water column.

The increase in turbidity should be short-lived and will last the duration of the dredging programme. However, if a lateral dispersion of the sediment plume is observed (i.e., flowing out to the Mediterranean) further mitigation may be required.

Construction of Marine Outfall

The marine outfall will be located greater than 500 m from the existing shoreline, as per Egyptian regulations. The diameter of the outfall pipe will be minimal (14 inches) and trenching is not anticipated. As mentioned above, the major identified impacts during the construction of the marine outfall are due to increase in seawater turbidity. However, if a lateral dispersion of the sediment plume is observed, silt curtains would be implemented to reduce the spread.

Operation of Loading Jetty and Maintenance Dredging

During the operational phase of the loading jetty, maintenance dredging will be conducted in the main shipping channel and in the loading berths, which will periodically increase overall water column turbidity and potentially reduce the overall water quality. Re-suspension of bottom sediments will also occur during the manoeuvring of vessels at the loading berth.

Operation of Marine Outfall

The normal flow of the outfall effluent is made up of the streams from the neutralization vessels, treated domestic waste, waste water treatment effluent, cooling tower blow down, plant rainwater, effluent from first flush pond, clean rainwater released from methanol storage tanks and diked spill contaminant areas. Discharges to the sea could also result from natural drainage such as surface water runoff and water tank overflows. This water is uncontaminated and should not cause any significant impacts. The marine outfall is designed to discharge a number of treated waste water streams that drain through a storm water catch pond.

The storm water catchment pond serves as a final check and release point for cooling tower blow-down, treated water effluents, and rainfall before it is pumped to the seawater outfall line. The catchment pond is divided into two catch basins. All water streams flow through one basin. Online analyzers monitor the water for pH, conductivity, and total organic carbon (TOC). If the stream is within the effluent limits, it is pumped out to the seawater outfall line via storm water pumps. If it is off-spec, the inlet flow is switched to the other catch basin while the off-spec water is pumped back to the first flush pond for further treatment.

The expected rates and types of discharges through the marine outfall are shown in Table 6-4.

Table 6-4: Routine discharges to the sea

Routine Discharge via outfall	Flow Type	Normal Flow Rate for One Methanol Plant	Quality
Waste water treatment effluent	Continuous	2.9 m^3/hour	Law 4 of 1994, Annex I
Treated domestic waste	Continuous	0.5 m^3/hour	Law 4 of 1994, Annex I
Cooling water tower blow down	Intermittent	100 m^3/hour	Law 4 of 1994, Annex I
Total site rainwater		150 m^3/hour	Law 4 of 1994, Annex I

The quality of wastewater discharged through the outfall would be monitored and will not exceed the limits for discharge to the marine environment, specified in Law No. 4 of 1994. The effluents will be monitored prior to discharge. In cases where discharge fails to meet the required specifications, off-spec effluent from the treatment units will be recycled for re-treatment.

A thermal dispersion model (CORMIX model) was used to determine the predicted temperature differential between the discharge effluent and the receiving environment. The modelled effluent discharge location is based on Egyptian Law, while the predicted effluent plume temperatures were compared to World Bank environmental protection criteria (which is more stringent than Law 4//94).

Any hazardous wastewater streams/chemicals will be segregated at the early stages and will not be disposed of through the marine outfall. These chemicals will be disposed of in special hazardous waste facilities. As such facilities do not exist in Egypt, such wastes may be exported to appropriate facilities.

Accidental (non-routine) Events – Ship Collision

Detrimental impacts to the surrounding water quality may occur through the accidental spillage of hydrocarbons (accidents between dredgers) and/or loss of Methanol (accidental events on Methanol transporters). Emergency response management plans will be in place to address these accidental events.

A preliminary qualitative risk assessment was prepared to evaluate the potential risks from accidental events and this is shown in Section 9 of this EIA report. Prior to construction, a full quantitative risk assessment will be produced to evaluate human health risk from accidental events.

Accidental (non-routine) Events – Spills and Leaks

Detrimental impacts to the surrounding water quality may occur through spillage of infilling material, discharge of off-spec effluent through accidental discharges and/or leaks, treatment chemicals, and also leaks or release of methanol during the loading operations. Emergency response management plans will be in place to address these accidental events.

6.4.2 Air and Climate

Air quality may be affected during site preparation, construction activities, and operation activities. It may also be affected by the occurrence of non-routine events. Impacts could result from the following environmental aspects:

- Creation of access roads;
- Transport and use of vehicles and site machinery during all project phases;
- Purchasing of supplies and services;
- Excavation and earthworks for methanol plant construction;
- Dredging at methanol loading terminal (jetty);
- Marine traffic (dredgers and vessels);
- Methanol plant equipment start-up;
- Operation of methanol plant;
- Road operation;
- Routine operation of methanol transporters (marine traffic);
- Maintenance dredging;
- Accidental (non-routine) events: ship collision / accidents;
- Accidental (non-routine) events: fire and explosion; and
- Accidental (non-routine) events: spills and leaks.

Dust and Particulates

During construction, air quality impacts may be a localized and temporary reduction in air quality as a result of dust and particulate generation. It is considered to be the most significant, with the potential to affect workers on-site, and off-site receptors such as people using the adjacent roads, land or working in the port areas. Creation of access roads, excavation and earthworks for methanol plant construction, dredging at methanol loading terminal, and ground transport may lead to the temporary air borne transport of particulates (increased dust).

This increased particulate load can be prevented, and should be short-lived providing the environmental protection plan guidelines (Mitigation plan, Chapter 7) outlined in this report are followed and enforced, such as the damping of roads.

Gaseous and Exhaust Emissions

During construction, air quality impacts may be a localized and temporary reduction in air quality as a result of emissions from site machinery, marine traffic (dredgers and vessels) and equipment. Furthermore, heavy equipment such as bulldozers, dredging vessels, tug boats and barges will produce exhaust emissions from diesel engines leading to temporary increases in SO_x, NO_x and CO_2.

In addition, gaseous emissions (such as N_2, H_2O, and traces of methane, methanol, and argon) from machinery and equipment may lead to a reduction in air quality inside the workplace as well as outside the project boundaries. These gaseous emissions are of special concern during the operational phase of the facility as they may cause general disturbance to area and human health issues to local occupants/users.

Furthermore, the operation of the Methanol loading jetty may cause increased air emissions from vessels. Methanol ships will be entering the Port and loading at the jetty; these vessels will utilise Natural Gas as a fuel source.

Emissions may occur in the event of an emergency. Shipping accidents, fire and explosion, and inappropriate waste disposal will be a major concern. Major impacts may arise in the event of accidental leakage or release of Methanol (escape to air unless ignited) and open burning of solid waste.

The main gases of concern include:

Sulphur dioxide - SO_2

The amount of SO_2 in exhaust gases is directly dependent on the sulphur content of the used fuel. Reducing SO_2 emissions from engines can be implemented by using low sulphur content fuel.

Nitrogen oxides - NO_x

NO_x emissions from contractor equipment/activities contribute to pollution in the form of acid rain, disturbances of the ozone layer and local health problems. Measures to reduce emissions include:

- modification of machinery and energy carriers; and

- use of new technologies.

Carbon dioxide

CO_2 emissions may occur during both the construction and operation phases. In addition to its being a green house gas, it is important to monitor and control CO_2 emissions to prevent general air quality deterioration inside and outside the workplace. Carbon dioxide will be generated and emitted both directly and indirectly during the construction and operational phases of the project. It is important that all energy consuming and CO_2-generating activities are done as efficiently as possible to minimise CO_2 emissions.

Under normal operating conditions, it is expected that the air emissions will not have significant impacts on the surrounding environment. Minor impacts may affect social receptors (neighbouring village and personnel) for short periods during equipment start up.

6.4.3 Land

Topographic changes and visual impact may occur during site preparation, construction activities, and operation activities. It may also be affected by the occurrence of non-routine events. Impacts could result from the following environmental aspects:

- Creation of access roads;
- Excavation and earthworks for methanol plant construction;
- Construction of marine outfall pipeline;
- Construction of freshwater intake pipeline;
- Waste disposal during construction and operation activities;
- Accidental (non-routine) events: spills and leaks; and
- Accidental (non-routine) events: inappropriate waste disposal.

The area designated for the implementation of the methanol plant, pipeline, and methanol product storage tanks is not considered as an area where geological features require protection. Excavation and earthworks are not regarded as sources of negative impact on local geology. As a means of recovery, surface deposits that will be dredged during construction may be used for levelling or backfill.

The site is within the petrochemical complex in Damietta Port, earmarked for industrial developments. As such, it is unlikely that the resource potential of the region will be affected. Overall, no significant impacts on geology are considered likely with the proposed facility during construction and operation.

During the construction activities, there will be a number of vessels, barges, bulldozers and tug boats in the port in the vicinity of the proposed loading jetty. This activity will be short lived. Generally, the proposed facility would introduce during operation activities storage tanks for raw material as well as products within the Damietta Port premises which may negatively visual impact. However existing industries are operating and ongoing in the petrochemical complex, and thus, the proposed project is expected to add no significant adverse visual impact on the area.

Solid waste generated during the construction and operation phases may negatively impact the site if handled inappropriately.

Accidental events including contaminant leaching to subsurface may eventually lead to a change in the surface soil type, chemical composition or fertility.

6.4.4 Ecology and Biodiversity

6.4.4.1 Marine Ecology and Biodiversity

Marine invertebrates are one of the important groups of organisms associated with the port and the coastal Mediterranean Sea. This ecosystem also supports a large diversity of fish species ranging from benthic dwellers to large pelagic species. The coastal area of the Mediterranean adjacent to the northern site boundary is prohibited for fishing (in the vicinity of the proposed outfall). Coastal grab samples taken in the vicinity of the project site at near shore and up to 5 km offshore indicate a sandy bottom, with low diversity and species abundance.

Marine ecology and biodiversity may be affected during construction and operation activities. It may also be affected by the occurrence of non-routine events. Impacts could result from the following environmental aspects:

- Dredging at methanol loading terminal (jetty);
- Marine traffic (dredgers and vessels);

- Construction of marine outfall pipeline;
- Construction of freshwater intake pipeline;
- Operation of methanol plant;
- Operation of methanol loading jetty;
- Operation of freshwater intake;
- Operation of marine outfall;
- Routine operation of methanol transporters (marine traffic);
- Maintenance dredging;
- Accidental (non-routine) events: ship collision / accidents; and
- Accidental (non-routine) events: spills and leaks.

Dredging at Methanol Loading Terminal (Jetty)

Prior to the construction of the methanol loading jetty, the sediment and shoreline must be protected. The coastal preparation will have a significant localised impact to the ecosystem, as the existing marine habitat will be removed. Construction activities may require some dredging of the benthos and will destroy the existing benthic community. Although this will be a significant impact, this loss will be temporary and the benthos will be re-colonised. However, the organisms that will re-colonise will be different to the existing ecosystem, as the existing sediment in the area is sand.

During the construction, a number of barges will be necessary to contain the infilling material. Material will be placed on the seabed using bulldozers. Any infilling over the seabed for the construction of the jetty in the port could destroy the marine life on the underlying area. Dredging activities may increase the turbidity level and result in a temporary decrease in water quality. Increased turbidity may be detrimental to benthic species – particularly sedentary species such as tube worms.

Prolonged reduced clarity may also lead to a reduction in the photosynthetic productivity of the water column. Furthermore, the construction of the Methanol loading terminal may negatively impact a number of VECs, including plankton, crustaceans, molluscs, pelagic and demersal fish.

Marine Traffic (Dredgers and Vessels)

During the construction phase of the project, there will be a major increase in the volume of marine traffic. The port currently has an active shipping channel that is utilised by large vessels within Damietta. The shipping channel is marked with navigational buoys. The increase in the volume of marine traffic, and also the nature of the dredging and shore-line protection works, may necessitate further marker buoys to be implemented to prevent ship collision. The location of the jetty works may interrupt routine vessel usage of the main shipping channel. The Port Authority and Harbour Master would be fully notified of all activities programmed for the jetty construction phases.

Movement of large vessels at the Methanol loading jetty may re-suspend the bottom sediments, thus causing increased turbidity which may in turn affect marine biota. Increased marine traffic during construction may negatively impact a number of VECs, including plankton, crustaceans, molluscs, pelagic and demersal fish.

Construction of Marine Outfall

The construction of the marine outfall is one of the major aspects that may affect marine ecology. Increased turbidity, resulting from the placement of the outfall, will cause a reduction in the depth of penetration of incident irradiance, which may have negative impacts on the micro algal community if the events are long-lived. High sedimentation rates may also directly impact the benthic community by smothering filter feeders and stationary organisms. The main VECs negatively impacted include crustaceans, molluscs, demersal fish and marine mammals.

Construction of Freshwater Intake

Construction at the freshwater intake activities may result in localised impacts on the current sparse native vegetation and may cause a localised increase in suspended solids in the water column.

Operation of Methanol Plant

The impact of the operation of the methanol plant on the marine ecology and biodiversity is only limited to those resulting from the operation of the marine outfall which will be further discussed in later sections.

Operation of Methanol Loading Jetty

The operation of the loading facility may negatively impact a number of VECs, including plankton, crustaceans, molluscs, pelagic and demersal fish.

Operation of Freshwater Intake

Operation of the fresh water intake may negatively impact a number of VECs, and potentially the local fishing industry. Appropriate pipe design (for water intake) should eliminate/reduce associated impacts, especially those related to fish intake.

Operation of Marine Outfall

The existence of an outfall structure may result in a change in the biological community along the corridor of the structure. Biofouling may also occur on the ports and pipeline. The main VECs potentially negatively impacted through operation include plankton, crustaceans, molluscs and demersal and pelagic fish, and marine mammals.

Routine Operation of Methanol Transporters

As a result of the routine operation of the jetty, there will be an increase in the overall number of vessels that use the shipping channel and berthing zone. Methanol ship docking times and schedules will be set through comprehensive consultation with the Harbour Master and Damietta Port. Movement of large ships may result in the re-suspension of bottom sediments. Increased marine traffic during operation may negatively impact a number of VECs, including plankton, crustaceans, molluscs, pelagic and demersal fish.

Maintenance Dredging

Maintenance dredging is necessary, particularly along the shipping channel and within the loading berths. Additional dredging at the methanol jetty will present adverse impacts to the benthic community within the Port, and may also cause increased turbidity and a decrease in water quality. Impacts are considered to be minor as there was very low biomass observed from the sediment samples collected in the vicinity of the site.

Accidental (non-routine) events: ship collision / accidents

Accidental spillage of hydrocarbons (accidents between dredgers) and/or loss of Methanol (accidental events on Methanol transporters) may lead to serious environmental problems, if not immediately contained. Floating contaminants would directly affect mammals and birds that swim or dive through the surface of the water.

In the open water, many birds and animals may be able to avoid contact with a surface slick, but in near-coastal zones, birds and animals may be trapped between the shore and the encroaching slick.

Methanol transporters, dredging vessels, barges and tugs may use diesel. The magnitude and persistence of contamination in the intertidal zone through hydrocarbon spills is greatly dependent on the geomorphology and the sediment characteristics of the coast.

Accidental (non-routine) events: spills and leaks

Accidental hydrocarbon and chemical spills may occur and impact a great number of VECs. Other impacts may be related to loss of ballast water from dredgers and vessels, usage of anti-fouling agents in paints, and general litter and wastes from human activities and boats during all phases of the development.

Release of Chemically Active Components

A wide variety of chemically active components released into the sea may damage marine life, leading to the degradation of the marine environment and loss of marine resources. Compounds that have been globally damaging include:

- Hydrocarbons;
- general nutrients; and,
- pesticides and fertilisers.

Hydrocarbons may be released from vessels working within the vicinity of the jetty as well as methanol vessels. As mentioned previously, this may result in floating oil that will directly affect birds that swim or dive through the surface of the water. Accidental events at the loading facility may negatively impact a number of VECs, including plankton, crustaceans, molluscs, pelagic and demersal fish, and potentially the local fishing industry. However, these impacts are deemed to be minimal based on their low probability and provided that best engineering practice is followed. Contingency plans will be in place for accidental events related to loading facility.

Accidental exceedance of certain parameter concentrations in treated domestic wastewater may lead to release of nutrients. This may cause excessive growth of algae, known as Eutrophication. The quantities of certain marine species such as *Enteromorpha* sp. and *Ulva* sp, may increase. As these species are opportunistic, their exceedance may exclude other forms of marine life. At high nutrient levels, accumulation of decomposing plant material typically leads to reduced oxygen conditions in which only bacteria thrive.

The impact of an enhanced nutrient load is that phytoplankton growth rates increase and can form nuisance blooms. Generally these blooms are not harmful, but reduce the aesthetic value of the area and can lead to an increase the BOD of the water column when the bloom dies off. However, in some cases the blooms can be formed by toxic algae that can be potentially dangerous for humans. The toxins pass through the food chain from micro-algae to fish, and finally to humans.

Loss of ballast water from dredgers and vessels

Loss of ballast water from dredgers and vessels may have an impact on marine ecology and biodiversity. Ships take in water for stability before a voyage and release it in a new location. The exotic species carried in ballast water can cause economic and environmental damage as they often out-compete native species. The International Maritime Organization (1997) has produced guidelines for the control and management of ships' ballast water to minimize the transfer of harmful aquatic organisms and pathogens. These guidelines should be carefully followed.

Usage of Anti-fouling Agents

Since the 1960's, butyltin compounds (organotins) have been used world-wide for various purposes. Tributyl Tin (TBT) has been implemented extensively as anti-fouling agents in paints used for boats and aquaculture nets. Organotins are also used as stabilisers in plastics and wood preservatives. Earlier studies on TBT effects focused mainly on lower trophic organisms in the food chain. These studies reported physiological abnormalities such as growth reduction in marine microalgae, shell thickening and spat failure in oysters and imposex in gastropods and whelks (imposex is a malformation of the female genitals). Other impacts include endocrine disruption in shellfish, algae mortality, and bioaccumulation in coastal ecosystems. Further investigation in marine vertebrate predators such as marine turtles, tuna and shark suggest that greater accumulation of butyltins can occur at higher food chain levels.

The usage of anti-fouling agents in paints such as Tributyl Tin (TBT) has many adverse effects on marine biota.

General Litter and Wastes

Under normal conditions, solid waste is not expected to reach or impact the marine environment. Accidental release of solid wastes from ships (potentially contaminated paper, plastic, cardboard) may cause negative impacts to the marine environment in terms of visual impacts and to biotic VECs. The application of prevention measures, in addition to proper handling of hazardous waste containers present a major tool for the protection of the marine environment from accidental spills.

Accidental events, related to leaks and ruptures of the pipe and/or screen at freshwater intake may negatively impact a number of VECs, and potentially the local fishing industry if screens are ruptured or if intake increases significantly.

6.4.4.2 Terrestrial Ecology

The area of the proposed development can be described as the coastal zone and consists of sandy shorelines, with undulating sand drifts across the main sections of the site. It is a harsh environment with dry, sandy soils, little rainfall, high salinity and exposure to wind. Almost, no terrestrial sensitive receptors were observed inside the site. Few mammal tracks as well as some bird tracks were sited in addition to low vegetation cover on site. The surrounding area is the deltaic agricultural lands. Most of the surrounding area is cultivated agricultural land with a complex network of irrigation and drainage canals.

Terrestrial ecology and biodiversity may be affected during site preparation, and construction and operation activities. It may also be affected by the occurrence of non-routine events. Impacts could result from the following environmental aspects:

- Creation of access roads;
- Transport and equipment use;
- Excavation and earthworks for methanol plant construction;
- Construction of marine outfall pipeline;
- Construction of freshwater intake pipeline;
- Waste disposal during construction and operation;
- Operation of methanol plant;
- Operation of freshwater intake;
- Operation of marine outfall;
- Road operation;
- Accidental (non-routine) events: fire and explosion
- Accidental (non-routine) events: spills and leaks; and
- Accidental (non-routine) events: inappropriate waste disposal

During the construction phases of the project, there will be an overall loss of terrestrial habitat, for example, loss of feeding areas, cover and nesting of fauna and disturbance of the part of the surrounding ecosystem hosting the fresh water intake pipeline. However, some of the identified habitats, especially those of agricultural areas, are of commercial importance for the local community. Accordingly, such loss is expected to be major as the proposed fresh water falls within an agricultural zone that is used for economic production and represents a rich area in terms of vegetation.

During the construction phases of the project, there will be an overall loss of marine habitat that will extend from the upper shore and intertidal zone, down to the subtidal zone. However, such loss is expected to be minor as the proposed location falls within an industrial zone that already has a low biodiversity value.

The proposed plant site is within an already developed area and the site is degraded in terms of biodiversity value. No significant habitat loss will occur through building the proposed methanol plant.

During the routine operation of the project, the impact could result from the operation of the outfall and freshwater intake, and road operation. Additionally, during the operational phase, plant activities will lead to an increase in garbage, solid wastes and wastewater treatment sludge. Solid waste, generated by operation activities, may negatively impact a number of VECs, including mammals and vegetation.

Accidental events during the construction and operation of the project may include ship collision, fire, explosion, spillage of fuel and spillage of infilling material, etc. This will have a significant impact on the fauna and flora in the vicinity of the site. Emergency response plans will be in place to mitigate any accidental event.

6.4.5 Human Environment

Valued components that should be evaluated in the context of this impact assessment include the neighbouring residents, local farmers, fishermen and other sea users within the Port. Generally, there will be positive benefits for the local community in terms of employment and income for the local economy during the construction and operation activities.

6.4.5.1 Socio-Economic Activities

Socio-Economic activities may be affected during site preparation, and construction and operation activities. Impacts could result from the following environmental aspects:

- Creation of access roads;
- Purchasing of supplies and services;
- Staffing; and
- All construction and operation activities.

The proposed site is located in the middle of a designated petrochemical industrial zone (New Damietta Port). The site is currently unoccupied and thus no relocation or resettlement will occur. There are no identifiable social concerns in terms of impacting any local indigenous populations and Economic impacts would be positive (i.e. Class 6). Discussions with local residents including the farmer residing to the west of the facility suggest that no negative impact should be imposed on any of their different sources of income. local residents of different categories explicitly showed very big interest in exploiting any employment opportunity with the plant whether direct or indirect. During discussions and interviews with local farmers they showed suspicious reaction towards the installation of the fresh water intake pipeline coming from the Nile branch and crossing farmlands through to the plant. They explained that this was due to a negative experience they had with the gas company that installed a similar pipeline. They said that no clear agreement on compensation for harmed source of income was made between them and the gas company the matter that created problems, some of which was serious. Local farmers expressed no intention to create problems as long as their source of income and economic properties will remain intact or shall there be an adequate compensation for any negative impact they would experience. The fact that a win-win situation prevails most interviewed local residents showed high level of understanding and readiness for cooperation.

During the construction phase, there will be positive benefits for the local community in terms of employment and income for the local economy. Employment prospects will exist for skilled and unskilled labour, administration staff, caterers and medical staff. Where available, these personnel will be pooled from the local community in Damietta and within Egypt. During construction, the need for local equipment would also be an economic boost to the local resources and would produce a positive impact (i.e. Class 6). Following the public meeting held at Damietta on 8 June 2006 it appears that most people welcome the new development and are excited at the prospect of additional employment for the area. A key concern for the EMethanex facility will be how they balance the expectations of the local community with the real level of employment and opportunities afforded by the phases of the project.

National unemployment levels are 11.8% (1999 estimate), with an employment breakdown of 40% Agriculture; 38% Services; 22% Industry. During the construction phase, the methanol project will offer up to 1 500 jobs directly in industry, and indirectly will offer many thousands of skilled and unskilled workers employment. Training will also be necessary for many of the new staff, and new skills and techniques will be transferred to the local market.

During operations, the project would provide employment opportunities (skilled workers) and revenue to local supporting businesses and industries within Egypt, such as existing waste facilities for the re-use and recycling of many products such as paper, cardboard, glass, mineral oils and lubricants. Influx into surrounding communities could occur as a result of people coming to the area seeking employment opportunities. Therefore, the local economy will be indirectly enhanced due to the increase in personnel in the area (and direct spending potential) and the associated opportunities for businesses and industries in the area (e.g. recycling industries, aggregate, accommodation). In conclusion, the socio-economic impact of the project would be positive (i.e. Class 6) provided that the facility manages the concerns and expectations of the community in a balanced, transparent and fair manner.

6.4.5.2 Community Health and Safety

Community safety may be affected by the occurrence of non-routine events. Impacts could result from the following environmental aspects:

- Waste disposal;
- Ship collision / accidents; and
- Fire and explosion.

During the construction of the facility, a number of trucks and heavy equipment will be necessary. The expected increase in volumes of vehicular traffic on existing road networks may result in increased risks to community safety. Operators of construction equipment and operations vehicles should adhere to local speed limits and rules.

Where communities are present, speed should be reduced. Those measures apply to both the construction and operational phase. Traffic increase would be regulated, as much as possible, through the recommendations provided in the mitigation and monitoring section.

Accidental events may include road accidents, ship collision (e.g., between routine users and methanol transporters), fire, explosion, and fatalities, etc. This may result in human injury. Loss of life is a major potential impact from accidental events involving explosions of flammable liquids or vapors. However, full contingency plans would be in place to prevent adverse actions. This will have a significant impact on the current sea users of the port. Full emergency response plans and rescue equipment and personnel will be in place to mitigate any accidental event.

6.4.5.3 Noise Pollution

Noise pollution may be affected during site preparation, and construction and operation activities. It may be affected by the occurrence of non-routine events. Impacts could result from the following environmental aspects:

- Creation of access roads;
- Transport and equipment use;
- Excavation and earthworks for methanol plant construction;
- Dredging at methanol loading terminal (jetty);
- Marine traffic;
- Construction of marine outfall;
- Construction of freshwater intake;
- Operation of methanol plant;
- Operation of methanol loading jetty;
- Road operation; and
- Fire and explosion.

During the construction of the methanol plant, marine outfall, and the jetty, there will be a number of heavy plant and offshore vessels operating in the area, which will increase the overall baseline noise load for the port. However, this will be short-lived and restricted to the construction period. Therefore, piling of the jetty structure should be conducted during day time hours to meet the Egyptian Noise Standards during night time hours.

Construction of water intake would result in impacts such as increased noise due to increased machinery usage. Dredging at methanol loading terminal and other construction activities may also lead to increased noise levels.

Operation of the Methanol plant and loading jetty may cause increased noise from equipment and vessels. Increased marine traffic may also result in increased noise levels. The noise prediction model shows that operational noise levels will meet the Egyptian Noise Standards at the facility boundaries and at nearby receptors. Incidental noise will occur from warning alarms, fog horns and navigational bells etc.

Accidental events such as explosion, collision warning alarms, etc. will surpass Egyptian Noise Standards; however these high noise levels would be unlikely events and should not be sustained.

6.4.5.4 Agriculture

Almost all of the area surrounding the petrochemical complex where the project is to be located is farmland. Farming is thus the main activity of local residents in that area. Their main source of income depends on farm crops and some animal production and trade of these goods in addition to some other related activities. The standards of living and level of education in this area are not high.

It is very likely that most of faming activities be impacted during the construction and the operation phases. Some of the foliar crops could very drastically be devaluated when mixed with dust or sand particles. Animals and birds assisting farmers are very likely to be affected by noise made during the construction phase as well as any other accidental elevated noise during operation (system start-up and shutdown).
Also all air and water pollution are expected to affect the crops as well as the local resident of the area and has an impact on the productivity of the land.

In addition to, and due to its very close proximity, farmlands and its residents could be experience the higher effects in case of any grave accidents.

During the construction of the fresh water intake pipeline, the farmlands will be highly damaged. This has been experienced before in the same area during the construction of a main gas pipeline. The level of impact is expected to vary in effect and magnitude due to the diversity of the receiving environment.

6.4.5.5 Archaeological Heritage

The proposed is petrochemical complex in Damietta Port and thus no significant archaeology has been reported. There were no neighbouring sites known to be of any archaeological importance in the close proximity of the proposed site. Therefore no direct impacts are expected to negatively affect any heritage resources in the close proximity of the proposed facility site.

6.4.5.6 Light Pollution

During construction phase, the potential use of excess light could represent a minor environmental impact. The management and control measures identified in section 7 of the report should be followed.

6.5 Impact Evaluation

The following steps in the EIA have been accomplished so far:

- Identification of project aspects;
- Identification of Valued Ecosystem Components (VECs); and,
- Determination of the potential environmental impact of each of the aspects on each VEC.

The next stage is to evaluate the significance of each potential environmental impact on each VEC. Impacts are evaluated using the following criteria:

- Character of the VEC;
- Duration of the impact;
- Magnitude of the impact;
- Spatial extent;
- Type (direct, indirect, cumulative); and,
- Probability of occurrence.

Definitions of the above parameters are given in Table 6-5.

Table 6-5: Assessment of Impact Significance

Duration – what is the length of the negative impact?	
None	no effect.
Short	less than one year.
Moderate	one to ten years.
Long	greater than ten years.
Permanent	irreversible
Magnitude – what is the effect on the resource within the study area?	
None	no effect.
Small	affecting less than 1% of the resource.
Moderate	affecting 1-10% of the resource.
Great	affecting greater than 10% of the resource.

Spatial Extent – what is the scale of the impact in terms of area, considering cumulative impacts and international importance?	
Local	in the immediate area of the impact.
Regional/National	having large-scale impacts.
International	having international importance
Type – what is the impact?	
Direct – caused by the project and occur simultaneously with project activities	
Indirect – associated with the project and may occur at a later time or wider area	
Cumulative – combined effects of the project with other existing /planned activities	
Probability – what is the likelihood of an impact occurring?	
Low	<25%
Medium	25-75%
High	>75%

Consideration of the above criteria leads to the definition of a significance for each potential environmental impact / VEC combination. Six significance classes have been defined, as outlined in Table 6-6

Table 6-6: Significance classes for environmental impact

Class	Significance	Description/Comments
1	Significant, Major impact	Impacts are expected to be permanent and non-reversible on a national scale and/or have international significance or result in a legislative non-compliance.
2	Significant, Moderate impact	Impacts are long term, but reversible and/or have regional significance.
3	Insignificant, Minor impact	Impacts are considered to be short term, reversible and/or localized in extent.
4	Insignificant	No impact is expected.
5	Unknown	There are insufficient data on which to assess significance.
6	Positive	Impacts are beneficial to the key VECs.

A summary of the significance of the potential impacts of the various aspects foreseen for the methanol plant project on the identified VECs is presented in Table 6-7.

Table 6-7: Summary of Potential Impacts

Project Component	Aspect	VEC	Impact	Duration	Magnitude	Extent	Type	Probability	Significance
SITE PREPARATION	Creation of Access Roads	Air quality	Increased air emissions (dust, and exhaust emissions)	SHORT	SMALL	LOCAL	DIRECT	25-75 %	MINOR
		Agriculture	Devaluation of crops (exhaust, dust and sand fine particles emissions)	MODERATE	MEDIUM	LOCAL	DIRECT	25-75%	MODERATE
		Topography and Landscape	Topographic changes and Visual Impact	MODERATE	MODERATE	REGIONAL	DIRECT	25-75 %	MODERATE
		Terrestrial ecology and biodiversity	Loss of habitat and clearing or damage to vegetation	MODERATE	MODERATE	LOCAL	DIRECT	< 25%	MINOR
		Noise Pollution	Increased noise levels	SHORT	SMALL	LOCAL	DIRECT	25-75 %	MINOR
		Socio-Economic activities	Temporary employment prospects in the area	SHORT	MODERATE	REGIONAL	INDIRECT	25-75 %	POSITIVE
	Transport and equipment use	Air quality	Increased air emissions (dust, and exhaust emissions)	SHORT	SMALL	LOCAL	DIRECT	> 75 %	MINOR
		Agriculture	Deposition of dust, sand particles and pollutants on crops	SHORT	SMALL	LOCAL	DIRECT	25-75%	MINOR
		Noise Pollution	Increased noise levels	SHORT	SMALL	REGIONAL	DIRECT	> 75 %	MODERATE
		Terrestrial ecology and biodiversity	Loss of habitat and clearing or damage to vegetation	SHORT	SMALL	REGIONAL	DIRECT	25-75 %	MINOR
	Purchasing of supplies and services	Air Quality	Increased CO_2 emissions	SHORT	SMALL	REGIONAL	INDIRECT	25-75 %	MINOR
		Agriculture	Deposition of dust, sand particles and pollutants on crops	SHORT	SMALL	REGIONAL	INDIRECT	<25%	MINOR

Project Component	Aspect	VEC	Impact	Duration	Magnitude	Extent	Type	Probability	Significance
		Socio-Economic activities	Increase in economic activity	SHORT	SMALL	REGIONAL	DIRECT	> 75 %	POSITIVE
	Staffing	Socio-Economic activities	Temporary employment prospects in the area	SHORT	SMALL	REGIONAL	DIRECT	25-75 %	POSITIVE
CONSTRUCTION ACTIVITIES	Excavation and earthworks for Methanol plant construction	Air quality	Increased air emissions (dust, and exhaust emissions)	SHORT	SMALL	LOCAL	DIRECT	> 75 %	MINOR
		Agriculture	Devaluation of crops (exhaust, dust and sand fine particles emissions)	MODERATE	MODERATE	REGIONAL	DIRECT	25-75%	MODERATE
		Noise Pollution	Increased noise levels	SHORT	SMALL	LOCAL	DIRECT	> 75 %	MINOR
		Topography and Landscape	Visual impacts due to use of unsustainable disposal methods	SHORT	SMALL	LOCAL	DIRECT	< 25%	INSIGNIFICANT
		Terrestrial ecology and biodiversity	Loss of habitat, and clear or damage to vegetation	MODERATE	MODERATE	LOCAL	DIRECT	25-75 %	MINOR
		Socio-Economic activities	Temporary employment prospects in the area	SHORT	SMALL	REGIONAL	DIRECT	> 75 %	POSITIVE
CONSTRUCTION ACTIVITIES	Dredging at Methanol Loading Terminal (Jetty)	Seawater Quality	Increased turbidity and BOD within the water column. Overall reduction in the dissolved oxygen concentration.	MODERATE	MODERATE	REGIONAL	DIRECT	25-75 %	MODERATE
		Marine ecology and biodiversity	Loss of marine biota	MODERATE	MODERATE	REGIONAL	DIRECT	25-75 %	MODERATE
		Air quality	Increased air emissions (dust, and exhaust emissions)	SHORT	SMALL	LOCAL	DIRECT	> 75 %	MINOR
		Noise Pollution	Increased noise levels	SHORT	SMALL	LOCAL	DIRECT	> 75 %	MINOR

Project Component	Aspect	VEC	Impact	Duration	Magnitude	Extent	Type	Probability	Significance
		Socio-Economic activities	Temporary employment prospects in the area	SHORT	SMALL	REGIONAL	DIRECT	> 75 %	POSITIVE
	Transport and use of vehicles and site machinery	Air quality	Increased air emissions (dust, and exhaust emissions)	SHORT	SMALL	LOCAL	DIRECT	> 75 %	MINOR
		Agriculture	Deposition of dust, sand particles and pollutants on crops	MODERATE	MODERATE	REGIONAL	INDIRECT	<25%	MINOR
		Terrestrial ecology and biodiversity	Loss of habitat, and clear or damage to vegetation	SHORT	SMALL	REGIONAL	DIRECT	25-75 %	MINOR
		Socio-Economic activities	Increase of employment	SHORT	SMALL	REGIONAL	DIRECT	> 75 %	POSITIVE
	Marine Traffic (dredgers and vessels)	Seawater Quality	Increased turbidity within the water column	SHORT	SMALL	REGIONAL	DIRECT	25-75 %	MINOR
		Air quality	Increased air emissions (exhaust emissions)	SHORT	SMALL	REGIONAL	DIRECT	25-75 %	MINOR
		Marine ecology and biodiversity	Loss of marine biota	SHORT	SMALL	REGIONAL	DIRECT	25-75 %	MINOR
		Noise Pollution	Increased noise levels	SHORT	SMALL	LOCAL	DIRECT	> 75 %	MINOR
		Socio-Economic activities	Temporary employment prospects in the area	SHORT	SMALL	REGIONAL	DIRECT	> 75 %	POSITIVE
	Construction of marine outfall pipeline	Seawater Quality	Increase overall water column turbidity	SHORT	SMALL	REGIONAL	DIRECT	> 75 %	MODERATE
		Noise Pollution	Increased noise levels	SHORT	SMALL	LOCAL	DIRECT	> 75 %	MINOR
		Topography and Landscape	Visual impacts due to use of unsustainable disposal methods	SHORT	SMALL	LOCAL	DIRECT	> 75 %	MINOR
		Marine ecology and biodiversity	Loss of marine biota	SHORT	SMALL	REGIONAL	DIRECT	> 75 %	MINOR

Project Component	Aspect	VEC	Impact	Duration	Magnitude	Extent	Type	Probability	Significance
		Terrestrial ecology and biodiversity	Loss of habitat, and clear or damage to vegetation	MODERATE	MODERATE	LOCAL	DIRECT	> 75 %	MODERATE
		Socio-Economic activities	Temporary employment prospects in the area	SHORT	SMALL	REGIONAL	DIRECT	> 75 %	POSITIVE
	Construction of freshwater intake pipeline	Freshwater Quality	Re-suspension of bottom sediments	SHORT	SMALL	REGIONAL	DIRECT	25-75 %	MINOR
		Topography and Landscape	Visual impacts due to use of unsustainable disposal methods	SHORT	SMALL	LOCAL	DIRECT	> 75 %	MINOR
		Noise Pollution	Increased noise levels	SHORT	SMALL	LOCAL	DIRECT	> 75 %	MINOR
		Marine ecology and biodiversity	Loss of marine biota	SHORT	SMALL	REGIONAL	DIRECT	25-75 %	MINOR
		Terrestrial ecology and biodiversity	Loss of habitat, and clear or damage to vegetation	MODERATE	MODERATE	LOCAL	DIRECT	> 75 %	MODERATE
		Agriculture	Oil spills and maintenance leftovers	SHORT	SMALL	LOCAL	DIRECT	<25%	MINOR
		Socio-Economic activities	Temporary employment prospects in the area	SHORT	SMALL	REGIONAL	DIRECT	> 75 %	POSITIVE
		Socio-Economic activities	Change in local fish industry and loss in field crops	SHORT	SMALL	LOCAL	DIRECT	> 75 %	MINOR
	Waste disposal	Groundwater Quality	Leaching of waste into aquifer	LONG	MODERATE	REGIONAL	DIRECT	< 25 %	MODERATE
		Topography and Landscape	Visual impacts due to use of unsustainable disposal methods	MODERATE	SMALL	LOCAL	DIRECT	> 75 %	MODERATE
		Terrestrial ecology and biodiversity	Loss of habitat, and clear or damage to vegetation	LONG	MODERATE	LOCAL	DIRECT	< 25 %	MINOR
		Community Health and Safety	Health impacts	MODERATE	SMALL	LOCAL	DIRECT	> 75 %	MODERATE

Project Component	Aspect	VEC	Impact	Duration	Magnitude	Extent	Type	Probability	Significance
OPERATION ACTIVITIES	Methanol plant equipment start-up	Air quality	Increased air emissions (gaseous emissions)	SHORT	SMALL	LOCAL	DIRECT	> 75 %	MINOR
	Operation of Methanol Plant	Air quality	Increased air emissions from vessels (gaseous emissions)	LONG	MODERATE	LOCAL	DIRECT	25-75 %	MODERATE
		Agriculture	Air pollution deposition on land and crops.	SHORT	SMALL	REGIONAL	INDIRECT	<25%	MINOR
		Noise Pollution	Increased noise levels	SHORT	SMALL	LOCAL	DIRECT	> 75 %	MINOR
		Marine ecology and biodiversity	Loss of marine biota due to outfall	LONG	MODERATE	REGIONAL	INDIRECT	25-75 %	MODERATE
		Terrestrial ecology and biodiversity	Loss of habitat, and clear or damage to vegetation	SHORT	SMALL	LOCAL	DIRECT	< 25 %	INSIGNIFICANT
		Socio-Economic activities	Permanent employment opportunities in the area	SHORT	SMALL	REGIONAL	DIRECT	> 75 %	POSITIVE
	Operation of Methanol Loading Jetty	Seawater Quality	Increase overall water column turbidity	LONG	MODERATE	REGIONAL	DIRECT	25-75 %	MAJOR
		Marine ecology and biodiversity	Loss of marine biota	LONG	MODERATE	REGIONAL	DIRECT	25-75 %	MAJOR
		Noise Pollution	Increased noise levels	SHORT	SMALL	LOCAL	DIRECT	> 75 %	MINOR
		Socio-Economic activities	Permanent employment opportunities in the area and increase in trading	SHORT	SMALL	REGIONAL	DIRECT	> 75 %	POSITIVE
	Operation of freshwater intake	Freshwater Quality	Changes in water quality	LONG	SMALL	REGIONAL	DIRECT	< 25 %	MINOR
		Marine ecology and biodiversity	Loss of marine biota	LONG	SMALL	REGIONAL	DIRECT	< 25 %	MINOR
		Terrestrial ecology and biodiversity	Loss of habitat, and clear or damage to vegetation	MODERATE	MODERATE	LOCAL	DIRECT	> 75 %	MODERATE

Project Component	Aspect	VEC	Impact	Duration	Magnitude	Extent	Type	Probability	Significance
		Agriculture	Destruction of farmland infrastructure; Destruction of crops; Halt of farm activities	MODERATE	MODERATE	LOCAL	DIRECT	>75%	MODERATE
		Socio-Economic activities	Change in local fish industry	LONG	SMALL	LOCAL	INDIRECT	< 25 %	INSIGINFICANT
	Operation of marine outfall	Seawater Quality	Reduced water quality due to effluent discharges	LONG	MODERATE	REGIONAL	DIRECT	> 75 %	MAJOR
		Terrestrial ecology and biodiversity	Loss of habitat, and clear or damage to vegetation	LONG	SMALL	LOCAL	DIRECT	25-75 %	MINOR
		Marine ecology and biodiversity	Loss of marine biota	LONG	MODERATE	REGIONAL	DIRECT	> 75 %	MAJOR
	Road operation	Air quality	Increased air emissions (dust, and exhaust emissions)	SHORT	SMALL	REGIONAL	DIRECT	25-75 %	MINOR
		Agriculture	Deposition of dust, sand particules and pollutants on crops	SHORT	SMALL	REGIONAL	INDIRECT	<25%	MINOR
		Terrestrial ecology and biodiversity	Loss of habitat, and clear or damage to vegetation	SHORT	SMALL	REGIONAL	DIRECT	25-75 %	MINOR
		Noise Pollution	Increased noise levels	SHORT	SMALL	LOCAL	DIRECT	> 75 %	MINOR
		Socio-Economic activities	Increase in trading	SHORT	SMALL	REGIONAL	DIRECT	> 75 %	POSITIVE
	Routine operation of Methanol transporters (Marine Traffic)	Air quality	Increased air emissions (exhaust emissions)	SHORT	SMALL	LOCAL	DIRECT	25-75 %	MINOR
		Seawater Quality	Re-suspension of bottom sediments	SHORT	SMALL	REGIONAL	DIRECT	25-75 %	MINOR
		Marine ecology and biodiversity	Loss of marine biota	SHORT	SMALL	REGIONAL	DIRECT	25-75 %	MINOR
		Noise Pollution	Increased noise levels	SHORT	SMALL	LOCAL	DIRECT	> 75 %	MINOR

Project Component	Aspect	VEC	Impact	Duration	Magnitude	Extent	Type	Probability	Significance
	Maintenance Dredging	Air quality	Increased air emissions (dust)	SHORT	SMALL	LOCAL	DIRECT	25-75 %	MINOR
		Seawater Quality	Increase overall water column turbidity and decrease water quality	SHORT	SMALL	REGIONAL	DIRECT	25-75 %	MINOR
		Marine ecology and biodiversity	Loss of marine biota	SHORT	SMALL	REGIONAL	DIRECT	25-75 %	MINOR
	Use of machinery and equipment	Air quality	Increased air emissions (exhaust emissions)	SHORT	SMALL	LOCAL	DIRECT	25-75 %	MINOR
		Agriculture	Deposition of dust, sand particules and pollutants on crops	SHORT	SMALL	REGIONAL	INDIRECT	<25%	MINOR
	Waste Disposal	Groundwater Quality	Release of contaminant	LONG	MODERATE	REGIONAL	DIRECT	< 25 %	MODERATE
		Topographic changes and visual impairment	Visual impacts due to use of unsustainable disposal methods	MODERATE	SMALL	LOCAL	DIRECT	> 75 %	MODERATE
		Terrestrial ecology and biodiversity	Loss of habitat, and clear or damage to vegetation	LONG	MODERATE	LOCAL	DIRECT	< 25 %	MINOR
ACCIDENTAL (NON-ROUTINE) EVENTS	Ship collision / accidents	Air quality	Increased air emissions	SHORT	SMALL	REGIONAL	DIRECT	25-75 %	MINOR
		Seawater Quality	Detrimental impacts to the surrounding water quality due to release of hydrocarbons and methanol	MODERATE	MODERATE	REGIONAL	DIRECT	> 75 %	MAJOR
		Marine ecology and biodiversity	Loss of marine biota	MODERATE	MODERATE	REGIONAL	DIRECT	> 75 %	MAJOR
		Community Health and Safety	Human injury and mortality	SHORT	GREAT	REGIONAL	DIRECT	25-75 %	MAJOR
	Fire and Explosion	Air quality	Increased air emissions	SHORT	GREAT	REGIONAL	DIRECT	25-75 %	MAJOR

Project Component	Aspect	VEC	Impact	Duration	Magnitude	Extent	Type	Probability	Significance
		Agriculture	Destruction of crops, Air and water pollution; Deposition of dust smoke and sand particles	MODERATE	MODERATE	REGIONAL	DIRECT	25-75%	MODERATE
		Noise Pollution	Increased noise levels	SHORT	SMALL	REGIONAL	DIRECT	> 75 %	MODERATE
		Terrestrial ecology and biodiversity	Loss oh habitat, and clear or damage to vegetation	SHORT	SMALL	REGIONAL	DIRECT	25-75 %	MINOR
		Community Health and Safety	Loss of life due to methanol explosion	SHORT	GREAT	REGIONAL	DIRECT	25-75 %	MAJOR
	Spills and Leaks	Seawater Quality	Detrimental impacts to the water quality due to spills of infilling material, off-specs effluents, etc.	SHORT	MODERATE	REGIONAL	DIRECT	25-75 %	MINOR
		Groundwater Quality	Groundwater contamination from surface discharge of liquid wastes	LONG	MODERATE	REGIONAL	DIRECT	< 25 %	MODERATE
		Freshwater Quality	Reduced freshwater quality	LONG	MODERATE	REGIONAL	DIRECT	< 25 %	MODERATE
		Topography and Landscape	Change in surface soil type, chemical composition or fertility.	SHORT	MODERATE	REGIONAL	DIRECT	25-75 %	MINOR
		Terrestrial ecology and biodiversity	Loss of habitat, and clear or damage to vegetation	SHORT	MODERATE	REGIONAL	DIRECT	25-75 %	MINOR
		Marine ecology and biodiversity	Loss of marine biota due to use of Anti-fouling paints, Loss of vessels' ballast water, etc.	SHORT	MODERATE	REGIONAL	DIRECT	25-75 %	MINOR
	Inappropriate waste disposal	Air Quality	Increased air emissions from waste open burning	SHORT	SMALL	REGIONAL	DIRECT	25-75 %	MINOR

Project Component	Aspect	VEC	Impact	Duration	Magnitude	Extent	Type	Probability	Significance
		Agriculture	Leakage; Spills Loss of land	SHORT	SMALL	LOCAL	DIRECT	<25%	MINOR
		Groundwater Quality	Leaching of waste into aquifer	LONG	MODERATE	REGIONAL	DIRECT	< 25 %	MODERATE
		Topography and Landscape	Visual impacts due to use of unsustainable disposal methods	MODERATE	SMALL	LOCAL	DIRECT	> 75 %	MODERATE
		Terrestrial ecology and biodiversity	Loss of marine biota	LONG	MODERATE	LOCAL	DIRECT	< 25 %	MINOR

7 PUBLIC PARTICIAPTION / HEARING

7.1 Executive Summary

As part of E-Methanex' continuous community involvement/consultation process, a first public consultation meeting was held on 16 May 2006 at the Center for Documentation of Cultural and Natural Heritage (CULTNAT) in the Smart Village, Cairo, Egypt to demonstrate the project, EMethanex commitment to the environment and to allow a forum for public comments and feedback. The project was presented to the audience with all its as built components. The audience had several clarifications on the project, which were all related to employment and environment.

The first public meeting was held in the Smart Village at "CULTNAT", where the public was invited to share a "Coffee Break" with EMethanex. The presentation and discussions took place for about 180 minutes. There were 20 people at the event including and not limited to EEAA representatives, NGO's, university professors, funded project representatives, EMethanex, ECHEM, and WorleyParsons Komex. The meeting was audio recorded in addition to a photographic record. A complete documentation of the event is available at EMethanex office. The list of attendees is presented in Appendix XIV.

The second public meeting was held on 8 June 2006 at El-Amal Club, Damietta City, Damietta Governorate. The second meeting was held in Damietta, where the public was invited to share a "Coffee Break" and "Lunch" with EMethanex. The presentation and discussions took place for about 4.5 hours. There were 84 people at the event including and not limited to EEAA representatives, NGO's, university professors, governmental officials, EMethanex, ECHEM, WorleyParsons Komex and local residents and the general public. The meeting was audio and video recorded in addition to photos. A complete documentation of the event is available at EMethanex office. The list of attendees is presented in Appendix XIV.

The attendees developed questions reflecting their interests and concerns and EMethanex responded to them. Hereunder is a list of the questions and answers raised at the end of the meeting.

7.2 Objective

The main objectives of inviting stakeholders was to:

- Update the public with the current status of the project;

- Demonstrate EMethanex' commitment to all stakeholders with respect to environmental and social issues.";
- Listen to public comments and concerns; and,
- Fulfil the lender requirements with regard to public access to information and public involvement in the decision-making process.

7.3 Methodology

7.3.1 Developing a Program

The meeting program was developed to fulfil the above mentioned objectives. The event program[27] was composed of:

- Registration.
- Welcome Speech.
- Introduction to EMethanex and Methanol Project.
- Discussions and Questions.

7.3.2 First Public Meeting Proceeding at CULTNAT

7.3.2.1 Introduction from CULTNAT

Dr. Hala Barakat, deputy director of CULTNAT, gave an introduction on services provided by the center and main products in the area of culture and natural heritage (website: www.cultnat.org).

7.3.2.2 Introduction from EMethanex

Mr. Goodyear, Technical Operations Manager – EMethanex, gave a background about Methanex worldwide, the joint venture between ECHEM and Methanex, and the methanol project to be developed by EMethanex. Mr. Goodyear also introduced Mr. Osama Kamal (ECHEM), Mr. Sherif Kamel (ECHEM), and Mr. Sadek El Kady (EMethanex).

[27] Program agenda.

7.3.2.3 Introduction from ECHEM

Mr. Osama Kamal, Vice chairman for planning & projects and member of the Board of Directors (ECHEM), gave an introduction about ECHEM which is one of the major four entities belonging to the ministry of petroleum. ECHEM has a master plan, which aims to produce 15 million tons of petrochemicals over 20 years. The plan consists of 3 phases, and the methanol project is one of the major projects of the first phase of the Master Plan. ECHEM is very selective in choosing its partners, from world leaders in all project aspects. Mr. Osama also referred to the expected public hearing event in Damietta, which is designed to take place within three weeks of this first meeting. He said that ECHEM will contribute in the event by a presentation and an annual report.

7.3.2.4 Background about the project and EMethanex environmental commitment

Mr. Goodyear, EMethanex, provided a detailed background on the proposed project. He stated that the intention is to build a world scale methanol site in the Damietta region, that will be designed for minimal impact on the environment. The EIA shall be made for two methanol plants (i.e. train 1 and 2). The long-term plan includes a third plant which may be introduced in the future based on market demand. Methanol will be exported to European markets and there is an opportunity of exporting to Pacific region through the Suez Canal. Mr. Goodyear also referred to other aspects of the project, such as using fresh water cooling and recycling the water onsite, the need for constructing a new jetty, and the number of workers during construction and operation.

Mr. Goodyear also emphasized the commitment of EMethanex to environmental protection, through Responsible Care. Responsible Care is an ethic that was adopted by Methanex in the early 1990's which seeks to minimize adverse effects on people, the environment and the community from the activities of the chemical industry. As a result of Methanex's performance of the last 15 years, a number of awards have been presented to the company as reported in Appendix IV. Mr. Goodyear highlighted the importance of community awareness, emergency response and constant feedback from neighbours, partners and key stakeholders, not only at the project public consultation stage, but throughout the life of the project. By keeping these performance standards high, and being very transparent in doing so, EMethanex aims to minimize the facility impact on people and the environment.

He also mentioned that feed natural gas is supplied through the grid, and that EMethanex is aiming to recycle and reuse material as much as possible, not only for economic reasons, but also to protect the environment.

7.3.2.5 EIA for the Proposed Project

Mr. Mohamed Hassan, Director –Middle East - WorleyParsons Komex, presented the procedures and methodology followed during the preparation of EIA for the proposed project.

Flare/expected emissions

Mr. Mohammed Hassan (WPK) and Mr. Goodyear referred to the flare designed for the proposed facility, which is a small flare (55 m height) that is only used as a safety device and is expected to be used less than 30 days per year. For most of that time, only a blue hydrogen flame visible only at night, is expected.

In continuation of the discussion about the flare, Mr. Goodyear and Mr. Osama Kamal (EMethanex) mentioned that there are differences in the process, materials, and emissions between the EMethanex methanol plant and any other LNG facility. EMethanex is using natural gas from the public network in all onsite activities. There are standby diesel generators, but they are normally shut down. He also mentioned that the process is a clean one.

Expected use of the jetty

The Methanol facility expects 4 to 6 ships per month (very low utilization of the jetty) which is not a huge traffic load on the Port.

Site selection and preliminary EIA

Mr. Mohamed Hassan (WPK) referred to the evaluation of 4 proposed sites from ECHEM in order to select the most economical and environmental feasible site. Damietta Port was chosen as the most feasible and environmentally suitable of the 4 sites. He also referred to the preliminary EIA, which consisted of highlighting the valued components and assessing the sensitivity of the area.

EIA preparation for the proposed facility

Mr. Mohamed Hassan (WPK) referred to the different steps of the EIA preparation, starting with the data collection and review, the site visits, legislation, etc.

ECHEM's HSE standards

Mr. Sherif Kamel (ECHEM) referred to the importance of including ECHEM's HSE standards, as part of the "Legislation and Regulatory Framework" section.

Project site alternatives

An open conversation was initiated about the methodology followed during the evaluation of the project site alternatives. Mr. Mahmoud Shawky (EEAA) emphasized the importance of mentioning the site selection in the alternatives section of the EIA and presenting an air quality monitoring program in the EIA report. Mr. Osama emphasized that the flare is only used in the EMethanex project as a safety device, and that the process is a clean one. Mr. Goodyear also mentioned that there is no expected waste of gas.

EIA for the whole area of the Port

Mr. Sherif Bahaa El Din, Natural Conservation Expert, raised a question regarding if the Damietta Port has developed an EIA for the whole area. Mr. Mahmoud Shawky and Mr. Mohamed Abdullah (EEAA) had identified that they have asked Damietta Port Authority to provide this EIA, but until now there is no strategic EIA for the Port; however, there are EIAs for individual activities in the Port.

Mr. Osama (ECHEM) mentioned that he believes there must be a study for the environmental impacts of the harbour on the location. Mr. Mahmoud Shawky and Mr. Mohamed Abdullah (EEAA) said "may be". Emphasis was made in the conversation on the importance of an EIA for the whole Port. Mr. Goodyear mentioned that WPK is already making an Environmental Cumulative Impact Assessment (ECIA) as part of the EIA.

EIA baseline assessment

Mr. Mohamed Hassan (WPK) continued the presentation of the EIA. He mentioned the baseline assessments conducted for ecosystem components (groundwater, soil, seawater, seabed sediment, fresh water intake, sediments from the intake, noise, air assessments, and terrestrial surveys).

Interactive dialogue between WPK and the FEED/EPC contractors

Mr. Osama (ECHEM) requested from Mr. Mohamed Hassan (WPK) to present to the audience an example for the interactive dialogue between WPK and the FEED/EPC contractors in addition to the challenges and if any changes were made to the original design of the facility, based on WPK environmental consultancy.

Mr. Mohamed Hassan (WPK) mentioned that some of the challenges WPK faced were the water intake route, and the outfall. WPK cooperated with the Engineering for the Petroleum & Process Industries (ENPPI) for the assessment of alternatives for both routes.

Mr. Goodyear also highlighted that the flare location in the original design was changed in cooperation with the FEED contractor. Based on environmental considerations, the flare was moved to a new location, in the middle of the site. He also mentioned that interaction with the contractors has been conducted for the outfall design as early stated.

Conclusion: This is not a theoretical environmental study. It is actually an interactive one, between environmentalists and project designers.

Project alternatives

The conversation continued on the project alternatives. WPK and EMethanex representatives mentioned that the project alternatives were studied in terms of site location, process, outfall, cooling water, etc. For example, the cooling water alternatives were seawater or freshwater from the River Nile. The evaluation of the alternatives resulted in freshwater being chosen because of the lower impact on the environment and a better quality of effluent being discharged from the facility.

Fresh water intake

Dr. Hala Barakat, CULTNAT, asked if EMethanex are going to pay for the water.

Mr. Osama (ECHEM) answered that annual fees will be paid for the water. He also mentioned that the design of the water intake was approved and monitored by the ministry of water resources. The system includes pumping water at a rate of 600m^3/hr, and the water is further recycled to the sea.

A conversation was held on the expected temperature of this water upon recycling to the Sea. Mr. Goodyear mentioned that regulatory limits of temperature variation shall not be exceeded by any means. Mr. Mohamed Hassan (WPK) mentioned that a thermal dispersion model was conducted, which showed that outfall should be compliant with permissible limits. Mr. Osama added that keeping the temperature variation to a minimal value is a major tool to maintain the efficiency of the cooling system.

Mr. Mohamed Hassan (WPK) further continued the introduction about the impacts evaluation, mitigation measures, management plan, and environmental monitoring during construction and operation.

7.3.2.6 Open Discussions

Transportation of equipment

Mr. Goodyear also mentioned that another challenge is the transportation of equipment through the Port to the project site, which would lead to a certain increase in traffic at the Port. Fortunately, the project was granted the approval to the project to bring the equipment by ships straight onto the jetty and further to site, and therefore this transportation is done with minimal impacts.

Recommendation for the Public hearing event

Mr. Goodyear highlighted the importance of inviting representatives from NGOs in Damietta to the public hearing event. Mr. Mohamed Hassan mentioned that we are aiming for maximum attendance in this meeting. He also mentioned that EEAA representatives from Mansoura region will also be invited to attend this meeting. Mr. Mahmoud Shawky and Mr. Mohamed Abdullah (EEAA) emphasized the importance of inviting representatives from New Damietta City and from Damietta Governorate.

Baseline data

Dr. Ameer Abdullah (Global Marine Programme) highlighted the importance of the availability of baseline data. Mr. Mohamed Hassan (WPK) mentioned that the data will be published in the EIA report, which will be available with the EEAA.

Mitigation of potential impacts

Dr. Ameer Abdullah recommended the use of an "offsetting impact" concept. He also highlighted the importance of studying the area biodiversity as well as conducting a social impact assessment. Dr. Sherif Bahaa El Din highlighted that offsetting impacts is a mitigation measure that may be adopted by companies to achieve a goal of zero impact. Offsetting is achieved by protecting the environment from a similar impact or resolving a similar environmental issue in another area. Mr. Osama (ECHEM) stated that environment requirements were taken into consideration during the design period in order to minimise the project's potential impacts. Mr. Goodyear highlighted that even after the completion of the EIA and taking into consideration all necessary environmental measures, continuous environmental work will be done to further control and minimise project impacts.

Recommendation for the Public hearing event

Mr. Mahmoud Shawky highlighted the importance of conducting the presentation and discussion in the public hearing event in Arabic language.

Cumulative impacts in Damietta

Mr. Mahmoud Shawky mentioned that the number of petrochemical and fertilizer facilities is increasing in Damietta, which may lead to cumulative adverse impacts on the environment. A discussion was made about the importance of conducting a strategic EIA for the whole port area. Mr. Mohamed Hassan (WPK) mentioned that environmental monitoring is done by each facility on its own. It is highly recommended that each facility conducts serious and correct monitoring.

Project Phases and the EIA

Mr. Mahmoud Shawky mentioned that the EIA studies two phases of the Methanol project, which are expected to be implemented in 2009 and 2015. He highlighted that an EIA should be conducted for the second phase of the project, after the implementation of the first phase. Mr. Osama (ECHEM) mentioned that the present EIA does not substitute the study that will be conducted for the second phase of the project. He highlighted that, by studying both phases in the present EIA, we are being more conservative and more stringent environmental conditions are being applied.

Conversation with EEAA representatives

Mr. Mahmoud Shawky asked if there is a storage tank for the natural gas. Mr. Osama, replied that there is no storage tank for the natural gas.

Mr. Mahmoud Shawky mentioned that Methanol is flammable, and therefore a quantitative risk assessment is needed. Mr. Osama mentioned that the hazardous operations risk assessment was already prepared during the design period. He also mentioned that safety and environmental considerations are strictly taken into account, even if they are only applied for routine testing.
Mr. Mahmoud Shawky asked if there is a heat recovery system. Mr. Osama mentioned that there is a material and heat balance for the process and no energy loss is allowed through the process.

Mr. Mahmoud Shawky asked: what is the percentage of gas burned. Mr. Goodyear answered that it is 15-20% for steam producing, as fuel gas, and not as process gas.

Mr. Mahmoud Shawky asked about the hazardous wastes, catalysts and the type of natural gas used. Mr. Mohamed Hassan (WPK) mentioned that the EIA will cover the management of hazardous waste. Wastes such as catalysts will be returned to suppliers for recovery of metals.

Mr. Osama mentioned that the natural gas used is 97% methane and 3% ethane. He highlighted that the process is different from the liquefaction of natural gas. The gas used by the methanol project is a purified one, which is mainly free from water, sulphur, and CO_2. It is a dry, clean gas.

Mr. Mohamed Abdullah asked about the use of the desulphurization and dehydration units. Mr. Osama mentioned that the desulphurization unit is used just for the protection of the process catalyst, by removing any traces of suplhur that may be remaining in the feed gas after purification. The same applies for Mercury, which is not allowed in the process network, if with trace concentrations. The dehydration unit is downstream of the process, and it is used for producing AA quality methanol.

Recommendation for public consultation

Mr. Amr Reda Orensa, Sahara Safari NGO, mentioned that he lives in New Damietta. He mentioned that that projects need to be introduced to the public through questionnaires, and that more public participation is needed.

Expatriates in Damietta

Mr. Amr Reda Orensa, Sahara Safari NGO, also highlighted that the number of expatriates in New Damietta has increased, thus leading to changes in culture. However, he also mentioned that these changes in culture have been positive changes.

Mr. Osama mentioned that expatriates are released from the project site location after the project implementation is completed and after performance tests are conducted, and that only representatives of shareholders would stay at the site. He also mentioned that such international cooperation is beneficial to the Egyptian market. Through such cooperation and international relations, Egyptian companies obtained more chances to start implementing projects in other countries.

Local employment

About the employment of local personnel from Damietta, Mr. Osama mentioned that local personnel employed are used during construction, which is certainly beneficial for Damietta. Mr. Osama and Mr. Mohamed Hassan (WPK) mentioned that during operation, personnel may or may not be from Damietta, based on the qualifications and training needed for the particular process.

Public and social part in Damietta

Mr. Osama mentioned that the public hearing event in Damietta shall include a focus on the ECHEM's social and national consideration considerations.

Mr. Mohamed Hassan (WPK) referred to the public hearing event that was conducted by WorleyParsons Komex at the SEGAS LNG site in Damietta. He also referred to the fact that the introduction of new industries and projects has lead to positive economic impacts in Damietta.

Offsetting of potential impacts

Mr. Mahmoud Shawky recommended the consideration of offsetting potential impacts, which is also a recommendation made by the World Bank to the EEAA. He mentioned that the only privilege of the Damietta Port site is its proximity to the production sites of natural gas. Mr. Mohamed Hassan (WPK) and Mr. Ihab El Sersy (WPK) mentioned that the site selection was mainly based on environmental criteria, and not only on financial considerations.

Site considerations

Mr. Mahmoud Shawky mentioned that the environment in Damietta is loaded with enough industries and is less capable to absorb more of them.

Sampling considerations

Dr. Ameer Abdullah emphasized the importance of monitoring sites before and after the project's implementation in addition to making control stations that are less expected to be affected by the project. He referred to the implementation of sampling procedures in Australia and the USA as the best practices. Mr. Goodyear mentioned that monitoring with continue throughout the lifetime of the project.

Cumulative impacts

Mr. Ameer made another reference to the cumulative impacts in Damietta. Mr. Goodyear emphasized EMethanex' commitment to the environment.

Dr. Sherif Bahaa El Din asked if Damietta Port Authority (DPA) have an environmental department. Mr. Mohamed Hassan (WPK) mentioned that we submit the EIAs to DPA, which in turn sends them to the EEAA. DPA is considered as the Competent Administrative Authority (CAA). Dr. Sherif Bahaa El Din mentioned that we need to see the whole picture in Damietta, through a comprehensive EIA, and that DPA should control the environmental impacts of projects in Damietta. Mr. Mohamed Hassan (WPK) mentioned that each facility needs to do its monitoring homework, and DPA should further gather the monitoring results from individual facilities, in a comprehensive database.

Dr. Sherif Bahaa El Din recommended that comprehensive study to be done by EMethanex. Mr. Goodyear answered that Methanex has already done this in Australia but this is not the case in Damietta.

Mr. Mahmoud Shawky mentioned that Damietta and Sokhna Ports were not designed for such extensive industries, and that the EEAA has asked for a strategic EIA for these areas.

Dr. Sherif Bahaa El Din mentioned that the strategic EIA for Damietta Port should be requested from the Damietta Port Authority.

7.3.3 Second Public Meeting Proceeding at Damietta

7.3.3.1 Opening

Mr. Hamed Farrag (Director – Environmental Department – Damietta Governorate) spoke on behalf of the Damietta Governor and gave an introduction about the public consultation and its importance. In addition he explained the governor's and the government's efforts to improve the investment map of Damietta. He explained the industrial development including the Port and the free zones. He highlighted the project and its components with a preface and slight explanation of the EIA. Encouraging the attendees to participate and contribute, Mr. Farrag explained the benefits of the project for Damietta. He also indicated the plans of the government in establishing an environmental monitoring station to ensure Environment and sustainable development.

7.3.3.2 Introduction to ECHEM

On behalf of Mr. Osama Kamal, CEO of ECHEM, Mr. Khaled gave an introduction about the Holding company. He explained the activities of the company including different affiliates, budgets and planning. In his presentation Mr. Khaled explained ECHEM's HSE policy and priorities. Mr. Khaled explained that the methanol plant will generate a series of income and direct and indirect benefits to Damietta's local community besides the National benefits. This would include almost US$ 7 billion as a national yearly income and an average of one million Egyptian pounds pumped daily into the Damietta local market. It also includes the involvement of almost 65 other industries and services.

7.3.3.3 Background about the project and EMethanex Environmental Commitment

Mr. Goodyear (EMethanex) presented the background to Methanex, the joint venture between ECHEM and Methanex, and an introduction about the Methanol project. Mr. Goodyear explained the company's policy towards HSE and invited Mr. Sadek El Kadi to make a presentation in Arabic. Mr. Goodyear highlighted the importance of the contribution and participation of local community (including NGOs) of Damietta to the public discussions and expresses all their views. Mr. Kadi gave an introduction about Methanex worldwide and about the project and its components in Arabic.

Mr. Goodyear Goodyear (EMethanex) continued his background on the project. He said that the intention is to build a world class methanol plant in the Damietta region having minimal impact on the environment. The EIA shall be made for two methanol plants. The long term plan includes a third plant which may be introduced in the future. Methanol will be exported to European markets and there is an opportunity of exporting to ports in the Pacific region through the Suez Canal. Mr. Goodyear also referred to other aspects of the project, such as using fresh water cooling and recycling the water onsite, the need for a new jetty, and the number of workers during construction and operation.

Mr. Goodyear also emphasized the commitment of EMethanex to environmental protection, through Responsible Care. Responsible Care is an ethic that was adopted by Methanex in the early 1990's which seeks to minimize adverse effects on people, the environment and the community from the activities of the chemical industry. As a result of Methanex's performance of the last 15 years, a number of awards have been presented to the company as reported in Appendix IV. Mr. Goodyear highlighted the importance of community awareness, emergency response and constant feedback from neighbours, partners and key stakeholders, not only at the project public consultation stage, but throughout the life of the project. By keeping these performance standards high, and being very transparent in doing so, EMethanex aims to minimize the facility impact on people and the environment."

7.3.3.4 EIA Process for the Proposed Project

Mr. Mohamed Hassan (WPK) gave an introduction about the EIA for the proposed project. He referred to the site selection (4 sites). Damietta Port was chosen as the most feasible and environmentally suitable of the 4 sites. He also referred to the preliminary EIA, which consisted in highlighting the valued components and studying the sensitivity of the area.

Project site alternatives

A conversation was held about the project site alternatives. Mr. Mohamed Abdel Allah (EEAA) emphasized the importance of including the site selection in the alternatives section of the EIA. Mr. Khaled (ECHEM) emphasized that the flare is only used in the EMethanex project as a safety device, and that the process is a clean one. Mr. Goodyear also mentioned that there is no expected waste of gas.

EIA preparation for the proposed facility

Mr. Mohamed Hassan (WPK) referred to the different steps of the EIA preparation, starting with the data collection and review, the site visits, legislation, etc. He mentioned the baseline assessments conducted for valued ecosystem components (groundwater, soil, seawater, seabed sediment, and fresh water intake, sediments from the intake, noise, air assessments, and terrestrial surveys).

Expected use of the jetty

Mr. Goodyear mentioned that we are expecting 4 to 6 ships per month (very low utilization of the jetty), which is not a huge traffic load on the Port. Mr. Goodyear further continued his introduction about the industry process. He also mentioned that feed gas (clean gas) is obtained from the grid, and that EMethanex is aiming to recycle and reuse material as much as possible, not only for economic reasons, but also to protect the environment.

7.3.3.5 Open Discussions

Making the results public

Mr. Ahmed Labib (Director, Environmental Dept., Damietta electricity) said the company should make all statistics and results of the study public to ensure trust between the company and the local community. He also highlighted that the area is very close to an important summer touristic resort (Ras El-Barr city) and this should be taken into consideration when coming to the marine outfall. Mr. Hassan (WPK) said all results would be available for the public on Methanex website once the EIA is prepared. He also added that we are complying with all international and national environmental regulations and in particular for marine outfall.

Positive sides and worries for the neighbouring beaches

Mr. Mohamed El-Shehabi (Director, Housing) praised the fact that the facility will be self-sufficient in regards to energy production and water consumption, which means no pressure on public utilities, which is a positive side. He emphasized on the security and cleanliness in regards to neighbouring swimming beaches especially Ras El-Barr resort. He wishes that this is being taken into consideration. Also this should apply for noise aspects.

Flare/expected emissions

Mr. El-Shehabi also expressed his worries about gas emissions and to what extent its effect could go, and what is the safety distance for closest residential areas Mr. Goodyear referred to the flare designed for the proposed facility, which is a small flare (55 m height) that is only used as a safety device and is expected to be used less than 30 days per year. For most of that time, only a blue hydrogen flame visible only at night, is expected.. Mr. Goodyear explained that there will be mostly water vapour with few combustion exhaust gas (CO_2, CO and some NO_x) but under allowed limits. Mr. Mohamed Hassan (WPK) added that there are no human activities without impacts, but that the difference is how the impact is moderated and treated to minimise its effects to minimum allowable limits. He added that the all the activities of this project are controlled and monitored to ensure that no significant harmful effect is made to local environment.

In continuation of the discussion about the flare, Mr. Goodyear (EMethanex) mentioned that EMethanex is using clean gas in all onsite activities. There are standby diesel generators, but they are normally shut down. He also mentioned that the process is completely clean and used technology is the most up-to-date used in the world. Mr. Khaled (ECHEM) and Mr. M. Hassan (WPK) together indicated that all impacts have been thoroughly studied and mathematical dispersion models have been made for appropriate impacts and that all mitigation measures have been taken into consideration and integrated into the internal design of the facility.

Environmental carrying capacity

Mr. Adel Mossa'ad (EEAA - Eastern Delta RBO) pointed at the issue of the environmental carrying capacity of the area and whether it can host such a project and what is the capacity or the share of that project to it. He also said that Egypt is a member in convention and treaties on Mediterranean conservation, as this facility will be directly contacting the Mediterranean what is then the contribution and the company trends towards Carbon trading.

Mr. Goodyear Goodyear answered that the company's emissions are very minor compare to other petrochemical production facilities. All gas emissions are restricted to steam, CO_2 and minor amount of CO in addition to very low level of NO_X. He assured that all emissions are under the allowed levels and that in addition to the fact that the technology used for Methanol production in this proposed facility is based on the desulphurisation of the Natural gas before it is processed. This means that no SO_x are expected to be emitted during throughout any phase of the process.

Benefits for Damietta

Dr, Kawthar Rizk, (Psychiatrist – Mansoura Univ.) said that Damietta is an investment attracting area, which is directly linked to the well being of the local community. She wanted to know the objective of this meeting. Whether it is for familiarizing the local community and appease the fears or is it for getting a public endorsement of studies and policies that has been made for other environmental realities other than ours. She added that there is a high rate of cancer and kidneys disease that has no other source but industrial pollution. She indicated also that it is not clear what the direct benefits are for Damietta local community and whether employment is one of it. She wishes that the negative impacts and aspect of the proposed project be exposed transparently in a very easy language that the layman can understand.

Mr. M. Hassan (WPK) said that simply this public hearing is an obligation set by the law for all developers willing to establish any industrial activities. The objective of this session is to make the project known to all stakeholders and building bridges of transparency and trust between the company and the local community. It is also for gathering the views of all stakeholders to integrate and consider during different phases of development of the project including the internal design.

Mr. Khaled (ECHEM) added that apart from the national benefits Egypt would gain from this project, the local labor and trade market of Damietta is the main beneficiary. He explained that at least 65 different industries and services are involved during different phases of the project from construction to operation. At least 1 500 workers will be involved in the construction and 150 in the operation. An average of one million Egyptian pounds will be pumped on daily basis into the local market through different activities.

Mr. Goodyear (EMethanex) explained that the company's policy is to fully involve the local community during all the life time of the project in a way that assures the mutual benefits between all stakeholders. This includes the commitment of the company in financing environmental projects or sponsoring educational programmes. Mr. Goodyear assured the full commitment of the company towards the local community and different sorts of social development efforts.

Previous negative experience

Mr. Mohamed El-Ezaby pointed at the previous negative experiences with other industrial developers with hollow promises. He recommends a compulsory protocol of employment to be issued between the developers and governorate to ensure the employment of local adequate capacities. He also recommended that the companies (industrial developers) in Damietta contribute to finance an environmental monitoring agency in Damietta to monitor and control cumulative pollution.

Mr. Goodyear (EMethanex) indicated that the company's economic interest is to hire local adequate labor and that this would happen during the construction phase. He added that during the operation priority would be given to local capacity depending on the adequacy to required positions.

Mr. Khaled (ECHEM) added that there will be indirect employment in services and industries related to the construction and the operation phases of the project. This could be noted in real estate, security, construction…etc.

Technology and facility ages

Mr. Zinhoum Masseoud (Director HSE - local labor/Employment agency) asked about the age of the facility units of production and the age of the technology, whether it is a brand new factory or is it transferred machineries. He also wanted to know how modern the used technology would be. He also wishes to learn more about the schematic design of the facility as no SO_x is expected to be emitted. He also referred to safe limits of pollution and to cumulative impact, limits and levels of cooperation between different neighboring industrial facilities in the area. As for employment, Mr. Masseoud said that in Damietta all the necessary capacities exist and all the developer should do is to contact the Labor/employment agency and the latter shall provide list with names and capacities even more than expected. He also recommended on emphasizing HSE programmes and all its components to assure its effectiveness.

Mr. Khaled (ECHEM) and Mr. M. Hassan (WPK) assured that the technology is the latest in this field and that the facility's machinery is the brand new that has never been used before.

Mr. Goodyear (Methanex) showed the schematic design of the facility and gave examples from other similar Methanex facilities around the world. He also assured on the Responsible Care programme that includes a very strong HSE policy. He also welcomed the initiative of employment of local labor as long as it will respond to the facility's technical requirements.

Water use

Ms. Aziza Abu Sabralah (Member of local council) recommended that the facility instead of using the freshwater from the Nile should establish a water treatment station to recycle agricultural and domestic waste water from the area.

Mr. Goodyear (Methanex) responded that the amount used from freshwater will be provided to the project through the ministry of water resources and irrigation (already approved). He also added that the cost of establishing and operating a water treatment station is very high and cannot be included in the project budget by any means.

Marine pollution

Dr. Mamdouh Salem (Faculty of Science – Mansoura Univ.) pointed out to the heavy load of chemical pollution to be added to the Mediterranean which is a point to be considered. The same applies, according to him, for the greenhouse effect that is now felt even on Damietta beach. This leads to a recommendation of assuring all environmental consideration and guarantees.

EA for the whole area of the Port

Mr. Mukhtar Al-Bheiry mentioned that the area of the Port needs a comprehensive EA and that the area of Palms has to be taken into consideration and study all impacts affecting its well being.

7.3.3.6 Conclusion

Mr. Farrag (Director Environment Dept. Damietta Governorate) summarized all contribution, views, questions and recommendations and suggestions of the public as well as commitments, views and clarifications of the project developer(s) (EMethanex & ECHEM) and the environmental consultant (WPK). Most of the public's contributions were around the worries related to pollution hazards and direct and indirect negative effects on Damietta local community.

Also, the attendees expressed curiosity for knowing the direct and indirect benefits Damietta would gain from the existence of such a project. The developer(s) explained their view and responsibility as well as full commitment towards environmental issues related to the proposed project, in addition to full readiness in participating to efforts made by local communities (groups) in favour of socio-economic sustainable development.

8 MITIGATION PLAN

This section recommends detailed mitigation procedures to be considered by EMethanex and its contractors in order to address those potential impacts identified as being Class 1 (significant, major impact) or Class 2 (significant, moderate impact). The primary goal of the mitigation and Environmental Management Plan (EMP) is to reduce the impact to an acceptable level (Class 3 or greater) for all of the project aspects.

Consideration of construction and operational design and site restoration, rehabilitation and aftercare requirements should be addressed during the planning phase of any operation or project. Careful planning will help avoid difficulties when the activities are finished and demobilization from the area takes place. Appropriate design and preparation can ensure that future liability related to the site is kept to a minimum. The underlying principle is the management of the land and community as an asset.

This section presents a summary of recommended mitigation measures divided into the five VEC categories (water, air and climate, land, ecology and biodiversity, and human environment) that have been referred to throughout this document.

8.1 WATER

8.1.1 Groundwater

The following measures are recommended to prevent groundwater contamination during the construction phase of the Methanol Plant:

- Release of any materials that may contaminate groundwater must be prevented.
- Subsurface pipes [such as water intake pipeline (wherever present)] should be adequately maintained so that leakage into surrounding natural ground is prevented.
- Concrete slabs should be free of any chemicals or additives that might leach out and affect ground water quality.
- The project must have regular site inspections and apply spill and pollution prevention procedures for handling and storage of materials and containers.
- Piling and foundations should be constructed so that they do not create a vertical pathway into deep strata that may be used for groundwater abstraction.
- All containers will be clearly and adequately labelled to identify the contents .
- A project spill response plan should be in place that includes the placement of emergency spill kits in storage areas.

- Spills should be contained or absorbed to prevent ground and groundwater contamination.
- Ensure that the linings of the first flash and the storm water catch ponds are intact, and undamaged after routine removal of solids.

The following measures are recommended to prevent groundwater contamination during the operational phase of the Methanol Plant:

- Adequate spill prevention and protection should to be applied where no concrete slabs or lining exist, to prevent leaching to groundwater.
- Solid wastes from the facility should be removed and properly disposed regularly.
- All storage tanks should be above ground and in bunds with impervious liners.
- Chemical storage tanks (caustic soda and sulphuric acid) will be curbed for spill containment.
- Emergency spill response kits will be readily available to reduce impacts to groundwater.
- Personal protective equipment will be readily available to reduce impacts to human health.
- All wastes should be regularly disposed in an environmentally sound manner.
- Subsurface pipes should be adequately maintained so that leakage is prevented.
- All containers will be clearly and adequately labelled to identify the contents .
- Ensure that concrete structures in all the facility are intact.

8.1.2 Surface Water (Freshwater)

The following measures are recommended to prevent surface water contamination from discharges to the Nile River (freshwater intake) during construction and operation phases:

- In general, surface water (Nile water) should be viewed as a valuable resource in all areas, and its preservation should be allocated the highest priority.
- All activities should prevent the release of any contaminant that might enter the surface water.
- Adequate emergency spill response should be in place.
- Good housekeeping should be practiced during construction to avoid spreading litter and wastes from human/construction activities.
- Online analysers should be installed to monitor quality of the raw water return, particularly for chlorine. If quality does not meet specifications the flow must be stopped and pumped back to a collection facility for further treatment or removal for off-site disposal.

8.1.3 Seawater

The following measures are recommended to prevent seawater contamination during the construction and operation phases of the Methanol Plant:

- Good housekeeping should be practiced during construction to avoid spreading litter and wastes from human/construction activities.
- Specific refueling areas should be designated, and appropriate secondary containment and / or spill kits should be located at each one.
- All containers should be clearly and adequately labeled to identify the contents .
- Regular site inspection needs to be conducted to prevent and minimize unexpected releases.
- Adequate materials management procedures must be implemented for handling and storage of materials and containers to prevent and minimize spills or leaks.
- Operating procedures should be in place for all operational activities, identifying specific training, checking and review on a regular basis.
- Contingency plans and emergency procedures should be available to respond to any accidental spills where runoff may enter the marine environment. These must be coordinated with Port procedures and national systems for responding promptly and effectively to potential polluting incidents.
- Transfer lines should be routinely serviced.

The following measures are recommended to prevent seawater contamination from routine discharges to the sea (outfall):

- Dredging techniques and dredgers which cause minimal disturbances (i.e. minimal re-suspension of sediments) must be used.
- Dredging works should be limited, as much as possible to the specific area to be dredged, to eliminate/minimise destruction of habitat. The quality of dredged spoil should be checked prior to off-shore disposal or reuse.
- The oil-contaminated water drain system flows to a collection sump where oil is separated via weirs. The collected oil shall be removed regularly to prevent overflow and disposed in an environmentally acceptable manner.
- Process wastewater intended for treatment is routed to a wastewater pond and then fed to the treatment package to remove the organics. The treated effluent from the waste water treatment package is transferred to the storm water catch pond. Online analysers check the stream for pH, conductivity, and total organic carbon. If the quality of the discharge does not comply with permitted limits, it will be held in one of the catch basins and either recycled for re-treatment or removed for off-site disposal.

- Wastewater treatment plant operators should be highly trained and a site specific Operation and Maintenance Manual for the wastewater facilities should be written to minimise the likelihood of sub-standard operation of the treatment plant .
- Domestic waste (sewer) is transferred via lift pumps from the control room and administration building to the sewerage treatment package. Treated water exiting the package pumped to the storm water catch pond via treated waste water pumps.
- Small amounts of methanol, if present, are removed in the first flush pond by sparging with plant air. If higher concentrations of methanol or other hydrocarbons are present, the content of the first flush pond are transferred at a controlled rate to the waste water pond for treatment in the waste water treatment package.
- Rainfall is collected in rainwater sumps and transferred to the storm water catch pond.
- Blow down from the cooling water tower is sent to the storm water catch pond.
- The storm water catch pond serves as a final check and release point prior to the marine outfall. Online analysers monitor the water for temperature, pH, conductivity, and total organic carbon. If the stream meets permitted effluent limits, it is pumped to the outfall. If it is non-compliant, the inlet flow is switched and pumped back to the first flush pond for further treatment or removal for off-site disposal.
- Thermal dispersion modelling was performed for the project as part of the EIA process. The results predict that the temperature of the effluent plume will cool rapidly. The model also predicts that there will be little seasonal or depth variation in the temperature and path of the effluent plume.
- Contingency plans should be available to respond to, contain and/or recover accidental spills in the shortest possible duration.

The following measures are recommended to prevent seawater contamination from the dredging at Methanol loading terminal (ship loading):

- To accommodate the Methanol transporters, a new loading jetty must be constructed. This requires a shoreline protection scheme to mitigate future erosion within the Port and protect against higher than average wave heights. The protection on the lower shore will be sufficient to resist the forces of the passage of shipping and the effects of propeller wash during manoeuvring.
- During the dredging phases, sediments will become re-suspended. To reduce the impacts on water quality, silt curtains should be implemented to confine the area of influence if sediment plumes are observed to move laterally within the Port.
- If sediments are found to be contaminated with hydrocarbons, high bacterial content or heavy metals, dredging works should stop and silt curtains implemented to reduce the area of influence. If bacterial concentrations of the sediments are high, the oxygen content of the water should be monitored during the dredging activity to ensure that anoxia of the water column does not occur.

- The methanol slops receiver and methanol slops load-out pump are provided to gather methanol-containing drains from the ship loading areas and vapour recovery system. These are pumped back to the crude/off-specification methanol tank.
- Contingency plans should be in place to respond to ship accidents which could cause hydrocarbons spills and/or loss of Methanol. Emergency response capability, response equipment and personnel should be available.

The following management and control measures are recommended to prevent seawater degradation by transfer of harmful organisms from ships:

- The uptake of organisms during ballasting can be minimized by avoiding areas where populations of harmful organisms are known to occur.
- Regular cleaning of ballast tanks and removal of muds and sludges which may harbour harmful organisms should be carried out.
- Avoiding unnecessary ballast discharge.
- Undertaking ballast management procedures, including:
  - Exchanging ballast water at sea and replacing it with 'clean' open ocean water. Marine species taken at the source port are less likely to survive in the open ocean;
  - Non-release of ballast water in confined Port locations; and
  - Ballast discharge to onshore reception and treatment facilities (when available).

The following management and control measures are recommended to prevent seawater degradation by sewage from ships:

- Regulations in Annex IV of MARPOL 73/78 prohibit ships from discharging sewage within four miles of the nearest land, unless they operate an approved treatment plant. Therefore, all ships should have sewage treatment plants to prevent this source of sewage pollution.
- Governments are required to ensure the provision of adequate sewage reception facilities at ports and terminals.

The following management and control measures are recommended to prevent seawater pollution by marine traffic:

- The vessels must be fully compliant with the International Maritime Organisation's protocol, the Oil Pollution Convention, the Convention on the Dumping of Wastes at Sea, Convention for the Prevention of Pollution from Ships, SOLAS, MARPOL (IBC and BCH Codes if applicable), Prevention of Air Pollution from Ships, and the Convention on Oil Pollution Preparedness, Response and Co-operation. There is a ban on plastic dumping to sea. Records of all garbage must be kept and reported, and a ship garbage management plan must be in place.

- Valid international certification must be carried, which may be presented as evidence that the ship complies with the Convention for the Prevention of Pollution from Ships.
- A HSE audit (undertaken by an approved contractor) should be conducted on the vessels prior to use, to ensure that all international regulations and procedures are followed.
- All ships must have an emergency response plan specific for the transport of Methanol. This plan must be co-ordinated with national systems for responding promptly and effectively to pollution incidents.
- Within the port of Damietta an emergency response plan must be established to respond to an event of Methanol spillage, leak or explosion. Neighbouring facilities should also be made aware of the procedures.

8.2 AIR AND CLIMATE

The following management and control measures are recommended to prevent air and climate pollution during construction phase:

- Comply with the requirements of the Egyptian Environmental Law for exhaust emissions from equipment and vehicles.
- Minimise unnecessary journeys and adopt a policy of switching off machinery and equipment when not in use.
- Air Pollution Control (Construction Dust) Regulation should be adopted by the site EPC contractor while carrying out construction works.
- Dust suppression should be undertaken where necessary by spraying affected land surfaces with water and/or covering.
- Vehicle movements should be kept to a minimum and hard cover areas for vehicle movements should be used where possible.
- Vehicle speed restrictions will be applied on internal roads across the project site to prevent collisions and other accidents.
- All vehicles carrying demolition waste should be covered to prevent spread of dust, demolition material, etc.
- Burning in open air shall be prohibited
- When consistent with safe operating practices, daytime work are encouraged to avoid night-time lighting.
- As part of the purchasing procedures choose machinery, equipment, vehicles and materials that have the lowest CO_2 emissions possible.
- Choose energy sources/fuels for equipment that produce the least amount of CO_2 emissions.
- Consider purchasing low energy products where available

- Consider purchasing carbon credits to off-set carbon generation, with a goal of achieving carbon neutrality.

The following management and control measures are recommended to prevent air and climate pollution during the operational phase:

- Air emissions from point sources shall meet all the national and international standards identified in section 2 of this report.
- Dry gas compressor seals will be used where there is proven experience in their operation.
- All methanol storage tanks shall be equipped with an internal floating roof and blanketed with nitrogen to mitigate VOC emissions .
- Methanol ships' tanks are provided with a vapour recovery system to reduce methanol emissions from ship and truck loading. Under normal conditions, vapour will be recovered via this system.
- Regular monitoring and maintenance of all equipment, generators, and flares will occur as part of the environmental monitoring plan. This would ensure that any emission exceedance is noticed, then mitigation measures can be put in place until the appropriate criteria are met. Mitigation could include process shut down.
- Besides point source monitoring, air quality monitoring will be carried out in specific locations (selected in accordance with the dispersion model).
- Stack sampling nozzles should be provided from all point air emissions where stack design allows for iso-kinetic sampling, except for flares.
- Tanks and elevated structures shall be fitted with warning lights to comply with air and safety navigation regulations.

The following management and control measures are recommended to prevent air and climate pollution from ships during construction and operation phases:

- Comply with MARPOL convention on the prevention of air pollution. MARPOL Annex VI on regulations for the prevention of air pollution from ships, sets limits on sulphur oxides and nitrogen oxides emissions from ship exhausts and prohibits deliberate emissions of ozone depleting substances.
- Ensure that the sulphur content of fuel oil used on ships doesnot exceed the set limits. Alternatively, ships must fit an exhaust gas cleaning system or use any other technological methods to limit SOx emissions.
- Ensure that emissions of ozone depleting substances such as halons and chlorofluorocarbons (CFCs) are prohibited on all ships. New ships shall not use or employ equipment containing ozone-depleting substances.
- Minimise use of ancillary vessels during construction and operation.

8.3 LAND

Mitigation measures relating to land are largely aimed at restricting visual impact and topographic changes. The impacts of some activities can be significant and persist for years.

The following management and control measures are recommended to minimise the impact to land due to generation of solid waste during construction and operation phases:

- Where possible, demolition wastes from the removal of existing roads should be reused during the construction of new roads and other construction works on site.
- Limit vehicle movements to essential construction areas to limit unnecessary soil compaction.
- Use hard cover areas for vehicle movements where possible.
- Consider as part of the purchasing procedure choosing machinery, equipment, vehicles and materials that are fuel-efficient.
- Purchase cost effective materials from sustainable sources where possible.
- Municipal solid wastes (combustible or non-combustible) generated by the methanol jetty shall be collected through the solid waste management system set up for the methanol site. Details of the waste management system are presented in section 9 of this EIA report.
- No materials containing PCBs or asbestos will be used for construction.
- All hazardous wastes generated by the project operations will be transported to waste disposal facilities outside the proposed methanol plant area. Transportation of all hazardous wastes would be conducted in full compliance with Egyptian and International laws regarding the transport of hazardous wastes (MARPOL, Basel). If no appropriate waste disposal sites are available in Egypt, other disposal means must be found, for example wastes may be returned to the manufacturer for reuse, exported to hazardous waste facilities out of the country or sold to local industrial facilities for recovery and re-use.
- Solid process wastes (particularly spent catalyst) should be exported for the supplier and/or sent for precious metal recovery where possible.
- A recycling policy should be implemented for all solid wastes including office materials where possible,.
- Waste lubricants, lube oil and/or solvents would be re-used, recycled or disposed in environmentally appropriate ways..
- Records of all offsite waste transfers will be maintained, listing date of transfer, destination, compound identification, volumes removed, and personnel responsible.

The following management and control measures are recommended to reduce visual impact during the construction and operation phases:

- Ongoing housekeeping will mitigate the potential aesthetic concerns associated with litter/waste accumulation/deposition, dust, etc., both on and off site, that result from construction and operation activities. Containment facilities for non-hazardous solid waste should be established prior to commencing site work, and waste should be regularly removed from site to prevent unacceptable accumulations..
- Where possible, stack heights will be kept to a minimum to prevent visual intrusion.

8.4 ECOLOGY AND BIODIVERSITY

Construction and operational activities may result in the degradation or destruction of some terrestrial and marine habitat, and the disturbance to and/or displacement of some of the fauna currently utilizing onshore and offshore areas of the site.

8.4.1 Terrestrial Ecology and Biodiversity, and Agriculture

The following management and control measures are recommended to control the impacts to terrestrial ecology and biodiversity during the construction and operation phases:

- The construction of a freshwater intake pipeline for a distance of 6 km will result in localised impacts on the current sparse native vegetation. EMethanex has routed the freshwater pipeline adjacent to the existing gas pipeline corridor to minimise the affected area.
- During the construction phase of the freshwater pipeline consider purchasing seasonal crops from farmers owning the cultivated areas in its trajectory to off-set potential crop losses.
- Notify farmers, industrial and residential neighbours during times of start-up and operational tests to ensure that the community is aware of these events and understands that they not accidental but part of the facility commissioning procedures.
- Contingency plans should be in place and emergency response procedures developed to allow immediate response to accidental spillage and/or releases of chemicals or other hazardous materials. A compensation scheme should be in place in the event of damage to crops from such an event.
- There is no mitigation for loss of habitat as a result of construction activities; however, re-colonisation will likely occur in areas not subjected to ongoing disturbance associated with site operations.

- General housekeeping should be ongoing to prevent litter and other wastes associated with site activities from fouling the site and areas adjacent to the site.
- Pipelines in the project site should be constructed above ground to minimize future habitat disturbance during maintenance operations.
- Where feasible, noise levels during dawn, dusk, and night hours should be minimised to reduce disturbance to mammals (e.g. livestock) and birds.
- Consider using native plants for landscaping along the corridor.
- Vehicles and equipment should be well maintained to minimize unnecessary emissions and leaks.
- Established vehicle tracks and roads should be used to minimize habitat destruction from off-road travel.
- Adequate materials and product storage and handling practices should be followed to reduce uncontrolled releases.

8.4.2 Marine Ecology and Biodiversity

The following management and control measures are recommended to minimize marine impacts during the construction and operation phases:

- The timing of the construction of the outfall, if possible/economically feasible, should not coincide with Spring, which is the peak season for marine biota breeding.
- Proper materials and product storage and handling practices should be followed to reduce uncontrolled releases.
- General housekeeping should be ongoing to prevent litter and other wastes associated with site activities from fouling offshore areas.
- Contingency measures should be in place and emergency response procedures developed to allow immediate response to accidental spillage/release of chemicals or other hazardous materials.
- Care should be taken to minimise damage to marine habitat and fauna during dredging and excavation activities through adequate planning and execution. It is recommended that dredging techniques and equipment that causes the least possible disturbance be used for construction of the jetty.
- Dredging works should be limited, as much as possible, to the specific area to be dredged, to minimise the area of habitat destruction.
- Sediments should be chemically analysed prior to disposal. If increased turbidity is observed beyond 100 m of the disposal site, silt curtains or other containment devices should be implemented.

- There is no mitigation for loss of marine habitat as a result of construction activities of the jetty; however, re-colonisation in areas not subjected to ongoing disturbance associated with site operations will likely occur once shore protection is in place.
- The design of the water intake pipe should be designed to prevent the entrance of fish. Water velocity should be low, thus minimising the possibility of fish capture.
- A conservation management plan should be designed to rehabilitate any affected areas.
- Routine maintenance should be conducted to ensure minimal re-suspension of sediments.

8.5 HUMAN ENVIRONMENT

8.5.1 Socio-Economics

- During the construction and operation phases, significant positive impacts will be gained by the local community through employment opportunities at the proposed plant. Employment prospects will exist for skilled and unskilled labour, administration staff, caterers and medical staff. Where available, these personnel will be drawn from the local community and within Egypt. Local sources of labour should be utilised where possible and/or feasible.
- The main village, local settlers and other port users should be fully informed about site activities and the associated project issues, prior to the project start. For this reason, EMethanex organized a series of public consultation events in Cairo and Damietta city to discuss and inform the public regarding the project.
- Provide an on-going point of contact for the local population and other companies to direct their concerns.
- Buy as many locally manufactured and distributed products as possible.
- Ongoing housekeeping should mitigate potential aesthetic concerns associated with litter/waste accumulation/deposition, etc., both on and off site.
- Containment facilities for non-hazardous solid waste should be well managed, and waste should be regularly removed from site to prevent accumulation.
- Personal protective equipment should be made available to all workers and should, as a minimum, include: eye protection; full chemical protection for employees dealing with potentially toxic chemicals (including face masks, hand protection and full overalls); steel toe-capped boots; hard hats; and high visibility clothing.
- Adequate security should be implemented to secure the presence of valuable equipment/materials and to manage the influx of construction workers.

8.5.2 Heritage Issues

- The project site has no major archaeological features of importance and based on observations and literature searches for the region (see section 4), no historical sites were identified within, or in close proximity to, the proposed methanol site.
- Should evidence of items of heritage significance be identified during any phase of the project (i.e., construction and/or operation), the appropriate government authorities should be consulted and measures developed to ensure that any potential concerns are properly addressed.

8.5.3 Accidental Events (Fire, Explosion, and Releases)

The following management and control measures are recommended to minimise accidental events impact during construction and operation phase:

- The basic qualitative risk analysis conducted has confirmed that the project risk acceptance criteria for individual risk, third party risk and escalation can be met. Confirmation that they will be met will be achieved by conducting a quantitative risk assessment and HAZOP studies during the detailed design phase.
- For all potential accidental events (fire, explosion, and releases), an onshore and offshore emergency response plan must be in place to immediately respond to the event.
- Operational systems should have two shut down systems in the case of emergencies:
    - Process Shut Down (Automatic shutdown of process equipment); and
    - Emergency Shut Down (Remote manual shutdown and isolation of unit/plant).
- Emergency warning alarms should be in place to address potential human health and safety issues. An alarm system should include:
    - Fire;
    - Releases to atmosphere; and
    - Leakage in buildings
- All areas where environmental contaminants are stored should have adequate secondary containment to collect accidental spillage.
- Around the Methanol storage tanks there should be an impounding area for spillage from loading pump discharge piping. This should be at a distance of greater than 6 m from the tank to contain any spilled liquid (BS EN 1473).
- Employees should be fully trained to implement the relevant emergency response plans in the event of emergency.

8.5.4 Noise

The following management and control measures are recommended to reduce the noise level during construction phase to comply with EEAA guidelines and international standards for noise emissions where available:

- Regular inspection and maintenance of construction vehicles and equipment should be made to maintain smooth running of vehicles.
- Machinery and generators with 'quiet', 'muffled' or 'silenced' running should be used where available.
- Restricted working hours for particularly loud or intrusive activities such as piling.
- Fitting vehicles with effective exhaust silencers, where available.
- Using air compressors and generators that are sound reduced with properly lined and sealed acoustic covers.
- Optimal selection of haul and access roads to avoid sensitive locations, such as residential areas.
- Regular maintenance of equipment in accordance with manufacturer's instructions should be carried out to reduce the risk of increased noise emissions from worn or poorly maintained parts.
- In areas where excessive noise may occur, noise countermeasures should be applied, such as acoustic insulation.

The following management and control measures are recommended to reduce the noise level during the operation phase:

- In all cases, equipment will be operated to comply with national and international regulations. Personnel working in confined areas where noise exceeds 90 db(A) must wear hearing protection equipment.
- Regular maintenance of equipment in accordance with manufacturer's instructions should be carried out to reduce the risk of increased noise emissions from worn or poorly maintained parts.
- In areas where excessive noise may occur, noise countermeasures will be applied, such as insulation.
- A regular program for noise monitoring (along the site boundary) will be carried out to validate the predicted noise levels and ensure that the environmental noise limit is not exceeded.
- Pipe acoustic insulation shall be applied, where piping noise is expected. Where insulation is provided, pipe supports shall include vibration isolation pads.
- In line suction and discharge silencers will be used for all compressors. They shall be located as close to the relevant machine nozzle as allowed by the detailed piping layout.

- It is recommended that all compressors and generators be fitted with acoustic enclosures with low noise ventilation systems, fire and gas detection and fire extinguishing systems.
- Large pump sets will be fitted with “dog house” style acoustic enclosures, if necessary. Standard pumps and motors will meet the required noise levels.
- Plant flares are located remotely from the process plant.

8.5.5 Health and Safety Issues

The following management and control measures are recommended during the construction phase:

- Comply with U.S. Occupational Safety and Health Administration (OSHA), Egyptian H&S regulations
- Government emergency services (fire and medical services) should be aware of fast access routes defined by emergency response plans.
- An emergency notification system should be implemented to inform nearby industries and residential communities of an emergency.
- Fire services may require specific information on the plant so that the most effective fire fighting methods can be determined.
- A site health and safety plan should be developed (including emergency procedures) and all employees and subcontractors (for construction and maintenance works) should have induction training.
- Appropriate training should be given for particular tasks (where necessary), and subcontractors should prove employee competency.
- Adequate personal protective equipment should be used, based upon risk assessments for particular tasks or handling of hazardous materials.
- Method statements should be developed to cover all aspects of construction.
- Require construction workers and suppliers to drive safely on local roads.
- Work with local transport authority on scheduling of large loads that are being transported by road.

8.5.6 Light Pollution

The following management and control measures are recommended during the construction phase:

- Appropriate lighting should be used, however the angle of light fixtures should be set so that unnecessary spread of light is kept to a minimum.
- Unnecessary lighting should be switched off.

8.6 SUMMARY OF RESIDUAL IMPACTS FOLLOWING MITIGATION

After appropriate (1) application of the mitigation measures, provided in this report, to different assessed activities/pathways; (2) proper implementation of the monitoring plan; and (3) ensuring normal efficient operation; residual construction and operation impacts, if any, are expected to be minor or insignificant.

With appropriate monitoring and mitigation measures, the detected impacts should be reduced to a minimum (short term, reversible and localised).

Table 8-1 summarises the expected residual impacts (after application of mitigation, monitoring, etc.) resulting from the project's different activities / pathways.

Based on this analysis, the assessment team concludes that if recommended mitigation and monitoring measures are followed, the proposed methanol project can be constructed and operated without significant impact to the environment. It should be noted that non-routine events will always carry a higher significance due to the magnitude and extent thus every precaution must be taken to ensure that the probability of these events remains unlikely.

Table 8-1: Summary of Residual Impacts

Project Component	Aspect	VEC	Impact	Significance before mitigation	Significance after mitigation
SITE PREPARATION	Creation of Access Roads	Air quality	Increased air emissions (dust, and exhaust emissions)	MINOR	INSIGNIFICANT
		Agriculture	Devaluation of crops (exhaust, dust and sand fine particles emissions)	MODERATE	MINOR
		Topographic changes and visual impairment	Topographic changes and Visual Impact	MODERATE	MINOR
		Terrestrial ecology and biodiversity	Loss of habitat and clearing or damage to vegetation	MINOR	INSIGNIFICANT
		Noise Pollution	Increased noise levels	MINOR	INSIGNIFICANT

Project Component	Aspect	VEC	Impact	Significance before mitigation	Significance after mitigation
		Socio-Economic activities	Temporary employment prospects in the area	POSITIVE	POSITIVE
	Transport and equipment use	Air quality	Increased air emissions (dust, and exhaust emissions)	MINOR	INSIGNIFICANT
		Agriculture	Deposition of dust, sand particles and pollutants on crops	MINOR	INSIGNIFICANT
		Noise Pollution	Increased noise levels	MODERATE	MINOR
		Terrestrial ecology and biodiversity	Loss of habitat and clearing or damage to vegetation	MINOR	INSIGNIFICANT
	Purchasing of supplies and services	Air Quality	Increased CO_2 emissions	MINOR	INSIGNIFICANT
		Agriculture	Deposition of dust, sand particles and pollutants on crops	MINOR	INSIGNIFICANT
		Socio-Economic activities	Increase in economic activity	POSITIVE	POSITIVE
	Staffing	Socio-Economic activities	Temporary employment prospects in the area	POSITIVE	POSITIVE
CONSTRUCTION ACTIVITIES	Excavation and earthworks for Methanol plant constructio n	Air quality	Increased air emissions (dust, and exhaust emissions)	MINOR	INSIGNIFICANT
		Agriculture	Devaluation of crops (exhaust, dust and sand fine particles emissions)	MODERATE	MODERATE
		Noise Pollution	Increased noise levels	MINOR	INSIGNIFICANT
		Topographic changes and visual impairment	Visual impacts due to use of unsustainable disposal methods	INSIGNIFICANT	INSIGNIFICANT

Project Component	Aspect	VEC	Impact	Significance before mitigation	Significance after mitigation
		Terrestrial ecology and biodiversity	Loss of habitat, and clear or damage to vegetation	MINOR	INSIGNIFICANT
		Socio-Economic activities	Temporary employment prospects in the area	POSITIVE	POSITIVE
CONSTRUCTION ACTIVITIES	Dredging at Methanol Loading Terminal (Jetty)	Seawater Quality	Increased turbidity and BOD within the water column. Overall reduction in the dissolved oxygen concentration.	MODERATE	MINOR
		Marine ecology and biodiversity	Loss of marine biota	MODERATE	MINOR
		Air quality	Increased air emissions (dust, and exhaust emissions)	MINOR	INSIGNIFICANT
		Noise Pollution	Increased noise levels	MINOR	INSIGNIFICANT
		Socio-Economic activities	Temporary employment prospects in the area	POSITIVE	POSITIVE
	Transport and use of vehicles and site machinery	Air quality	Increased air emissions (dust, and exhaust emissions)	MINOR	INSIGNIFICANT
		Agriculture	Deposition of dust, sand particles and pollutants on crops	MINOR	INSIGNIFICANT
		Terrestrial ecology and biodiversity	Loss of habitat, and clear or damage to vegetation	MINOR	INSIGNIFICANT
		Socio-Economic activities	Increase of employment	POSITIVE	POSITIVE
	Marine Traffic (dredgers and	Seawater Quality	Increased turbidity within the water column	MINOR	INSIGNIFICANT

Project Component	Aspect	VEC	Impact	Significance before mitigation	Significance after mitigation
	vessels)	Air quality	Increased air emissions (exhaust emissions)	MINOR	INSIGNIFICANT
		Marine ecology and biodiversity	Loss of marine biota	MINOR	INSIGNIFICANT
		Noise Pollution	Increased noise levels	MINOR	INSIGNIFICANT
		Socio-Economic activities	Temporary employment prospects in the area	POSITIVE	POSITIVE
	Construction of marine outfall pipeline	Seawater Quality	Increase overall water column turbidity	MODERATE	MINOR
		Noise Pollution	Increased noise levels	MINOR	INSIGNIFICANT
		Topographic changes and visual impairment	Visual impacts due to use of unsustainable disposal methods	MINOR	INSIGNIFICANT
		Marine ecology and biodiversity	Loss of marine biota	MINOR	INSIGNIFICANT
		Terrestrial ecology and biodiversity	Loss of habitat, and clear or damage to vegetation	MODERATE	MINOR
		Socio-Economic activities	Temporary employment prospects in the area	POSITIVE	POSTIVE
	Construction of freshwater intake pipeline	Freshwater Quality	Re-suspension of bottom sediments	MINOR	INSIGNIFICANT
		Topographic changes and visual impairment	Visual impacts due to use of unsustainable disposal methods	MINOR	INSIGNIFICANT
		Noise Pollution	Increased noise levels	MINOR	INSIGNIFICANT
		Marine ecology and biodiversity	Loss of marine biota	MINOR	INSIGNIFICANT
		Terrestrial ecology and biodiversity	Loss of habitat, and clear or damage to vegetation	MODERATE	MINOR
		Agriculture	Oil spills and maintenance leftovers	MINOR	INSIGNIFICANT

Project Component	Aspect	VEC	Impact	Significance before mitigation	Significance after mitigation
		Socio-Economic activities	Temporary employment prospects in the area	POSITIVE	POSITIVE
		Socio-Economic activities	Change in local fish industry and loss in field crops	MINOR	INSIGNIFICANT
	Waste disposal	Groundwater Quality	Leaching of waste into aquifer	MODERATE	MINOR
		Topographic changes and visual impairment	Visual impacts due to use of unsustainable disposal methods	MODERATE	MINOR
		Terrestrial ecology and biodiversity	Loss of habitat, and clear or damage to vegetation	MINOR	INSIGNIFICANT
		Community Health and Safety	Health impacts	MODERATE	MINOR
OPERATION ACTIVITIES	Methanol plant equipment start-up	Air quality	Increased air emissions (gaseous emissions)	MINOR	INSIGNIFICANT
	Operation of Methanol Plant	Air quality	Increased air emissions from vessels (gaseous emissions)	MODERATE	MINOR
		Agriculture	Air pollution deposition on land and crops.	MINOR	INSIGNIFICANT
		Noise Pollution	Increased noise levels	MINOR	INSIGNIFICANT
		Marine ecology and biodiversity	Loss of marine biota due to outfall	MODERATE	MINOR
		Terrestrial ecology and biodiversity	Loss of habitat, and clear or damage to vegetation	INSIGNIFICANT	INSIGNIFICANT
		Socio-Economic activities	Permanent employment opportunities in the area	POSITIVE	POSITIVE

Project Component	Aspect	VEC	Impact	Significance before mitigation	Significance after mitigation
	Operation of Methanol Loading Jetty	Seawater Quality	Increase overall water column turbidity	MAJOR	MINOR
		Marine ecology and biodiversity	Loss of marine biota	MAJOR	MINOR
		Noise Pollution	Increased noise levels	MINOR	INSIGNIFICANT
		Socio-Economic activities	Permanent employment opportunities in the area and increase in trading	POSITIVE	POSITIVE
	Operation of freshwater intake	Freshwater Quality	Changes in water quality	MINOR	INSIGNIFICANT
		Agriculture	Destruction of farmland infrastructure; Destruction of crops; Halt of farm activities	MODERATE	MODERATE
		Marine ecology and biodiversity	Loss of marine biota	MINOR	INSIGNIFICANT
		Terrestrial ecology and biodiversity	Loss of habitat, and clear or damage to vegetation	MODERATE	MINOR
		Socio-Economic activities	Change in local fish industry	INSIGNIFICANT	INSIGNIFICANT
	Operation of marine outfall	Seawater Quality	Reduced water quality due to effluent discharges	MAJOR	MINOR
		Terrestrial ecology and biodiversity	Loss of habitat, and clear or damage to vegetation	MINOR	INSIGNIFICANT
		Marine ecology and biodiversity	Loss of marine biota	MAJOR	MINOR
	Road operation	Air quality	Increased air emissions (dust, and exhaust emissions)	MINOR	INSIGNIFICANT

Project Component	Aspect	VEC	Impact	Significance before mitigation	Significance after mitigation
		Agriculture	Deposition of dust, sand particules and pollutants on crops	MINOR	INSIGNIFICANT
		Terrestrial ecology and biodiversity	Loss of habitat, and clear or damage to vegetation	MINOR	INSIGNIFICANT
		Noise Pollution	Increased noise levels	MINOR	INSIGNIFICANT
		Socio-Economic activities	Increase in trading	POSITIVE	POSITIVE
	Routine operation of Methanol transporters (Marine Traffic)	Air quality	Increased air emissions (exhaust emissions)	MINOR	INSIGNIFICANT
		Seawater Quality	Re-suspension of bottom sediments	MINOR	INSIGNIFICANT
		Marine ecology and biodiversity	Loss of marine biota	MINOR	INSIGNIFICANT
		Noise Pollution	Increased noise levels	MINOR	INSIGNIFICANT
	Maintenance Dredging	Air quality	Increased air emissions (dust)	MINOR	INSIGNIFICANT
		Seawater Quality	Increase overall water column turbidity and decrease water quality	MINOR	INSIGNIFICANT
		Marine ecology and biodiversity	Loss of marine biota	MINOR	INSIGNIFICANT
	Use of machinery and equipment	Air quality	Increased air emissions (exhaust emissions)	MINOR	INSIGNIFICANT
	Waste Disposal	Groundwater Quality	Release of contaminant	MODERATE	MINOR
		Topographic changes and visual impairment	Visual impacts due to use of unsustainable disposal methods	MODERATE	MINOR
		Terrestrial ecology and biodiversity	Loss of habitat, and clear or damage to vegetation	MINOR	INSIGNIFICANT

Project Component	Aspect	VEC	Impact	Significance before mitigation	Significance after mitigation
ACCIDENTAL (NON-ROUTINE) EVENTS	Ship collision / accidents	Air quality	Increased air emissions	MINOR	INSIGNIFICANT
		Seawater Quality	Detrimental impacts to the surrounding water quality due to release of hydrocarbons and methanol	MAJOR	MODERATE
		Marine ecology and biodiversity	Loss of marine biota	MAJOR	MINOR
		Community Health and Safety	Human injury and mortality	MAJOR	MAJOR
	Fire and Explosion	Air quality	Increased air emissions	MAJOR	MAJOR
		Agriculture	Destruction of crops, Air and water pollution; Deposition of dust smoke and sand particles	MODERATE	MINOR
		Noise Pollution	Increased noise levels	MODERATE	MINOR
		Terrestrial ecology and biodiversity	Loss oh habitat, and clear or damage to vegetation	MINOR	MINOR
		Community Health and Safety	Loss of life due to methanol explosion	MAJOR	MAJOR
	Spills and Leaks	Seawater Quality	Detrimental impacts to the water quality due to spills of infilling material, off-specs effluents, etc.	MINOR	MINOR
		Groundwater Quality	Groundwater contamination from surface discharge of liquid wastes	MODERATE	MODERATE
		Freshwater Quality	Reduced freshwater quality	MODERATE	MODERATE

Project Component	Aspect	VEC	Impact	Significance before mitigation	Significance after mitigation
		Topographic changes	Change in surface soil type, chemical composition or fertility.	MINOR	MINOR
		Terrestrial ecology and biodiversity	Loss of habitat, and clear or damage to vegetation	MINOR	MINOR
		Marine ecology and biodiversity	Loss of marine biota due to use of Anti-fouling paints, Loss of vessels' ballast water, etc.	MINOR	MINOR
	Inappropriate waste disposal	Air Quality	Increased air emissions from waste open burning	MINOR	MINOR
		Agriculture	Leakage; Spills Loss of land	MINOR	INSIGNIFICANT
		Groundwater Quality	Leaching of waste into aquifer	MODERATE	MODERATE
		Visual impairment	Visual impacts due to use of unsustainable disposal methods	MODERATE	MINOR
		Terrestrial ecology and biodiversity	Loss of marine biota	MINOR	MINOR

9 ENVIRONMENTAL MANAGEMENT PLAN

9.1 INTRODUCTION

This document applies to the construction and operation of the EMethanex site in Damietta Port, Egypt. Its purpose, as a framework Environmental Management System (EMS), is to provide a process to ensure environmental statutory compliance; consistency with external standards; and promotes effective environmental management at the proposed methanol facility during all project phases.

Note: this framework EMP will require further development to produce the final EMS for construction and operation, subject to further design details, contractual arrangements with the chosen EPC Contractor and the formation of the full EMethanex HSE/ RC management team. As such, the final EMS will be separate documents and will not be included in the EIA report.

The purpose of this framework EMS is to:

- establish a minimum standard for an Environmental Management System at the EMethanex site, Damietta Port;
- provide a framework that can be customized into a site specific Environmental Management System (EMS) following the choice of an Engineering, Procurement and Construction (EPC) contractor and the formation of the operational teams (EMethanex and other suppliers/ contractors);
- provide an EMS framework that will facilitate ISO 14000 certification at the site, if it is so desired.

EMethanex has adopted the Responsible Care® ethic as its overall business management system. The requirements of Environmental Management Systems are addressed in the Responsible Care® codes of practice and the ISO 9001:2000 Quality systems policies and procedures.

Overall governance for Responsible Care (RC) is managed by the Board of Directors of EMethanex, Senior Management of EMethanex and the Methanex Global RC Team.

9.1.1 THE EMS

This document details the framework EMS for EMethanex operations in Damietta Port, Egypt.

The operations comprise the following site activities:

- Construction;
- Operation; and
- Decommissioning.

The objectives of the EMS are:

- To provide a means of ensuring that environmental statutory compliance is achieved;
- To provide a means of ensuring that Responsible Care environmental compliance is achieved;
- To provide for the ability to comply with external standards and expectations that may arise in the future; and
- To provide a guide for the systems to be implemented at the facility and how they combine to achieve an effective EMS.

The key elements of the EMS are:

- Training / employee education;
- Compliance with laws / regulations;
- Assessing environmental effects and setting targets;
- Procedures and procedural reviews;
- Emergency preparedness;
- Community partnerships;
- Reporting; and
- Audit and management review.

Maintenance of the EMS is a key element in the Position Descriptions for the EPC Contractor (Construction) and Plant Manager (Operation). These Position Descriptions will be formulated in the final EMS documents.

9.1.2 DOCUMENTATION AND RECORDS

Central to the EMS is the documentation and records system. This system relates to:

- Operations manuals;
- Compliance and monitoring records and reporting;

- Incident reporting;
- Training manuals;
- Training records;
- Project records; and
- Materials Management System (raw, in process, waste).

This document describes the different types of records systems for environmental management at the site.

9.1.3 MANAGEMENT STRUCTURE

Responsibilities with regard to environmental management are set out below.

- All workers must be aware of their environmental responsibilities under Egyptian legislation, and all EPC contractors and operational staff members and contractors must undergo the Induction/Orientation Programme, which includes a section on Environmental Awareness.
- Each Supervisor is responsible for management of environmental issues in his/her section.
- The EPC contractor (Construction) and the Plant Manager (Operation) will oversee the waste management system, determine how much waste EMethanex produces and find efficient ways of minimizing the waste produced.
- The EPC contractor (Construction) and the Plant Manager (Operation) are responsible for the co-ordination of the Environmental Management System.
- The EPC contractor (Construction) and the Plant Manager (Operation) have the overall responsibility for environmental performance at the site, and will assign dedicated resources to coordinate all aspects of the Environmental Management System.
- The EPC contractor (Construction) and the Plant Manager (Operation) will assign dedicated resources to coordinate all aspects of the Environmental Management System.

9.1.4 RESPONSIBLE CARE

Background Information

Responsible Care is Methanex Corporation's commitment to the international chemical industry and the responsible management of its products and the processes by which they are created and marketed.

Responsible Care management systems are the means by which the commitment is carried out.

The goal of Responsible Care is to reduce risk from all activities and promote continuous improvement in the health, safety and environmental performance of the chemical industry.
Responsible Care promotes the safest possible management of construction and operational activities, such as assessing risks from chemical products throughout their life cycles, from the planning of new products through to their manufacture, distribution, use and ultimate disposal.

Addressing Environmental Principles in Responsible Care

Pollution Prevention - This addresses waste and emissions reduction in construction and operation (chemical-producing plants). It sets three goals: long-term reductions in all releases from construction and operating facilities with sound management of remaining wastes and releases, ongoing reductions in the amount of waste generated, and improvements in efficiency in the use of resources.

Hazardous Materials Management for Construction and Operation - EMethanex advocates minimization of use of raw materials, substitution, waste elimination and reduction at source, followed by recycling, recovery or re-use as preferred options to disposal. Where options other than disposal are not feasible, destruction or treatment to render waste material non-hazardous is recommended. If the hazard cannot be eliminated, the waste must be contained in a secure manner and monitored to ensure that it is not endangering the environment.

9.2 TRAINING / EMPLOYEE EDUCATION

EMethanex runs an employee education programme. Ensuring the delivery of the following training programmes is the responsibility of the EPC contractor (Construction) and the Plant Manager (Operation):
The training program covers the following aspects:

- Responsible Care;
- Security;
- Incident Reporting;
- Emergency Response and Notification;
- Environmental Protection;
- Site Hazards;
- Personal Protective Equipment;
- General Safety Rules & Safety Program and;
- Work Permit System/ Hazard Identification.

This is supported by documentation that the EPC contractor (Construction) and the Plant Manager (Operation) deem appropriate.

The **Methanex Environmental Awareness** training programme covers the following areas:

- The environmental framework and environmental management at the operating site;
- The Egyptian legislation and employees' and employers' responsibilities;
- The EPC contractor (Construction) and the Plant Manager (Operation) will ensure that employees and suppliers will, where appropriate, have refresher training sessions. Typically these will vary in frequency. For example, during construction, daily toolbox talks will take place, backed up by monthly HSE meetings and special training sessions, such as for confined spaces. For operation, every two years, all employees and permanent contractors will have refresher training on environmental awareness and issues relevant to their work activities.
- Hazardous Materials Handling Training will be provided to workers who handle them. The level of training will be appropriate to the material being handled and the circumstances. Environmental training records must be kept and stored in a suitable manner, consistent with other such records.

9.3 COMPLIANCE WITH LAWS / REGULATIONS / MONITORING PLAN

9.3.1 INTRODUCTION

Approvals / permits / consents / licenses relating to the environment are stored in a location which is readily available to the appropriate staff.

Approvals / permits / consents / licenses will be (at a minimum) in place prior to construction and operational phases for:

- Discharges to air;
- Discharges to water and land;
- Water Intake permits;
- Land Use permits;
- Planning Permission;
- Transport of Waste;
- Hazardous Substance test Certificates; and
- Transport of Dangerous Goods.

Should any other approvals or permits be required for new activities, these will be obtained prior to the commencement of the activities. The facility shall comply with relevant legislation, as presented in Chapter 2 of the EIA.

9.3.2 MONITORING PLAN

This section provides the monitoring requirements for the proposed Methanol facility. It is recommended that the facility assign an environmental officer (EO). One of the duties of the EO is to ensure that the monitoring program/requirements are fulfilled and properly implemented. The EO should be provided all necessary assistance from personnel of the different departments at the facility. He/she should have sufficient and appropriate environmental, sampling/analyses and environmental management background.

The proposed monitoring program is composed of three main categories:

- Environmental Monitoring;
- Socio-Economic Monitoring; and,
- Monitoring documentation.

9.3.2.1 ENVIRONMENTAL MONITORING

Environmental monitoring should be conducted during both construction and operation phases. The environmental monitoring program includes:

- Water environment:
  - Freshwater intake;
  - Groundwater;
  - Seawater and sediment;
  - Seawater outfall;
  - Potable water; and
  - Cooling water.
- Air emissions;
- Noise levels;
- Solid and hazardous waste;
- Monitoring of incoming and outgoing chemicals;
- Monitoring of trucking and machinery activities; and
- Health risk/workplace monitoring.

9.3.2.1.1 WATER INTAKE MONITORING REQUIREMENTS

CONSTRUCTION

Construction phase monitoring should be conducted to ensure that no adverse impact on Nile water or sediment quality occurs as a result of the construction activities.

Item	Performance Standard	Monitoring Regime
Quantity and type of direct or indirect waste reaching the Nile water	No reportable incidents	Ongoing visual inspection
Freshwater and sediment analyses	Comparison to baseline values / relevant legislation	***Two analysis rounds*** down stream the construction location for the parameters presented in Table 9-1, and Table 9-2

Table 9-1: Freshwater quality monitoring parameters (construction phase)

Temperature	Nitrate	Iron
Colour	Fluoride	Manganese
pH	Phosphate	Zinc
Dissolved Oxygen	Sulphate	Copper
TDS	Silica	Cyanide
COD	Chlorine	Phenol
BOD	Arsenic	Oil and grease
TSS	Cadmium	Polychlorinated Biphenyls (PCBs)
Total alkalinity	Chromium	Pesticides
Total hardness	Lead	Faecal coliform
Organic nitrogen	Cobalt	Total coliform
Ammonia	Nickel	Phytoplankton
Sulphides	Mercury	Zooplankton

Table 9-2: Sediment (freshwater intake) monitoring parameters (construction phase)

Phosphate	Chromium	Nickel
Aluminium	Copper	Silver
Arsenic	Iron	Zinc
Barium	Lead	Total petroleum hydrocarbons
Boron	Manganese	Sediment infauna
Cadmium	Mercury	Microbiological & Parasites analyses
Cobalt	Molybdenum	

OPERATION

Item	Performance Standard	Monitoring Regime
Raw water silt return analysis • residual chlorine • pH • TDS	A61, Decree 8/1983, Law 48/1982 • 1.0 mg/L • 6 – 9 • 800 mg/L	Online monitoring for pH and residual chlorine and daily analysis of TDS. In case of non-compliance, the raw water silt shall be directed to a holding tank for further treatment before discharge to the Nile or for offsite disposal.
Freshwater analyses	Comparison to baseline values / relevant legislation	***Annual monitoring*** for the parameters presented in Table 9-3

Table 9-3: Freshwater quality monitoring parameters (operational phase)

Temperature	COD
Colour	BOD
pH	Chlorine
Dissolved Oxygen	Oil and grease
TDS	Ammonia

9.3.2.1.2 GROUNDWATER MONITORING REQUIREMENTS

Groundwater quality should be monitored to ensure that the project/facility activities (during both construction and operation phases) exert no unexpected impacts from leachates or discharges, which may contaminate the groundwater. Given that groundwater at the site is in hydraulic connection with the sea, it is important to ensure that subsurface migration from the site is not contributing to contaminant load to the sea.

CONSTRUCTION

Item	Performance Standard	Monitoring Regime
Quantity and type of direct or indirect waste reaching groundwater	No reportable incidents	Ongoing visual inspection at • All storage areas; • Workshops; and, • Waste collection/water and wastewater storage tanks.
Groundwater analyses	Comparison to baseline values / relevant legislation	Biannual analysis (3 monitoring wells) for the parameters presented in Table 9-4

Table 9-4: Groundwater quality monitoring parameters (construction/operational phase)

Temperature	Iron
pH	Lead
Dissolved Oxygen	Magnesium
Conductivity/total dissolved solids	Nickel
Turbidity	Zinc
Chloride	Mercury
BOD	Copper
COD	Total coliform
Sulphate	Faecal coliform
Phosphate	Phenols
Nitrate	Polychlorinated Biphenyls (PCBs)
Nitrite	Total Petroleum Hydrocarbons
Cadmium	Pesticides

OPERATION

Item	Performance Standard	Monitoring Regime
Quantity and type of leachate reaching groundwater	No reportable incidents	• Continuous QA/QC procedures for the facility. • Ongoing inspection
Groundwater analyses	Comparison to baseline values / relevant legislation	***Quarterly analysis (3 monitoring wells)*** during the first year of operation for the parameters presented in Table 9-4. If after the first year, no major impacts are detected, the monitoring program may be modified and monitoring parameters may be reduced.

9.3.2.1.3 SEAWATER AND SEDIMENT QUALITY MONITORING

CONSTRUCTION

Construction activities should be regularly inspected to ensure no direct or indirect contamination is introduced to the marine environment.

Item	Performance Standard	Monitoring Regime
Quantity and type of direct or indirect waste reaching the Sea	No reportable violations	Ongoing visual inspection
Dredged sediments analysis	Comparison to baseline values / relevant legislation	***Three monitoring rounds*** for dredged sediments: • Two samples at the jetty area • Two samples at the outfall area Monitoring parameters are presented in Table 9-5.

Table 9-5: Dredged sediment quality monitoring parameters (construction phase)

Phosphate	Chromium	Nickel
Aluminium	Copper	Silver
Arsenic	Iron	Zinc
Barium	Lead	Cobalt
Boron	Manganese	Molybdenum
Cadmium	Mercury	Total Petroleum Hydrocarbons

OPERATION

Item	Performance Standard	Monitoring Regime
Comprehensive seawater and sediment analyses	Comparison to baseline values / relevant legislation	Biannual analysis for the parameters presented in Table 9-6 and Table 9-7. • Two samples at the jetty area • Three samples at the outfall area. In case the outfall effluent quality is not in compliance with environmental requirements, the frequency and parameters of the monitoring program shall be increased. Biannual sampling to take place for the first 2 years of operation after which if no adverse impacts are noted, the frequency and parameters for monitoring can be reduced.

Table 9-6: Seawater quality monitoring parameters (operational phase)

Temperature	Sodium	Arsenic
pH	Potassium	Mercury
Dissolved Oxygen	Chloride	Cadmium
Conductivity/TDS	Sulphate	Nickel
Chlorine	Ammonia	Iron
Fluoride	Nitrate	Manganese
TSS	Nitrite	Zinc
Total hardness	Phosphate	Total Petroleum Hydrocarbons
Calcium	Cyanide	Faecal coliform
Magnesium	Sulphides	Total coliform
Total alkalinity	Silica	PCBs
COD	Lead	Pesticides
BOD	Chromium	Phytoplankton
Copper	Cobalt	Zooplankton

Table 9-7: Seabed sediment quality monitoring parameters (operational phase)

Phosphate	Chromium	Nickel
Aluminium	Copper	Silver
Arsenic	Iron	Zinc
Barium	Lead	Total petroleum hydrocarbons
Boron	Manganese	Sediment infauna
Cadmium	Mercury	Microbiological analyses
Cobalt	Molybdenum	Grain size distribution (only for first round)

9.3.2.1.4 SEAWATER OUTFALL

CONSTRUCTION

During the construction phase for the facility's outfall, activities should be monitored to ensure that no adverse impacts are exerted to the environment.

Item	**Performance Standard**	**Monitoring Regime**
Quantity and type of direct or indirect waste reaching the sea	No reportable violations	Ongoing visual inspection

OPERATION

During the operational phase, the facility's outfall should be monitored to ensure that the quality of treated effluent complies with environmental regulations. In case of non-compliance, corrective actions should be taken.

Item	Performance Standard	Monitoring Regime
Storm water catchment pond monitoring	Compliance with relevant legislation-most stringent criteria (Chapter 2 of the EIA)	Online analysis for: • Temperature; • pH; • Total organic carbon; and, • Conductivity.
Seawater outfall quality monitoring	Compliance with relevant legislation-most stringent criteria (Chapter 2 of the EIA)	• Sampling point: upstream the final control valve prior to outfall discharge to the sea, a sampling port will be used. • Monitoring parameters are presented in Table 9-8. All parameters should be quarterly monitored during the first year of operation, and more frequent monitoring is to be conducted during start up and upset conditions. Quarterly sampling to take place for the first 2 years of operation after which if no adverse impacts are noted, the frequency and parameters for monitoring can be reduced.

Table 9-8: Effluent outfall monitoring parameters and frequency

Quarterly + additional[28] monitoring every 8 hrs during start up and upset conditions	**Quarterly + additional[29] monthly monitoring during start up and upset conditions**	**Quarterly monitoring**		
Temperature increase	Cadmium	Colour	Fluoride	Silver

[28] Monitoring requirement as per the PPAH (World Bank, 1998)
[29] Monitoring requirement as per the PPAH (World Bank, 1998)

pH	Chromium	TDS	Ammonia (nitrogen)	Barium
BOD	Copper	Turbidity	Lead	Mercury
COD (dichromate)		Phosphate	Arsenic	Cobalt
TSS		Nitrate	Nickel	Cyanide
Nitrogen (total)		Silica	Aluminium	Chlorine
Oil and grease		Calcium	Iron	Pesticides
Phenols		Magnesium	Manganese	Total organic carbon
Benzene		Potassium	Zinc	Coliform (MPN in 100 cm^3)
Sulphides				

9.3.2.1.5 POTABLE WATER

Potable water should be regularly monitored prior to the point of supply to the facility's potable water supply network to ensure compliance with health standards.

Item	Performance Standard	Monitoring Regime
Potable water analysis	Egyptian drinking water quality standards adopted by the Ministry of Health (Decree 108/1995)	• Quarterly monitoring shall take place for the first year of operation after which if no adverse results are found, the frequency and parameters of monitoring can be reduced. • Quarterly monitoring for the parameters presented in Table 9-9. • A sampling port is recommended for potable water sampling.

Table 9-9: Potable water quality monitoring parameters

pH	Fluoride	Selenium
Temperature	Nitrite	Silver
Chlorine	Nitrate	Zinc
Colour	Sulphate	Cadmium
Dissolved oxygen	Aluminium	Chromium

Turbidity	Arsenic	Barium
TDS	Beryllium	Asbestos
Total hardness	Copper	Acrylamide
Calcium	Iron	Benzene
Protozoa	Lead	Benzo (a) pyrene
Total coliform	Manganese	Carbon tetra-chloride
Chloride	Nickel	Chlorite
Cyanide	Mercury	Pesticides
Faecal coliform	Trihalomethanes	

9.3.2.1.6 COOLING WATER

Cooling water should be monitored in order to ensure it meets quality assurance for design specifications. Such monitoring is considered part of normal efficient operation and is not covered in this section.

9.3.2.1.7 AIR EMISSION MONITORING REQUIREMENTS

CONSTRUCTION

Item	Performance Standard	Monitoring Regime
Ambient air quality		
PM10	**EU directive 99/30/EC** ▪ 50 µg/m³ (Averaging period 24 hours) Not to be exceed more than 35 times a calendar year; ▪ 40 µg/m³ (averaging period 1 year) ; ▪ 20 µg/m³ (averaging period 1 year). Due date to meet limit: 1/1/10.	• ***Quarterly monitoring***: Active sampling for: - PM10; - SO_2; - CO; and, - NOx. • ***Monitoring locations:*** - Two locations within the facility boundaries; and, - One location outside the facility boundary.
SO_2	**EU DIRECTIVE: 99/30/EC** ▪ 350 µg/m³ (Average period 1 hour) not to be exceeded more than 24 times a calendar year; ▪ 125 µg/m³ (Average period 24 hours) not to be exceeded more than 3 times/year; **World Bank PPAH (1998) – General Environmental Guidelines** ▪ 50 µg/m³ (Average period 1 year).	

Item	Performance Standard	Monitoring Regime
CO	**Egyptian Law4/1994** ▪ 30,000 µg/m^3 (Average period 1 hour) ▪ 10,000 µg/m^3 (Average period 8 hour)	
NOx (measured as NO_2)	**DIRECTIVE: 99/30/EC** ▪ 200 µg/m^3 (Average period 1 hour) not to be exceeded more than 18 times a calendar year. Due date to meet limit: 1/1/10; ▪ 40 µg/m^3 (Average period 1 year). Due date to meet limit: 1/1/10; ▪ Annual value for the protection of vegetation: 30 µg/m³ (Average period 1 year). Due date to meet limit 19/7/01. **World Bank PPAH (1998) – General Environmental Guidelines** ▪ 150 µg/m^3 (Average period 24 hr)	
Fuel burning equipment		
Equipment failures	No reportable failure	Leakages should be checked by: ▪ Visual inspection every eight hours; and, ▪ Using leak detection equipment at least once a week

OPERATION

Item	Performance Standard	Monitoring Regime
Ambient air quality		
PM10	Same as for the construction phase monitoring	• ***Quarterly monitoring*** (active sampling). • ***Monitoring locations:*** - Two locations within the facility boundaries; and, - One location outside the facility boundary. • Quarterly sampling to take place for the first 2 years of operation after which if no adverse impacts are noted, the frequency and parameters for monitoring can be reduced.
SO_2		
CO		
NOx (measured as NO_2)		

Item	Performance Standard	Monitoring Regime
Stacks/vents		
Equipment failure	No reportable failure	Air emissions should be visually monitored for opacity at least once every eight hours.
Stacks/vents Emissions	Compliance with relevant legislation-most stringent criteria for emissions (Chapter 2 of the EIA)	• ***Quarterly monitoring*** Active sampling for: - Particulate Emissions; - SOx; - NOx; - CO; and, - CO2. • ***Sampling Port*** (1 inch diameter) • Quarterly sampling to take place for the first 2 years of operation after which if no adverse impacts are noted, the frequency and parameters for monitoring can be reduced.
Fugitive emissions	No reportable accidents	Monitored as part of the QA/QC procedures and occupational health and safety requirements of the facility.

9.3.2.1.8 NOISE MONITORING REQUIREMENTS

CONSTRUCTION

Item	Performance Standard	Monitoring Regime
Noise from pile-driving activities	Compliance with relevant legislation for noise levels inside the workplace (Annex7/executive regulations of Egyptian Law4, and IFC occupational health and safety guidelines)	Monitoring should take place each day while pile-driving activities are occurring
Areas with direct contact to equipment usage		Weekly noise recording

Ambient noise	**Annex7/executive regulations of Egyptian Law4**: Industrial Zone (heavy industries): 70 dB(A) Day time (7am – 6pm) 65 dB(A) Evening (6pm–10pm) 60 dB(A) Night (10pm–7am)	• ***Biannual monitoring*** at the facility boundaries. • 24 hour noise measurement using Type 1 sound level meter (Precision Grade). • Biannual sampling to take place for the first 2 years of operation after which if no adverse impacts are noted, the frequency and parameters for monitoring can be reduced.
	Annex7/executive regulations of Egyptian Law4: Dwelling zone on a public road 60 dB(A) Day time (7am – 6pm) 55 dB(A) Evening (6pm–10pm) 50 dB(A) Night (10pm–7am)	• ***Biannual monitoring*** at two locations in the near dwelling area on the public road. • 24 hour noise measurement using Type 1 sound level meter (Precision Grade). • Biannual sampling to take place for the first 2 years of operation after which if no adverse impacts are noted, the frequency and parameters for monitoring can be reduced.

OPERATION

Item	Performance Standard	Monitoring Regime
Ambient noise	**Annex7/executive regulations of Egyptian Law4**: *Industrial Zone (heavy industries):* 70 dB(A) Day time (7am – 6pm) 65 dB(A) Evening (6pm–10pm) 60 dB(A) Night (10pm–7am)	• ***Quarterly monitoring*** at the facility boundaries. • 24 hour noise measurement using Type 1 sound level meter (Precision Grade).
	Annex7/executive regulations of Egyptian Law4: *Dwelling zone on a public road:* 60 dB(A) Day time (7am – 6pm) 55 dB(A) Evening (6pm–10pm) 50 dB(A) Night (10pm–7am)	• ***Quarterly monitoring*** at two locations in the near dwelling area on the public road. • 24 hour noise measurement using Type 1 sound level meter (Precision Grade).

9.3.2.1.9 SOLID AND HAZARDOUS WASTE MONITORING

During both construction and operation phases, waste should be handled according to a waste management plan (outlines mentioned in Section 9.4.4). Monitoring is required to ensure proper implementation of the management plan. Solid and hazardous waste quantities and destination (final disposal) should be documented and kept, to ensure proper handling and disposal.

As per the requirements of the World Bank PPAH (1998), in case of solid waste disposal, the waste should be monitored for toxic substances prior to disposal.

9.3.2.1.10 MONITORING OF INCOMING AND OUTGOING CHEMICALS

A logbook shall be kept and maintained for all incoming and outgoing chemicals. This book shall be reviewed regularly to check the chemicals consumption. An inventory of material data sheets for all chemicals on the site should also be kept. Any new chemical proposed for purchase for the first time must be approved by site Environmental Officer prior to the purchase.

9.3.2.1.11 MONITORING OF TRUCKING AND MACHINERY ACTIVITIES

During both construction and operational phases, trucking and machinery shall be continuously monitored to avoid unnecessary use. Road and truck related accidents should be recorded.

9.3.2.1.12 HEALTH RISK / WORKPLACE MONITORING

In addition to the requirements listed above for noise monitoring inside the workplace, other important items should be taken included in the monitoring plan.

Item	Performance Standard	Monitoring Regime
Occupational Noise	Compliance with relevant legislation for noise levels inside the workplace (Annex7/executive regulations of Egyptian Law4, and IFC occupational health and safety guidelines)	▪ Weekly monitoring inside workplaces, including the jetty area using Type II noise instrument. If new operation is undertaken this may need to be more frequent. High noise areas will need occupational continual monitoring for workers. Weekly sampling to take place for the first 6 months of operation after which if no adverse impacts are

		noted, the frequency for monitoring can be reduced.
Air quality/ventilation inside the workplace	Precautions should be implemented to ensure no violation of relevant legislation (Egyptian criteria- Annex 8 of executive regulations of Law 4, and IFC health and safety standards).	▪ Daily tuning of equipment ▪ Mechanical ventilation systems are to be maintained in good working order. ▪ Point-source exhaust systems must have local indicators of correct functioning. ▪ Re-circulation of contaminated air is not acceptable. ▪ Air inlet filters must be kept clean and free from dust and micro-organisms.
Temperature inside the workplace	Compliance with relevant legislation (Egyptian criteria- Annex 9 of executive regulations of Law 4/ IFC health and safety criteria)	Ambient thermometer to be visually inspected and temperature recorded.
Cleanliness, and tidiness	No reportable violation	Ongoing monitoring – personal judgement
Accidents/month	No reportable accidents	▪ Daily records ▪ Regular review of records
Employees health conditions	No reportable work-related health problems	▪ A baseline check-up on all employees (before they start work) should be carried out. ▪ Employee medical check-up results, carried out periodically shall also be documented and stored.

9.3.2.2 Socio-Economic Monitoring

This monitoring covers relevant socio-economic impacts of the project and surrounding community/activities. A community survey should be undertaken annually beginning during the first year of construction and continuing annually for first 2 years of operation and every 2-3 years thereafter, in coordination with the community advisory panel (comprising members who represent the local community). Key elements to be monitored may include change of income, job availability, internal transportation costs, etc. The will be a mechanism to allow for community feedback to be evaluated and standards of performance monitored. This would include addressing complaints from the local community and public in a transparent manner. Annual socio-economic monitoring reports shall be kept with the EO.

9.3.2.3 Monitoring Documentation

This involves checking that all data are documented and interpreted, and that corrective actions are followed up and implemented.

9.3.2.3.1 Documentation

The documentation system (including logbooks, internal/external communication documentation, etc.) and environmental register should be regularly checked (bi-monthly) and updated (daily), in compliance with the requirements of Egyptian Law4/1994. Monitoring results should also be available to be presented to responsible authorities, as required. Upon discovery of any data gaps, corrective actions should be undertaken and documented. Corrective action should be followed up weekly until they are finalised.

Any such documentation system shall be structured so as to be ISO 9000-2000 certification-capable whether or not it is in fact certified. Wherever possible, the documentation shall be electronic.

9.3.2.4 Monitoring Work Plan

This section describes the tasks required to fulfil the monitoring requirements.

9.3.2.4.1 List of Tasks

- Review the monitoring plan.
- Set a start date, adjust all following dates to fit the monitoring schedule.
- Keep copies of the monitoring plan in areas relevant to sampling locations
- Review locations, monitoring parameter lists and activities (sampling, analysis, etc.)
- Clearly mark the monitoring locations on site plans.
- Conduct (or supervise) the required sampling and analysis.
- Record any site remarks observed, while sampling and analysing.
- Based on site remarks and data interpretation, determine non-conformances and requirements for corrective actions, if any.
- In case non-conformances are detected, propose, document and follow up on corrective actions (weekly).
- For each monitoring round, prepare a report including:
  - Findings of the monitoring program and data interpretation.
  - Status of corrective and preventative actions.
  - Remarks and recommendations.
  - Monitoring activities and dates for the coming round.

- During each monitoring round, examine previous monitoring results, and based on the parameter analyses levels, decide on any future additions or reductions in monitoring parameters and frequencies accordingly.

9.3.2.4.2 General recommendations

- It is advised that qualified individuals implement the monitoring program and train local representatives.
- It is recommended that sample analyses be conducted by a third-party accredited laboratory, to ensure that impartial objective data are produced.
- It is also recommended that all locations be accurately geo-referenced.

Any monitoring required is undertaken and paid for by the EPC Contractor (Construction) and EMethanex (Operation).

9.3.3 LEGISLATIVE AWARENESS

Awareness of current and pending legislation is maintained by assigning that responsibility to a specific job position (EPC contractor (Construction) and the Plant Manager (Operation)) and by using any or all of the following practices:

- Reviewing pending/ draft legislation and amendments to existing legislation and making submissions on them. Maintaining regular contact with the local statutory authorities and being part of their initial plan review group;
- Reviewing proposed Regional and District plans and assessing the potential impact of them. Serving on Government appointed committees reviewing pending regulations and development of new Standards;
- Attending business forums reviewing aspects of legislation; and
- Use of external services (e.g., consultants, lawyers).

9.3.4 SUPPLIER ASSESSMENTS

As a Responsible Care Company, EMethanex and its EPC Contractor will work with its suppliers to ensure the safe use, storage, handling, sale, distribution, recycle and disposal of chemical products so as to minimise adverse effects on human health and well being and on the environment. To achieve this, the supplier assessment process will include environmental aspects.

9.4 ASSESSING ENVIRONMENTAL EFFECTS AND SETTING TARGETS

9.4.1 ASSESSING ENVIRONMENTAL EFFECTS

This report constitutes the Environmental Assessments that has been carried out in relation to construction and operational activities at the site, and includes an assessment of:

- Physical Disturbance during Construction/ Maintenance;
- Air Emissions;
- Water Intake;
- Water Discharges;
- Waste Characterization and Inventory;
- Aesthetics;
- Noise;
- Consumption of chemicals, energy and other raw materials; and
- Labour and social issues.

Please refer to Chapter 6 of this EIA Report (Ref. KE-60029) for further details on specific construction and operational impacts.

9.4.2 SETTING ENVIRONMENTAL OBJECTIVES

There are a number of specific environmental objectives that relate to construction and operation of the plant. As such, in terms of key environmental objectives, the EPC Contractor (Construction) and EMethanex (Operation) will:

- Design, construct and operate its facilities in a manner that protects human Health and minimizes the impact of its operations on the environment;
- Strive for an injury-free work force and minimize environmental impact through implementation of programs in our facilities and the surrounding communities that reduce risks to employees, neighbours, the public at large and the environment;
- EMethanex, Basic Engineering Contractor and Main EPC Construction Contractor will encourage and promote waste minimization, the sustainable use of natural resources, recycling, energy efficiency, resource conservation and resource recovery;
- EMethanex, will actively participate with Egypt government agencies and other appropriate groups to ensure that the development and implementation of environmental policies, laws, regulations and practices serve the public interest and are based on sound scientific judgment;

- The implementation of the Project Environmental Policy is accomplished through organized environmental management systems;
- All employees are expected to work in a safe manner and comply with the company's Environmental policies and procedures. The Project Team will encourage and expect each employee to be environmentally responsible;
- Each component will comply with or exceed all applicable Environmental Egyptian's laws and regulations. Where existing laws and regulations are deemed inadequate, the EPC Contractor and/ or EMethanex will adopt its own (Methanex Corporation) Environmental Standards;
- Each component will develop and maintain written safety policies and programs to address known hazards in our project workplace. Policy and program effectiveness and compliance will be regularly assessed;
- Each component will provide a means for appropriate Environmental Safety communication with its employees, contractors, and visitors;
- Safe behaviour and judgment will be considered essential measures of performance at all levels;
- One of the most important components of these management systems is the Environmental Performance Review. The true significance of a frequent performance review is that it goes beyond compliance with Egypt government requirements and Methanex Corporation Policy;
- The frequency of audits is determined by the complexity of the construction operation or manufacturing operation and the potential environmental risk, as well as how critical the facility is to the company;
- Audit teams consist of environmental professionals from corporate environmental affairs, legal, and plant sites other than the site being audited. This cross section of environmental professionals helps promote communication and awareness of important issues;
- When an audit is completed, the auditors report the findings to the site environmental management team and works with them to develop action plans to correct any deficiencies found;
- Egypt State, and local environmental agencies perform frequent inspections of the Project facilities to determine compliance with environmental regulations and permits;
- Despite EMethanex and EPC Construction Contractor commitment to complying with every applicable regulation and conducting its own internal inspections, occasional violations may be noted, some of which result in the assessment of penalties. When a violation is discovered, the Team will immediately report the violation to the appropriate authorities and work quickly to correct the situation;

- The Project Team will recognize and respond to the community's questions about its operations. We believe strongly in responding to any questions or concerns our neighbours might have about who we are, what we do, and how we do it; and
- Our commitment to Responsible Care® has driven us to create a community issues forum at our project if it is necessary.
- **Recycle:** Recycling efforts can be seen throughout the EMethanex & Egypt Project organization from our manufacturing and Construction facilities to our office recycling programs.
- **Reuse:** Reusing materials is not only environmentally friendly, it's cost effective.
- **Treatment:** Progressive treatment programs have helped EMethanex lead the way in environmental stewardship (Catalyst, Oils, etc.).
- **Disposal:** EMethanex has been successful in reducing the amount of wastes it commits to disposal both on- and off-site. Only small, specialized waste streams are sent to third-party treatment.

9.4.3 PERFORMANCE STANDARDS

Performance standards during construction and operation for the site will be driven by:

- Permits, approvals and resource use consents;
- KPI targets set by EMethanex and EPC Contractor;
- Additional targets set from time to time; and
- Other external drivers (e.g., sensitive species, unique site conditions).

Environmental performance at the site is monitored regularly by the EPC Contractor (Construction) and EMethanex (Operation) and regulatory agencies. A monitoring programme related to specific approvals, permits or consents is included in tables in Section 9.3

9.4.4 WASTE MANAGEMENT PROCEDURES

The EIA outlines waste management system requirements for construction and operation as follows:

- Individuals and the company must accept responsibility for waste generated;
- Waste elimination at source, followed by recycling, reuse, or recovery are the preferred options to disposal;
- Where options other than disposal are not feasible, destruction or treatment to render the waste non-hazardous will be carried out if possible;
- If the hazard cannot be eliminated, the waste will be contained in a secure manner and monitored to ensure it is not and will not be damaging the environment; and

- Wastes will be segregated and quantified so they can be effectively managed. The amount of waste disposed of offsite will be kept to a minimum.

During construction and operation, all hazardous waste shipped from site requires a waste manifest to track generation, transportation, receipt and disposal. Disposal certificates are required from the waste disposal company and these are filed with the completed manifest to document the disposal process.

All waste disposal companies should have a supplier assessment carried out prior to use.

During operation, EMethanex manufacturing sites undergo major maintenance shutdowns on a regular but infrequent basis (approximately one every 2 years). Non–routine wastes are generated in large volumes at these times.

9.4.4.1 Waste handling

Reference Egyptian Law Decrees # 88 and 673 (1999) related to determining the hazardous substances and waste handling.

During construction and operational phases, normally the following types of waste exist:

- Hazardous waste; and
- Non Hazardous waste.

Hazardous waste materials, such as catalysts, shall be handled according to the plan prepared for each job. It shall be collected at a location approved by EMethanex.
Non hazardous industrial waste shall be stored in collection containers located around the job site and shall be appropriately identified. These waste materials will be constantly removed according to a schedule by an approved contractor.
Waste materials that could introduce agricultural plagues or complications must be handled according to the requirements of the appropriate governmental agency.

9.4.4.2 Waste Handling Program

A waste handling program must exist for all the following waste steams in order to avoid waste accumulation and to prevent major problems in future.

- Wooden handling program & disposal;
- Plastic waste handling program & disposal;
- Metal cuttings handling program & disposal;
- Used oils handling program & disposal;

- Paint containers handling program & disposal;
- Chemical cleaning waste (piping and vessels) handling program & disposal;
- Paper waste handling program & disposal;
- Domestic sewage waste handling program & disposal;
- Bio hazard waste handling program & disposal
- Domestic (food) waste handling program & disposal; and
- Administration offices waste handling program & disposal.

9.4.4.3 Waste containers and Labelling

Each type of waste material must be placed in adequate containers bearing in mind weather conditions (rainfalls, strong winds and other climatic conditions) in the area in order to avoid spillage of hazardous products.

Hazardous waste containers shall be identified with the NFPA diamond and labelled with the content identification and associated risks

The diamond is broken into four sections. Numbers in the three coloured sections range from 0 (least severe hazard) to 4 (most severe hazard). The fourth (white) section is left blank and is used only to denote special fire fighting measures/hazards.

	**Health Hazard** **4** Very short exposure could cause death or serious residual injury even though prompt medical attention was given. **3** Short exposure could cause serious temporary or residual injury even though prompt medical attention was given. **2** Intense or continued exposure could cause temporary incapacitation or possible residual injury unless prompt medical attention is given.

	1 Exposure could cause irritation but only minor residual injury even if no treatment is given. **0** Exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials.

A full Waste Management Plan must be completed but the EPC Contractor (Construction) and EMethanex (Operation) prior to the start of these phases.

9.4.5 ENVIRONMENTAL OBJECTIVES FOR THE YEAR

Specific objectives, though the formulation of annual Responsible Care plans, will cover the construction and operational phases. These will be created in due course, starting with the first construction Responsible Care plan, which will be created with significant input from the EPC Contractor.

9.5 PROCEDURES AND PROCEDURAL REVIEW

9.5.1 FACILITY CONSTRUCTION AND OPERATING PROCEDURES

For any EMS to be effective, every site must have in place procedures relating to the following activities:

9.5.1.1 Construction Procedures

EMethanex will require, through contract terms, that this framework EMP is adopted and developed by the EPC Contractor. Suppliers will also be included in the EMP, through auditing and approved supplier lists.

9.5.1.2 Normal Operating Procedures

These procedures cover all unit operations such as plant start-up, shutdown, restart and all operating equipment. The procedures can be linked together in a hierarchical structure according to the links between sections of plant.

These procedures also cover routines that are scheduled on a time basis. Routines cover such operations as standby pump checks, safety equipment checks and critical alarm checks.

9.5.1.3 Emergency Procedures

These procedures cover all uncontrolled initial events, which by use of the emergency procedures allows the incident, plant and equipment to be brought under control, whilst minimizing adverse impacts on health, safety and the environment.

9.5.1.4 Operational Plans

These plans provide the philosophy by which the plant must be operated. They contain such information as resource consent, permit and approvals limits, constraint parameters, guiding principles and optimization parameters. All operating procedures are bounded by the relevant plant operating plan.

9.5.1.5 Administration Procedures

These procedures cover the methods by which each department is administered.

9.5.1.6 Production and Utilities Technical Procedures

These procedures are relevant to the routine functions performed by the Technical group.

9.5.1.7 Laboratory Procedures

These are the procedures used by the Laboratory and are controlled by an internal Laboratory Quality Manual which will be produced prior to the start of operations.

9.5.2 ENVIRONMENTAL PROCEDURES

Specific environmental procedures must be in place prior to the commencement of construction or operation. Procedures may include (this list is not exhaustive – it is to be fully developed in final EMP):

- Effluent Monitoring Procedures;
- Stack Emission Monitoring Procedures;
- Procedure for Notification of Environmental Exceedances;
- Environmental Consents & Permits;
- Generation of Routine Statutory Environmental Reports;
- Sludge Management;
- Solid Waste Disposal and Reuse Procedures;
- Management of Ozone Depleting Substances;
- Hazardous Materials (HAZMAT) & Hazardous Waste Management System;
- Emergency Response Procedures; and
- Environmental & Security Management.

A full list will be created with the EPC Contractor (Construction) and EMethanex (Operation) prior to commencement of works.

9.5.3 ENVIRONMENTAL PROCEDURE REVIEW

The procedures are reviewed according to the frequency specified in the document control system, or on an as-required basis following an incident, or non-compliance.

9.6 EMERGENCY PREPAREDNESS

9.6.1 EMERGENCY PROCEDURES

The Emergency Procedures state the site contingency plans that cover all potential accidental events during both construction and operation. Specific Emergency Procedures must be developed by the EPC Contractor (Construction) and EMethanex (Operation) prior to the commencement of these phases.

These procedures govern any emergency incidents on EMethanex sites such as spills, fires, gas leaks or personnel injury or rescues. Emergency Response procedures cover most chemical emergency incidents.

9.6.2 EMERGENCY RESPONSE PERSONNEL

Emergency Response Team

The role of the emergency response team (ERT) is to handle any emergency incident at during construction and operations of the EMethanex site in Damietta. The ERT is responsible for all incidents including Hazardous material handling, rescue and fire control.

Members of this team, or other nominated employees. may be requested by the EPC Contractor (Construction) and/ or EMethanex (Operation) management to give advice or assistance in any incident in which EMethanex products are or could be involved, outside of any EMethanex facility. The ERT may be requested by EPC Contractor (Construction) and/ or EMethanex (Operation) management to assist any other company in the event of mutual aid.
The ERT may consist of shift operators and relevantly trained day staff volunteers. This team will be lead by the Incident Controller, based in the construction offices (Construction) or control room (Operation). A site chief will be assigned and control the incident from the field. A coordinator will be assigned to control all services requested from the site chief, these will include all outside services, such as fire, ambulance and other public services.

9.7 COMMUNITY PARTNERSHIPS

Development of community partnerships, e.g. community projects, community advisory panels and handling complaints and queries, is a component of many Environmental Management Systems, such as ISO 14001.

9.7.1 COMMUNITY PROJECTS

EMethanex actively supports the community in a number of ways. These include donations, sponsorships, and other support projects that may be undertaken from time to time. Donations and sponsorships are managed through an internal Social Investment Committee of which the Manufacturing Director and the Manager of Public Affairs are members.

Each year a community communication programme will be developed and documented. Communities that may be defined in this document are (not exhaustive):

- Local Workforce of the EPC Contractor and Suppliers (Construction);
- Plant Neighbours;
- EPC Contractors (Construction) and EMethanex Staff & Families;
- Temporary and Permanent Contractors;
- Local, Regional and National Regulators (as necessary);
- Emergency Services;
- Local Industry;
- Medical Fraternity;
- Port/ Marine Users and Authorities; and
- Schools and Technical Colleges.

A full list will be created with the EPC Contractor (Construction) and EMethanex (Operation) prior to commencement of works.

9.7.2 COMMUNITY ADVISORY PANEL

A community advisory panel will be set up, comprising members who represent the local community. The panel will be mandated to meet on a regular basis, and will receive copies of internal and external communications relating to community issues.

9.7.3 COMPLAINTS / QUERIES

The EPC Contractor (Construction) and EMethanex (Operation) will foster a good relationship with the community, and will be open to receiving suggestions or complaints.

The procedure for dealing with complaints from the public or from other interested parties will be dealt with in a Public Affairs Procedures document, that must be completed prior to the start of construction. Any complaints that are received will be dealt with in a timely manner and followed up with a written letter.

9.8 REPORTING

9.8.1 REPORTING OF ENVIRONMENTAL EXCEEDANCES

The reporting of exceedances will take the following path:

- Recording of the nature and scale of the exceedance,
- reporting to the necessary competent/ responsible persons,
- internal global reporting and external regulatory notification.

It should be stressed that the severity of the exceedance will determine the speed of reporting and the type of response that will be required.

Full procedures will be developed as part of the final EMP for construction and operational phases, prior to these phases commencing.

9.8.2 INTERNAL REPORTING

During construction and operation, environmental performance against targets is reviewed by management at monthly frequency and reported to the EPC Contractor and EMethanex Corporation at monthly frequency.

9.8.3 INCIDENT / INJURY REPORTING

EMethanex uses an integrated incident reporting system for all EHS incidents. This will also apply to the EPC Contractor.

An incident is defined as an uncontrolled or undesired event which reasonably had the potential to, or did endanger people, damage property, cause loss of production, result in breach of procedures, or impact on the environment or the Company's image.

The types of incident that are reported on the EMethanex Damietta site during construction and operation will include, as a minimum, the following:

- Health and Safety including medical, first aid, lost time, and Near Miss;
- Environmental;
- Procedure Non-compliance;
- Loss Prevention;

- Quality; and
- Potential Majors.

The system is designed to record incidents and to ensure investigation, root cause analysis, corrective action and follow up. Records are kept of all incidents, investigations and actions.

9.8.4 REGULATORY REPORTING

The frequency of regulatory reporting, in terms of licenses, permits, etc. will be set during the license application negotiations. These procedures will be included within the final EMP for construction and operation.

9.8.5 ANNUAL REPORTING

Regulatory and HSE reporting systems will be brought together on a monthly basis to be collated and input into EMethnex's Reporting System. On an annual basis, the yearly results from this system will provide annual performance figure for scrutiny by interested parties, both internally (EMethanex) and externally (e.g. Community Advisory Group).

9.9 AUDITING AND MANAGEMENT REVIEW

9.9.1 AUDIT PROGRAM

An auditing program is a component of many Environmental Management Systems, such as ISO 14001.

Methanex instituted Responsible Care auditing in 1995 with the environmental compliance / environmental management system assessment.

- Methanex has its own internal audit program that will be shared and will include the EMethanex facility in Damietta.

9.9.2 AUDIT PURPOSE

The company-wide Methanex Responsible Care audit program is a critical component of EMethanex's management system for assessing and continually improving Responsible Care performance. We communicate the information gathered from audits to all key individuals to ensure that they are aware of the Responsible Care challenges and the areas of opportunity to reduce risk. This requirement will be also be a contractual requirement for the EPC Contractors during construction.

The EMethanex Audit system is sponsored by the Senior Vice President of Corporate Resources and through this position, audit results and corrective actions are reported directly to the Senior Management of EMethanex and the Board of Directors.

The primary purposes of the audit program are:

- To verify continued conformance with respect to all applicable laws and regulations, to Responsible Care guiding principles, and to EMethanex internal policy and procedure;
- To confirm the continued existence and efficacy of management systems to ensure compliance and superior performance;
- To assist in the identification of actual and / or potential risks.

The realized benefits of the program are:

- Assistance for management in identifying and prioritizing activities and / or practices that have opportunities for improvement;
- Reduction in risk through identification of areas of concern and triggering appropriate corrective action;
- Promotion of consistency in Responsible Care approach and performance at all EMethanex facilities; and
- Assistance with benchmarking and measuring improvement in Responsible Care performance.

9.9.3 AUDIT SCOPE

The Audit Program applies to all divisions of Methanex Corporation and its subsidiaries. This may include all EMethanex facilities/sites/offices, feedstock and product pipelines and terminals.

EPC Contractors not directly under the control of EMethanex management may be included in the Audit Program.

The Audit Program also recognizes that Customer/Supplier Assessments are carried out at third party terminals. Audits of these locations will focus on the quality of the assessment program.

10 QUALITATIVE RISK ASSESSMENT

10.1 EXECUTIVE SUMMARY

It is proposed to construct a 3,600 metric tonne per day (MTPD) methanol plant at Damietta Port Marine Terminal on the Mediterranean coast of Egypt. The plant will produce International Methanol Producers and Consumers Association "IMPCA" grade methanol from natural gas via a combined reforming methanol process.

The purpose of this section of the EIA is to conduct a basic qualitative risk assessment summary for the proposed facility. The purpose of the assessment is twofold, i.e.

- to establish where the major risks lie within the development, in order that these can be carried forward for more detailed assessment;
- to eliminate minor and / or non-credible risks from further analysis.

This assessment is designed to meet the requirements of the Egyptian regulatory authorities for:-

> *"…an assessment of the occurrence of potential industrial hazards, e.g. accidental spills, fires, explosions, impoundment structural failure, gaseous releases. Consideration of the ability of the community to provide emergency response services for potential industrial hazards. Also it is necessary considering the ability of the establishment and the community to provide medical services to respond emergencies."*

The overall conclusions of this section are the following:

- There are a range of potential hazard scenarios arising from this project, however these are all considered to be 'typical' for developments of this type. No unusual or novel features have been identified during the course of this study.
- With regard to the risks arising from loss of containment and other significant hazards, the results of previous studies carried out for similar facilities elsewhere in the world indicate that these are likely to be within acceptable criteria for both workers and members of the public. However, there is insufficient site and project-specific data available at this time to conduct a Quantitative Risk Assessment for this development, and thus to confirm (or otherwise) that this will be the case at Damietta Port. It should be noted that Egyptian regulatory requirements do not appear to require that a quantitative assessment is carried out, only that industrial hazards are 'assessed' – from which it may be assumed that a qualitative risk assessment may provide sufficient demonstration of compliance. However, it is still recommended that more detailed analysis is conducted on the hazard scenarios deemed to present the

greatest risk to both personnel within the facility and members of the public residing beyond it, to ensure that appropriate measures are taken during the design and installation of the facility to eliminate, control or mitigate the hazards associated with this type of development.

- There is presently insufficient information regarding the arrangements for emergency response to reach a conclusion as to the ability of the establishment and the community to provide medical services under these conditions. As discussed, it is recommended that a Quantitative Risk Assessment be undertaken prior to construction. This would include detailed assessment of this aspect.

10.2 INTRODUCTION

10.2.1 Construction Materials, Equipment, and Activities

The construction scope will be typical for developments of this type and is described in detail in section 3 of this EIA report, but can be summarised as:

- general site grading;
- access and service roads;
- administrative, control and maintenance buildings;
- methanol process unit, including crude / off-spec methanol tank and two methanol product tanks and pumps;
- steam generation and fresh raw water intake treatment and ancillary utility systems;
- diesel emergency generators; and,
- cooling water towers.

Site grading will be minimal due to the current level nature of the site. The general earth work will consist of cut and fill activities for grading of the site, construction of dikes, foundation and pavement sub-grade preparation and excavation and backfill for utilities and drainage facilities. Other major on-site activities will include erection of process vessels, acceptance and placement of major fabricated equipment items, construction of buildings, testing and commissioning of rotating equipment, vessels and piping.

10.2.2 Process Description

A 3,600 metric tonne per day (MTPD) methanol plant is proposed during phase I of the project. The plant will produce IMPCA grade methanol from natural gas via a combined reforming methanol technology process.

10.2.3 Population Settlements

During the peak construction phase, it is anticipated that approximately 1 500 personnel will be present on-site. However, these will only be present when actually on-shift – no on-site accommodation is to be provided and the workforce is to be housed in a residential area within New Damietta City. It should be further noted that the workforce will only be exposed to the majority of the most serious hazardous events, i.e. those relating to loss of containment of pressurised flammable inventories, once the plant reaches the commissioning stages. Risks during the construction phase will be largely limited to occupational type accidents, e.g. traffic accidents, dropped objects, slips, trips and falls, etc.

During the operational phase of the project, it is intended that the complex will have 150 workers, with the majority of personnel housed within a dedicated maintenance building.

A few members of the public (farmers) may be present adjacent to the western boundary of the site and there is a permanent settlement of approximately 500 persons located to the north and west of the facility. It would appear that no part of the methanol complex is within 200 metres of the SEGAS Fence, which is assumed to form the northern boundary of the complex (and hence the minimum distance separating members of the public from the facilities), however this assumption is to be confirmed.

10.3 METHODOLOGY

Based on project available information, a preliminary assessment of the hazards and risks posed by the development has been conducted. This assessment is designed to meet the requirements of the Egyptian regulatory authorities for:

> *"…an assessment of the occurrence of potential industrial hazards, e.g. accidental spills, fires, explosions, impoundment structural failure, gaseous releases. Consideration of the ability of the community to provide emergency response services for potential industrial hazards. Also it is necessary considering the ability of the establishment and the community to provide medical services to respond emergencies."*

Based on the supplied documents, a high level preliminary hazard analysis has been carried out, by assessing each potential identified hazard in terms of the consequences of its realisation and the likelihood of its occurrence. From this process was derived an overall risk category for each of the identified events. Table 10-1 illustrates a standard Risk Matrix for this process.

Table 10-1: Risk Matrix

SEVERITY	CONSEQUENCES				INCREASING LIKELIHOOD				
	PEOPLE	ASSETS	ENVIRONMENT	REPUTATION	Never heard of in chemical industry ($>10^{-6}$ to 10^{-5})	Heard of in chemical industry ($>10^{-5}$ to 10^{-3})	Incident has occurred in our company ($>10^{-2}$ to 10^{-3})	Happens several times per year in our Company ($> 10^{-1}$ to 10^{-2})	Happens several times a year in a location ($> 10^{-1}$)
0	No health effect/injury	No damage	No effect	No impact	NEGLIGIBLE	LOW	LOW	LOW	LOW
1	Slight health effect/injury	Slight damage	Slight effect	Slight impact	LOW	LOW	LOW	LOW	LOW
2	Minor health effect/injury	Minor damage	Minor effect	Limited impact	LOW	LOW	LOW	MEDIUM	MEDIUM
3	Major health effect/injury	Localised damage	Localised effect	Considerable impact	LOW	LOW	MEDIUM	MEDIUM	HIGH
4	Permanent total disability (PTD) or 1 – 3 fatalities	Major damage	Major effect	National impact	LOW	MEDIUM	MEDIUM	HIGH	HIGH
5	Multiple fatalities	Extensive damage	Massive effect	International impact	MEDIUM	MEDIUM	HIGH	HIGH	HIGH

RISK CATEGORY	ACTION REQUIRED	OVERALL RISK CATEGORY:
HIGH	Design out whenever possible	
MEDIUM	Mitigate at source plus Operational Controls	
LOW	Control/Manage risk via Operational Controls, etc	
NEGLIGIBLE	No action required	

Established hazard identification techniques were used to identify all significant potential hazards and credible accident events for the facility. As only limited project information is available at this stage of development, certain generic assumptions regarding the operation of these types of facilities have been made. It should be particularly noted that there is very limited information available regarding the various systems to be provided for the detection, control, mitigation and recovery from accident events. In assessing the likely seriousness of the consequences of such events, it has been assumed that the usual types of protection will be provided, e.g. fire and gas detection, emergency shutdown / blow-down systems, active fire protection systems and emergency power systems and that these (and the facility itself) will be designed to internationally recognised Codes and Standards. The principal source of reference material is this EIA report, from which have been derived materials' composition and product specifications.

The next stage in the assessment process was to conduct a systematic review of the potential hazardous scenarios which may arise from operation of project facilities, focussing particularly on hazards arising from hydrocarbon loss of containment events, e.g. fire (jet and pool) and vapour cloud explosions. At this stage in project development, it is only possible to identify which of the identified events should be carried forward into detailed Quantitative Risk Assessment (QRA), if this is to be carried out, once the process parameters have been defined. As a result of this initial review process, carried out using the risk matrix given in Table 10-1 above, the following types of events were screened out from further analysis:

- incidents which were considered to be non-credible, i.e. where either the proposed method of operation would preclude the realisation of such an event, or where the frequency with which it may occur is so low as to be negligible, or
- where the consequences of an event would have only limited localised impact, with no further escalation potential.

This then leaves major incidents with potential off-site consequences, or with the potential to escalate to cause off-site impacts, to be carried forward and subjected to more detailed analysis.

10.4 HAZARD SCREENING PROCESS

As has been stated above, a comprehensive approach to Hazard Identification has been adopted, based on the project process /layout information currently available. The following hazards have been identified and are discussed in detail within the Hazard Summary sheets given in this section.

DAMIETTA PORT METHANOL PROCESSING FACILITY HAZARD REGISTER HAZARD SUMMARY SHEETS		TABLE No.: CL1
HAZARD DESCRIPTION		
Hazard Number:	CL1	**Areas affected:**
Hazard Category:	Containment Loss	Natural gas feed supply, conditioning and compression facilities (inc desulphurisation unit)
System:	Process Gas	
Frequency:	Medium	
Consequence	High	
Risk Rating:	High	
Outcome:	Carry forward into QRA and Risk Register	
Description:	Major release of gas under pressure which may form a flammable gas cloud and could be ignited causing an explosion, flashfire or jet fire. Fire may injure personnel, damage other infrastructure or cause escalation to other areas, including possibly beyond the fence.	

HAZARD CAUSES				
DIRECT CAUSE	**POTENTIAL CONSEQUENCES**	**MAJOR ESCALATING CONSEQUENCES**	**PROCEDURES FOR CONTROL AND PREVENTION**	**PROCEDURES FOR DETECTION AND MITIGATION**
CL 1.1 Material failure				
Corrosion Erosion Fatigue (due to pressure & temp. changes) Defect Vibration	Failure of / leakage from pressure containing pipework and vessels. Loss of containment leading to Gas Release and possible Fire / Explosion	Fatalities Personnel injury Equipment Damage Process Downtime	Internal/ external: Design codes Corrosion allowance Integrity Management System	Routine inspection Preventive Maintenance procedures Emergency procedures in the event of loss of containment and / or Fire / Explosion, e.g. – F&G detection – ESD/ Blowdown/ Flare – Electrical Shutdown – AFP deployment
CL 1.2 Natural Occurrences				

Earthquake	Possible loss of local structural support depending on severity Potential loss of containment leading to Gas Release and possible Fire / Explosion	Fatalities Personnel injury Equipment Damage Process Downtime Potential loss of AFP and safeguarding systems	Design basis	Emergency Procedures in the event of loss of containment and / or Fire Explosion as for Corrosion, etc. above
HAZARD CAUSES (cont'd)				
DIRECT CAUSE	**POTENTIAL CONSEQUENCES**	**MAJOR ESCALATING CONSEQUENCES**	**PROCEDURES FOR CONTROL AND PREVENTION**	**PROCEDURES FOR DETECTION AND MITIGATION**
Extreme weather (e.g. high ambient temperature, dust and storm)	Reduced efficiency of some equipment, but loss of containment not envisaged.	N/A	Design codes and standards	Routine inspection to detect weather induced defects Maintenance procedures
Lightning	Potential loss of containment leading to Fire / Explosion	Fatalities Personnel injury Major Equipment Damage Major Process Downtime	Design codes and standards	Lightning arrestors and conductors Earthing Maintenance procedures
Subsidence	As for Earthquake above			
CL 1.3 Impact				
Aircraft (e.g. helicopter, commercial / military)	Loss of local structural support depending on severity. Potential loss of containment leading to Fire / Explosion	Fatalities Personnel injury Major Equipment Damage Major Process Downtime	Control of aircraft movements	Aircraft Warning Lights to alert aircraft to the presence of the installation Emergency procedures in the event of loss of containment and / or Fire Explosion, e.g. – F&G detection – ESD/ Blowdown/ Flare – Electrical Shutdown – AFP deployment

From Vehicular Transport (e.g. from road tankers, cranes, lifting equipment)	Potential damage to pressure containing pipework / vessels. Potential loss of containment leading to Gas Release and Fire / Explosion Potential ignition source from motors	Fatalities Personnel injury Equipment Damage Process Downtime	Restricted Access Inherent safe design of plant/ road layout Barriers protecting critical equipment Training and competence assessment of drivers Lifting procedures	Emergency procedures in the event of loss of containment and / or Fire Explosion, e.g. – F&G detection – ESD/ Blowdown/ Flare – Electrical Shutdown – AFP deployment
CL 1.4 Human Error				
Smoking/ Naked Flames Valves left open Maintenance Error	Potential loss of containment Gas Release and possible Fire / Explosion	Fatalities Personnel injury Equipment Damage Process Downtime	Operational procedures Permit to work system Training and Competence Assessment	Emergency procedures in the event of loss of containment and / or Fire Explosion, e.g. – F&G detection – ESD/ Blowdown/ Flare – Electrical Shutdown – AFP deployment

DAMIETTA PORT METHANOL PROCESSING FACILITY HAZARD REGISTER HAZARD SUMMARY SHEETS			TABLE No.: CL2
HAZARD DESCRIPTION			
Hazard Number:	CL2	**Areas Affected:**	
Hazard Category:	Containment Loss	Natural gas reforming equipment, including primary and auto thermal reformer units, boilers and coolers.	
System:	Process Gas		
Frequency:	Medium		
Consequence:	High		
Risk Rating:	High		
Outcome:	Carry forward into QRA and Risk Register		
Description:	Major release of gas under pressure which may form a flammable gas cloud and could be ignited causing an explosion/ flashfire or jet fire. Fire may injure personnel, damage other infrastructure or cause escalation to other areas, including possibly beyond the fence		

HAZARD CAUSES				
DIRECT CAUSE	**POTENTIAL CONSEQUENCES**	**MAJOR ESCALATING CONSEQUENCES**	**PROCEDURE FOR CONTROL AND PREVENTION**	**PROCEDURES FOR DETECTION AND MITIGATION**
CL 2.1 Material failure				
Corrosion Erosion Fatigue (due to pressure & temp. changes) Defect Vibration	Failure of / leakage from pressure containing pipework and vessels. Loss of containment leading to Gas Release and possible Fire / Explosion	Fatalities Personnel injury Equipment Damage Process Downtime	Internal/external: Design codes Corrosion allowance Integrity Management System	Routine inspection Preventive Maintenance procedures Emergency procedures in the event of loss of containment and / or Fire / Explosion, e.g. – F&G detection – ESD/ Blowdown/ Flare – Electrical Shutdown – AFP deployment
CL 2.2 Natural Occurrences				

Earthquake	Possible loss of local structural support depending on severity Potential loss of containment leading to Gas Release / Fire / Explosion	Fatalities Personnel injury Process Downtime Potential loss of safeguarding systems	Design basis	Emergency Procedures in the event of loss of containment as for Corrosion, etc. above

HAZARD CAUSES				
DIRECT CAUSE	**POTENTIAL CONSEQUENCES**	**MAJOR ESCALATING CONSEQUENCES**	**PROCEDURE FOR CONTROL AND PREVENTION**	**PROCEDURES FOR DETECTION AND MITIGATION**
Extreme weather (e.g. high ambient temperature, dust and storm)	Reduced efficiency of some equipment, but loss of containment not envisaged.	N/A	Design codes and standards	Routine inspection to detect weather induced defects Maintenance procedures
Lightning	Loss of containment leading to Gas Release	Fatalities Personnel injury Process Downtime	Design codes and standards	Lightning conductors Earthing Maintenance procedures
Subsidence	As for Earthquake above			
CL 2.3 Impact				
Aircraft (e.g. helicopter, commercial / military)	Loss of local structural support depending on severity. Loss of containment leading to Gas Release	Fatalities Personnel injury Major Equipment Damage Major Process Downtime	Control of aircraft movements	Navigation Aids alert aircraft to the presence of the installation Emergency procedures in the event of loss of containment – Gas detection – ESD/ Blowdown/ Flare – Emergency Response

From Vehicular Transport (e.g. from tankers, cranes, lifting equipment)	Potential damage to pressure containing pipework / vessels. Loss of containment leading to Gas Release	Fatalities Personnel injury Process Downtime	Restricted Access Inherent safe design of plant/road layout Barriers protecting critical equipment Training and competence assessment of drivers Lifting procedures	Emergency procedures in the event of loss of containment, e.g. – Gas detection – ESD/ Blowdown/ Flare – Emergency Response
CL 2.4 Human Error				
Smoking/ Naked Flames Valves left open Maintenance Error	Loss of containment leading to Gas Release	Fatalities Personnel injury Process Downtime	Operational procedures Permit to work system Training and Competence Assessment	Emergency procedures in the event of loss of containment, e.g. – Gas detection – ESD/ Blowdown/ Flare – Emergency Response

DAMIETTA PORT METHANOL PROCESSING FACILITY HAZARD REGISTER HAZARD SUMMARY SHEETS		TABLE No.: CL3
HAZARD DESCRIPTION		
Hazard Number:	CL3	**Areas Affected:**
Hazard Category:	Containment Loss	Methanol synthesis equipment
System:	High pressure methanol	
Frequency:	Medium	
Consequence:	High	
Risk Rating:	High	
Outcome:	Carry forward into QRA and Risk Register	
Description:	Release of high pressure (80 barg) flammable methane gas from synthesis equipment. This may form a flammable gas cloud and could cause an explosion, spray fire if the gas source continues to be fed or pool fire. Fire may injure personnel, damage other infrastructure or cause escalation to other areas, including beyond the fence	

HAZARD CAUSES				
DIRECT CAUSE	**POTENTIAL CONSEQUENCES**	**MAJOR ESCALATING CONSEQUENCES**	**PROCEDURE FOR CONTROL AND PREVENTION**	**PROCEDURES FOR DETECTION AND MITIGATION**
CL 3.1 Material failure				
Corrosion Erosion Fatigue (due to pressure & temp. changes) Defect Vibration	Failure of / leakage from pressure containing pipework and vessels. Loss of containment leading to Gas Release and possible Fire	Fatalities Personnel injury Equipment Damage Process Downtime	Internal/external: Design codes Corrosion allowance Integrity Management System	Routine inspection Maintenance procedures Emergency procedures in the event of loss of containment and / or Fire / Explosion, e.g. – F&G detection – ESD/ Blowdown/ Flare – Electrical Shutdown – AFP deployment
CL 3.2 Natural Occurrences				

Earthquake	Possible loss of local structural support depending on severity Potential loss of containment leading to Gas Release and possible Fire / Explosion	Fatalities Personnel injury Equipment Damage Process Downtime Potential loss of AFP and safeguarding systems	Design basis	Emergency Procedures in the event of loss of containment and / or Fire Explosion as for Corrosion, etc. above

HAZARD CAUSES				
DIRECT CAUSE	**POTENTIAL CONSEQUENCES**	**MAJOR ESCALATING CONSEQUENCES**	**PROCEDURE FOR CONTROL AND PREVENTION**	**PROCEDURES FOR DETECTION AND MITIGATION**
Extreme weather (e.g. high ambient temperature, dust and storm)	Reduced efficiency of some equipment, but loss of containment not envisaged.	N/A	Design codes and standards	Routine inspection to detect weather induced defects Maintenance procedures
Lightning	Potential loss of containment leading to Fire / Explosion	Fatalities Personnel injury Major Equipment Damage Major Process Downtime	Design codes and standards	Lightning conductors Earthing Maintenance procedures
Subsidence	As for Earthquake above			
CL 3.3 Impact				
Aircraft (e.g. helicopter, commercial / military)	Loss of local structural support depending on severity. Potential loss of containment leading to Fire / Explosion	Fatalities Personnel injury Major Equipment Damage Major Process Downtime	Control of aircraft movements	Navigation Aids alert aircraft to the presence of the installation Emergency procedures in the event of loss of containment and / or Fire Explosion, e.g. – F&G detection – ESD/ Blowdown/ Flare – Electrical Shutdown – AFP deployment

From Vehicular Transport (e.g. from tankers, cranes, lifting equipment)	Potential damage to pressure containing pipework / vessels. Potential loss of containment leading to Gas Release and Fire / Explosion Potential ignition source from motors	Fatalities Personnel injury Equipment Damage Process Downtime	Restricted Access Inherent safe design of plant/road layout Barriers protecting critical equipment Training and competence assessment of drivers Lifting procedures	Emergency procedures in the event of loss of containment and / or Fire Explosion, e.g. – F&G detection – ESD/ Blowdown/ Flare – Electrical Shutdown – AFP deployment
CL 3.4 Human Error				
Smoking/Naked Flames Valves left open Maintenance Error	Potential loss of containment Gas Release and possible Fire / Explosion	Fatalities Personnel injury Equipment Damage Process Downtime	Operational procedures Permit to work system Training and Competence Assessment	Emergency procedures in the event of loss of containment and / or Fire Explosion, e.g. – F&G detection – ESD – Electrical Shutdown – AFP deployment

DAMIETTA PORT METHANOL PROCESSING FACILITY HAZARD REGISTER HAZARD SUMMARY SHEETS		TABLE No.: CL4
HAZARD DESCRIPTION		
Hazard Number:	CL4	**Areas Affected:**
Hazard Category:	Containment Loss	Methanol distillation three column system
System:	Liquid methanol	
Frequency:	Medium	
Consequence:	High	
Risk Rating:	High	
Outcome:	Carry forward into QRA and Risk Register	
Description:	Release of flammable methanol, which if ignited will result in a pool fire. Fire may injure personnel and damage other infrastructure.	

HAZARD CAUSES				
DIRECT CAUSE	**POTENTIAL CONSEQUENCES**	**MAJOR ESCALATING CONSEQUENCES**	**PROCEDURE FOR CONTROL AND PREVENTION**	**PROCEDURES FOR DETECTION AND MITIGATION**
CL 4.1 Material failure				
Corrosion Erosion Fatigue (due to pressure & temp. changes) Defect Vibration	Failure of / leakage from pressure containing pipework and vessels. Loss of containment leading to predominantly Liquid Release and pool Fires	Damage to equipment containing methanol causing further escalation.	Internal/external: Design codes Corrosion allowance Integrity Management System Passive fireproofing of structures supporting process equipment	Routine inspection Maintenance procedures Emergency procedures in the event of loss of containment and / or Fire / Explosion, e.g. – F&G detection – ESD – Electrical Shutdown – AFP deployment
CL 4.2 Natural Occurrences				

Earthquake	Possible loss of local structural support depending on severity Potential loss of containment leading to liquid release and possible Pool Fire.	None – consequences are considered to be localised only.	Design basis	Emergency Procedures in the event of loss of containment and / or Fire Explosion as for Corrosion, etc. above

HAZARD CAUSES				
DIRECT CAUSE	**POTENTIAL CONSEQUENCES**	**MAJOR ESCALATING CONSEQUENCES**	**PROCEDURE FOR CONTROL AND PREVENTION**	**PROCEDURES FOR DETECTION AND MITIGATION**
Extreme weather (e.g. high ambient temperature, dust and storm)	Reduced efficiency of some equipment, but loss of containment not envisaged.	N/A	Design codes and standards	Routine inspection to detect weather induced defects Maintenance procedures
Lightning	Potential loss of containment leading to Fire / Explosion	None – consequences are considered to be localised only.	Design codes and standards	Lightning conductors Earthing Maintenance procedures
Subsidence	As for Earthquake above			
CL 4.3 Impact				
Aircraft (e.g. helicopter, commercial / military)	Loss of local structural support depending on severity. Potential loss of containment leading to Fire / Explosion	None – consequences are considered to be localised only.	Control of aircraft movements	Aircraft warning lights on the tallest structure to alert aircraft to the presence of the installation Emergency procedures in the event of loss of containment and / or Fire Explosion, e.g. – F&G detection – ESD – Electrical Shutdown – AFP deployment

From Vehicular Transport (e.g. from tankers, cranes, lifting equipment)	Potential damage to pressure containing pipe work / vessels. Potential loss of containment leading to Gas Release and Fire / Explosion Potential ignition source from motors	None – consequences are considered to be localised only.	Restricted Access Inherent safe design of plant/road layout Barriers protecting critical equipment Training and competence assessment of drivers Lifting procedures	Emergency procedures in the event of loss of containment and / or Fire Explosion, e.g. – F&G detection – ESD – Electrical Shutdown – AFP deployment
CL 4.4 Human Error				
Smoking/ Naked Flames Valves left open Maintenance Error	Potential loss of containment Gas Release and possible Fire / Explosion	None – consequences are considered to be localised only.	Operational procedures Permit to work system Safety Training and Competence Assessment	Emergency procedures in the event of loss of containment and / or Fire Explosion, e.g. – F&G detection – ESD – Electrical Shutdown – AFP deployment

DAMIETTA PORT METHANOL PROCESSING FACILITY HAZARD REGISTER HAZARD SUMMARY SHEETS				TABLE No.: CL5
HAZARD DESCRIPTION				
Hazard Number:	CL5	**Areas Affected:**		
Hazard Category:	Containment Loss	Methanol storage and loading facilities, including tank and pumps		
System:	Liquid methanol			
Frequency:	Low			
Consequence	High			
Risk Rating:	High			
Outcome:	Carry forward into QRA and Risk Register			
Description:	Release of flammable methanol, which if ignited will result in a pool fire, either in tank bunds or on the sea in the event of breach of loaded ships at jetty. Fire may injure personnel, damage other infrastructure and potentially escalate beyond the boundary wall			
HAZARD CAUSES				
DIRECT CAUSE	**POTENTIAL CONSEQUENCES**	**MAJOR ESCALATING CONSEQUENCES**	**PROCEDURE FOR CONTROL AND PREVENTION**	**PROCEDURE FOR DETECTION AND MITIGATION**
CL 5.1 Material failure				
Corrosion Erosion Fatigue (due to pressure & temp. changes) Defect Vibration	Failure of / leakage from pressure containing pipe work and vessels. Loss of containment leading to Liquid Release and possible Fire	Fatalities Personnel injury Equipment Damage Process Downtime	Internal/external: Tank Design in accordance with codes Corrosion allowance Integrity Management System Tank bunds for containment of spills	Routine inspection Maintenance procedures Emergency procedures in the event of loss of containment and / or Fire / Explosion, e.g. – F&G detection – ESD – AFP deployment
CL 5.2 Natural Occurrences				

Earthquake	Possible loss of local structural support depending on severity Potential loss of containment leading to Liquid Release and possible Fire.	Fatalities Personnel injury Equipment Damage Process Downtime Potential loss of AFP and safeguarding systems	Design basis	Emergency Procedures in the event of loss of containment and / or Fire Explosion as for Corrosion, etc. above

HAZARD CAUSES (cont'd)				
DIRECT CAUSE	**POTENTIAL CONSEQUENCES**	**MAJOR ESCALATING CONSEQUENCES**	**PROCEDURES FOR CONTROL AND PREVENTION**	**PROCEDURES FOR DETECTION AND MITIGATION**
Extreme weather (e.g. high ambient temperature, dust and storm)	Reduced efficiency of some equipment, but loss of containment not envisaged.	N/A	Design codes and standards	Routine inspection to detect weather induced defects Maintenance procedures
Lightning	Potential loss of containment leading to Fire	Fatalities Personnel injury Major Equipment Damage Major Process Downtime	Design codes and standards	Lightning conductors Earthing Maintenance procedures
Subsidence	As for Earthquake above			
CL 5.3 Impact				

Aircraft (e.g. helicopter, commercial / military)	Loss of local structural support depending on severity. Potential loss of containment leading to Fire	Fatalities Personnel injury Major Equipment Damage Major Process Downtime	Control of aircraft movements	Aircraft warning lights on the tallest structure to alert aircraft to the presence of the installation Emergency procedures in the event of loss of containment and / or Fire Explosion, e.g. – F&G detection – ESD – AFP deployment
From Vehicular Transport (e.g. from tankers, cranes, lifting equipment)	Potential damage to pressure containing pipework / vessels Potential loss of containment leading to Liquid Release and Fire Potential ignition source from motors	Fatalities Personnel injury Equipment Damage Process Downtime	Restricted Access Permit to work system for any major operation inside the tankfarm area Inherent safe design of storage tankfarm/ road layout Barriers protecting critical equipment Training and competence assessment of drivers Lifting procedures	Emergency procedures in the event of loss of containment and / or Fire Explosion, e.g. – F&G detection – ESD – Electrical Shutdown – AFP deployment
From other shipping in the port terminal	Potential breach of ship hull Potential loss of containment leading to Methanol Release and Fire Potential ignition source from engines	Fatalities Personnel injury Equipment Damage Process Downtime	Restricted Access Barriers protecting critical equipment Training and competence assessment of dock workers Loading procedures	Emergency procedures in the event of loss of containment and / or Fire Explosion, e.g. – F&G detection – ESD – Electrical Shutdown – AFP deployment

HAZARD CAUSES (cont'd)				
CL 5.4 Human Error				
Smoking/Naked Flames Valves left open Maintenance Error	Potential loss of containment, Liquid release and possible Fire	Fatalities Personnel injury Equipment Damage Process Downtime	Operational procedures Permit to work system Training and Competence Assessment No high voltage electricals inside the tankfarm area	Emergency procedures in the event of loss of containment and / or Fire Explosion, e.g. – F&G detection – ESD – AFP deployment

DAMIETTA PORT METHANOL PROCESSING FACILITY HAZARD REGISTER HAZARD SUMMARY SHEETS			TABLE No.: CL6
HAZARD DESCRIPTION			
Hazard Number:	CL6	**Areas Affected:**	
Hazard Category:	Containment loss	Storage area for Caustic Soda and Sulphuric Acid	
System:	Chemical storage		
Frequency:	Medium		
Consequence	Medium		
Risk Rating:	Medium		
Outcome:	Assessed qualitatively, not carried forward for detailed QRA		
Description:	Neither Caustic Soda nor Sulphuric Acid is flammable, consequences of loss of containment therefore limited to potential localised injuries or fatalities.		

HAZARD CAUSES				
DIRECT CAUSE	**POTENTIAL CONSEQUENCES**	**MAJOR ESCALATING CONSEQUENCES**	**PROCEDURE FOR CONTROL AND PREVENTION**	**PROCEDURES FOR DETECTION AND MITIGATION**
CL 6.1 Material failure				
Corrosion Defect	Leakage of corrosives with potential injuries among exposed persons	Accidental contact of the corrosives with water resulting in generation of fumes	Design of storage tanks, piping and pumps in accordance with codes and standards MSDS detailing procedures for correct storage	Provision of PPE Provision of safety showers, eyewash fountains and hazmat foam Acid/ Caustic Spill Handling Procedures
CL 6.2 Natural Occurrences				
Earthquake or subsidence	As above	None	N/A	N/A
CL 6.3 Impact				
Aircraft (e.g. helicopter, commercial / military)	As above	None	N/A	N/A
From Vehicular Transport (e.g. from tankers, cranes, lifting equipment)	Leakage of chemicals	None	N/A	Provision of PPE Provision of safety showers, eyewash fountains and hazmat foam Acid/ Caustic Spill Handling Procedures

CL 6.4 Human Error				
Spillage whilst unloading from road tankers, transfer, decanting, etc	Leakage of corrosives with possible injuries among exposed workers Exposure to corrosive fumes	Ingress of corrosives into open drains containing water	MSDS detailing procedures for correct storage, transfer and handling Selection of appropriate material of construction Provision of flange guards to avoid splashing	Provision of PPE, safety showers and eyewash fountains

DAMIETTA PORT METHANOL PROCESSING FACILITY HAZARD REGISTER HAZARD SUMMARY SHEETS				TABLE No.: CL7
HAZARD DESCRIPTION				
Hazard Number:	CL7	**Areas affected:**		
Hazard Category:	Containment Loss	Diesel Storage area		
System:	Diesel			
Frequency:	Low			
Consequence	Medium			
Risk Rating:	Medium			
Outcome:	Carry forward into QRA and Risk Register assuming a large storage of diesel in aboveground atmospheric storage tanks			
Description:	Diesel is flammable, but generally difficult to ignite. If ignited, will burn as a pool fire, generally contained within tank bunds; but with a possibility of tank explosions.			
HAZARD CAUSES				
DIRECT CAUSE	**POTENTIAL CONSEQUENCES**	**MAJOR ESCALATING CONSEQUENCES**	**PROCEDURE FOR CONTROL AND PREVENTION**	**PROCEDURE FOR DETECTION AND MITIGATION**
CL7.1 Material failure				
Corrosion Fatigue Defect	Diesel Spillage, which if ignited will burn as a pool fire	Possible damage to the adjoining storage tanks and other facilities	Bunding and Drainage Basis of Design Regular inspection and maintenance of pipework	Manual monitoring Spillage Clean-up procedures. Visual inspection of tanks
CL 7.2 Natural Occurrences				
Earthquake or subsidence	Leakage of diesel, but insignificant compared to likely other consequences of earthquake event	None	N/A	N/A
CL 7.3 Impact				
Aircraft (e.g. helicopter, commercial / military)	Leakage of diesel, but insignificant compared to likely other consequences of crash	None	N/A	N/A

From Vehicular Transport (e.g. from tankers, cranes, lifting equipment)	Leakage of diesel	None	Inherent safe design of storage tankfarm/ road layout Barriers protecting critical equipment Training and competence assessment of drivers Lifting procedures	Clean-up procedures for minor spills
CL 7.4 Human Error				
Spillage whilst moving, decanting, etc	As for Material Failure above			

DAMIETTA PORT METHANOL PROCESSING FACILITY HAZARD REGISTER HAZARD SUMMARY SHEETS				TABLE No.: CL8
HAZARD DESCRIPTION				
Hazard Number:	CL8	**Areas Affected:**		
Hazard Category:	Containment Loss	Water systems		
System:	Steam			
Frequency:	Low			
Consequence	Medium			
Risk Rating:	Low			
Outcome:	Assessed qualitatively, not carried forward into QRA and Risk Register			
Description:	Containment loss of steam			
HAZARD CAUSES				
DIRECT CAUSE	**POTENTIAL CONSEQUENCES**	**MAJOR ESCALATING CONSEQUENCES**	**PROCEDURE FOR CONTROL AND PREVENTION**	**PROCEDURES FOR DETECTION AND MITIGATION**
CL 8.1 Material failure				
Corrosion Fatigue (due to pressure & temp. changes) Defect Vibration	Failure of / leakage from water systems. Release of steam	Personnel injury Process Downtime	Design codes Corrosion allowance Integrity Management System	Routine inspection Maintenance procedures
CL 8.2 Natural Occurrences				
Earthquake or Subsidence	Loss of containment from water system, but insignificant compared to likely other consequences of earthquake event	None	N/A	N/A
CL 8.3 Impact				

Aircraft (e.g. helicopter, commercial / military)	Loss of containment from cooling water system, but insignificant compared to likely other consequences of crash	None	N/A	N/A
CL 8.4 Human Error				

DAMIETTA PORT METHANOL PROCESSING FACILITY HAZARD REGISTER HAZARD SUMMARY SHEETS		TABLE No.: CL9
HAZARD DESCRIPTION		
Hazard Number:	CL 9	**Areas Affected:**
Hazard Category:	Containment Loss	Instrument and Plant Air Systems
System:	Compressed Air Systems	
Frequency:	Low	
Consequence	Medium	
Risk Rating:	Low	
Outcome:	Assessed qualitatively, not carried forward for detailed QRA	
Description:	Loss of containment of Compressed Air or catastrophic failure of part of the system	

DIRECT CAUSE	POTENTIAL CONSEQUENCES	MAJOR ESCALATING CONSEQUENCES	PROCEDURE FOR CONTROL AND PREVENTION	PROCEDURES FOR DETECTION AND MITIGATION
CL 9.1 Material failure				
Corrosion Erosion Fatigue (due to pressure & temp. changes) Defect Vibration	Failure of / leakage from pipework and vessels. Loss of containment of air	Personnel injury Process Downtime Explosion involving air receivers/ vessels	Internal/external: Design codes Corrosion allowance Integrity Management System	Routine inspection Maintenance procedures Emergency procedures in the event of loss of containment e.g. – ESD – Emergency Response
CL 9.2 Natural Occurrences				
Earthquake or Subsidence	Loss of containment from air systems, but insignificant compared to likely other consequences of earthquake event	None	N/A	N/A

CL 9.3 Failure of Relief Devices or pressure control system	Over-pressurisation of air system leading to mechanical failure and possible catastrophic explosion	Personnel injury Equipment damage Process downtime	Design codes and standards Maintenance Strategy	Routine inspection Duplication/redundancy of RVs
CL 9.4 Impact				
Aircraft (e.g. helicopter, commercial / military)	Loss of containment from air systems, but insignificant compared to likely other consequences of crash	None	N/A	N/A
HAZARD CAUSES (cont'd)				
CL 9.5 Human Error				
Valves left open Maintenance Error	Loss of containment leading to loss of containment of air or nitrogen	Personnel injury Process downtime	Operational procedures Permit to work system Training and Competence Assessment	Emergency procedures in the event of loss of containment, e.g. – ESD – Emergency Response

DAMIETTA PORT METHANOL PROCESSING FACILITY HAZARD REGISTER HAZARD SUMMARY SHEETS				TABLE No.: CF1
HAZARD DESCRIPTION				
Hazard Number:	CF1	**Areas Affected:**		
Hazard Category:	Control Failure	All areas containing Process Equipment		
System:	Process Systems			
Frequency:	Medium			
Consequence	High			
Risk Rating:	High			
Outcome:	Assessed qualitatively, not carried forward for detailed QRA, as outcome is as for Loss of Containment events above.			
Description:	Process Control Failure			
HAZARD CAUSES				
DIRECT CAUSE	**POTENTIAL CONSEQUENCES**	**MAJOR ESCALATING CONSEQUENCES**	**PROCEDURE FOR CONTROL AND PREVENTION**	**PROCEDURE FOR MITIGATION AND DETECTION**
CF 1.1 Material failure				
Corrosion Fatigue Defect Vibration	Loss of process control, potential escalation to equipment failure (requires failure of safeguarding systems). Loss of containment leading to Gas Cloud/ Fire / Explosion / Release	Fatalities Personnel injury Process Downtime Fire Environmental pollution	Design codes Common mode failure analysis Provision of redundancy Diagnostic failure alarms on the DCS	Revealed failure analysis Inspection programme Routine testing Planned maintenance Emergency procedures in the event of loss of containment, e.g. – ESD – Emergency Response
Loss of Power (see CF4)				
CF 1.2 Human Error				

Incorrect manual control input Maintenance Error (software) Maintenance – Cable inadvertently cut	Loss of process control, potential escalation to equipment failure (requires failure of safeguarding systems). Loss of containment leading to Fire / Explosion / Release	Fatalities Personnel injury Process Downtime Fire Environmental pollution	Operational procedures Permit to work system Training and Competence Assessment	Emergency procedures in the event of loss of containment, e.g. – ESD – Emergency Response

DAMIETTA PORT METHANOL PROCESSING FACILITY HAZARD REGISTER HAZARD SUMMARY SHEETS		TABLE No.: CF2
HAZARD DESCRIPTION		
Hazard Number:	CF2	**Areas Affected:**
Hazard Category:	Control Failure	All utilities
System:	Utility Systems	
Frequency:	Medium	
Consequence	Low	
Risk Rating:	Low	
Outcome:	Assessed qualitatively, not carried forward for detailed QRA, as outcome is as for Loss of Containment events above	
Description:	Utility Control failure	

HAZARD CAUSES				
DIRECT CAUSE	**POTENTIAL CONSEQUENCES**	**MAJOR ESCALATING CONSEQUENCES**	**PROCEDURE FOR CONTROL AND PREVENTION**	**PROCEDURE FOR MITIGATION AND DETECTION**
CF 2.1 Material failure				
Corrosion Fatigue Defect Vibration	Loss of process control, potential escalation to equipment failure (requires failure of safeguarding systems). Loss of containment leading to Gas Cloud/ Fire / Explosion / Release	Personnel injury Process Downtime Fire Environmental pollution	Design codes Common mode failure analysis Systems fail safe (to low energy state)	Revealed failure analysis Inspection programme Routine testing Planned maintenance Emergency procedures in the event of loss of containment, e.g. – ESD – Emergency Response
Loss of Power See CF4				
CF 2.2 Human Error				

Incorrect manual control input Maintenance Error (software) Maintenance – Cable inadvertently cut	Loss of process control, potential escalation to equipment failure (requires failure of safeguarding systems). Loss of containment leading to Fire / Explosion / Release	Personnel injury Process Downtime Fire Environmental pollution	Operational procedures Permit to work system Training and Competence Assessment	Emergency procedures in the event of loss of containment, e.g. – ESD – Emergency Response

DAMIETTA PORT METHANOL PROCESSING FACILITY HAZARD REGISTER HAZARD SUMMARY SHEETS			TABLE No.: CF3
HAZARD DESCRIPTION			
Hazard Number:	CF3	**Areas Affected:**	
Hazard Category:	Control Failure	All Safety Systems	
System:	Safety Systems		
Frequency:	Low		
Consequence	High		
Risk Rating:	Medium		
Outcome:	Failure of Safety Systems should be included within event trees for failure of process plant and equipment, leading to possible loss of containment and fire / explosion / or liquid release. Should be addressed as part of QRA for that scenario		
Description:	Failure of the control of any safety system (e.g. ESD, blowdown, flare, firewater, F&G systems) which leads to its non-availability or false operation (e.g. spurious blowdown)		

HAZARD CAUSES				
DIRECT CAUSE	**POTENTIAL CONSEQUENCES**	**MAJOR ESCALATING CONSEQUENCES**	**PROCEDURE FOR CONTROL AND PREVENTION**	**PROCEDURE FOR MITIGATION AND DETECTION**
CF 3.1 Material failure				
Corrosion Fatigue Defect Vibration	Loss of process control, potential escalation to equipment failure (requires failure of safeguarding systems). Loss of containment leading to Gas Cloud/ Fire / Explosion / Release	Fatalities Personnel injury Process Downtime Fire Environmental pollution	Design codes Common mode failure analysis Systems fail safe (to low energy state) Back-up (e.g. UPS, battery, accumulators) required for safety critical systems Flare tip flame monitoring Failure of flare system to cause emergency plant shutdown Mechanical relief devices against pressure rise	Revealed failure analysis Inspection programme Routine testing Planned maintenance Emergency power supply Emergency procedures
Loss of Power (see CF4)				
CF 3.2 Human Error				

Incorrect manual control input Maintenance Error (software) Maintenance – Cable inadvertently cut	Loss of process control, potential escalation to equipment failure (requires failure of safeguarding systems). Loss of containment leading to Fire / Explosion / Release	Fatalities Personnel injury Process Downtime Fire Environmental pollution	Operational procedures Permit to work system Training and Competence Assessment	Emergency procedures in the event of loss of containment, e.g. – ESD – Emergency Response

DAMIETTA PORT METHANOL PROCESSING FACILITY HAZARD REGISTER HAZARD SUMMARY SHEETS				TABLE No.: CF4
HAZARD DESCRIPTION				
Hazard Number:	CF4	**Areas Affected:**		
Hazard Category:	Control Failure	All Power Generation Systems		
System:	Electrical Power			
Frequency:	Medium			
Consequence	Low			
Risk Rating:	Low			
Outcome:	Assessed qualitatively, not carried forward for detailed QRA as outcome is as for Loss of Containment events above.			
Description:	Power failure (internally or externally) or inability to control power source			
HAZARD CAUSES				
DIRECT CAUSE	**POTENTIAL CONSEQUENCES**	**MAJOR ESCALATING CONSEQUENCES**	**PROCEDURE FOR CONTROL AND PREVENTION**	**PROCEDURE FOR MITIGATION AND DETECTION**
CF 4.1 Material failure				
Corrosion Fatigue Defect Vibration	Loss of process control, potential escalation to equipment left in unsafe state	Process Downtime	Design codes Common mode failure analysis Systems fail safe (to low energy state) Back-up (e.g. UPS, battery, accumulators) required for safety critical systems	Revealed failure analysis Inspection programme Routine testing Planned maintenance Emergency power supply (diesel generators with automatic start-up)
CF 4.2 Failure of power Source	As above	As above	As above	As above
CF 4.3 Human Error				
Incorrect manual control input Maintenance Error (software) Maintenance – Cable inadvertently cut	Loss of process control, potential escalation to equipment left in unsafe state	Process Downtime	Operational procedures Permit to work system Training and Competence Assessment	Emergency power supply

DAMIETTA PORT METHANOL PROCESSING FACILITY HAZARD REGISTER HAZARD SUMMARY SHEETS				TABLE No.: EF1
HAZARD DESCRIPTION				
Hazard Number:	EF1	**Areas Affected:**		
Hazard Category:	Equipment Failure	All Electrical Equipment		
System:	Electrical			
Frequency:	Medium			
Consequence	Low			
Risk Rating:	Low			
Outcome:	Assessed qualitatively, not carried forward for detailed QRA, as outcome is as for Loss of Containment events above.			
Description:	Failure of transformers, switchgear and generators as a loss of function which does not release energy but results in loss of electrical power.			
HAZARD CAUSES				
DIRECT CAUSE	**POTENTIAL CONSEQUENCES**	**MAJOR ESCALATING CONSEQUENCES**	**PROCEDURE FOR CONTROL AND PREVENTION**	**PROCEDURE FOR MITIGATION AND DETECTION**
EF 1.1 Material failure				
Corrosion Fatigue Defect Vibration	Loss of equipment function, potential escalation to process equipment failure (requires failure of safeguarding systems). Possible loss of containment leading to Gas Cloud/ Fire / Explosion / or Liquid Release	Fatalities Personnel injury Process Downtime Fire Environmental pollution	Design codes Common mode failure analysis Systems fail safe (to low energy state) Back-up (e.g. UPS, battery, accumulators) required for safety critical systems	Revealed failure analysis Inspection programme Routine testing Planned maintenance Procedures in the event of loss of electrical equipment
Loss of Power (see CF4)				
EF 1.2 Human Error				

Maintenance Error (software) Maintenance – Cable inadvertently cut	Loss of equipment function, potential escalation to process equipment failure (requires failure of safeguarding systems). Possible loss of containment leading to Gas Cloud/ Fire / Explosion / or Liquid Release	Fatalities Personnel injury Process Downtime Fire Environmental pollution	Operational procedures Permit to work system Training and Competence Assessment	Procedures in the event of loss of electrical equipment

DAMIETTA PORT METHANOL PROCESSING FACILITY HAZARD REGISTER HAZARD SUMMARY SHEETS			TABLE No.: EF2
HAZARD DESCRIPTION			
Hazard Number:	EF2	**Areas Affected:**	
Hazard Category:	Equipment Failure	All Mechanical Equipment	
System:	Machinery		
Frequency:	Medium		
Consequence	Medium		
Risk Rating:	Medium		
Outcome:	Assessed qualitatively, not carried forward for detailed QRA as outcome is as for Loss of Containment events above.		
Description:	Failure of turbines resulting in loss of function and integrity which can subsequently cause system control failure, projectile damage and/or loss of containment. Failure of other rotating machinery such as pumps and compressors.		

HAZARD CAUSES

DIRECT CAUSE	POTENTIAL CONSEQUENCES	MAJOR ESCALATING CONSEQUENCES	PROCEDURE FOR CONTROL AND PREVENTION	PROCEDURE FOR MITIGATION AND DETECTION
EF 2.1 Material failure				
Corrosion Fatigue Defect Vibration	Loss of equipment function, potential escalation to process equipment failure (requires failure of safeguarding systems). Possible loss of containment leading to Gas Cloud/ Fire / Explosion / or Liquid Release Projectiles	Fatalities Personnel injury Process Downtime Fire Environmental pollution	Design codes Common mode failure analysis Systems fail safe (to low energy state) Redundancy required for safety critical systems	Revealed failure analysis Inspection programme Routine testing Planned maintenance Procedures in the event of loss of mechanical equipment
Loss of Power (see CF4)				
EF 2.2 Human Error				

Operator Error Maintenance Error (software) Maintenance – Cable inadvertently cut	Loss of equipment function, potential escalation to process equipment failure (requires failure of safeguarding systems). Possible loss of containment leading to Gas Cloud/ Fire / Explosion / or Liquid Release	Fatalities Personnel injury Process Downtime Fire Environmental pollution	Operator Friendly, Ergonomic design Operational procedures Permit to work system Training and Competence Assessment	Procedures in the event of loss of mechanical equipment

DAMIETTA PORT METHANOL PROCESSING FACILITY HAZARD REGISTER HAZARD SUMMARY SHEETS				TABLE No.: EF3
HAZARD DESCRIPTION				
Hazard Number:	EF3	**Areas Affected:**		
Hazard Category:	Equipment Failure	All Safety Systems		
System:	Safety			
Frequency:	Low			
Consequence	High			
Risk Rating:	Medium			
Outcome:	Carry forward into QRA and Risk Register			
Description:	Failure of critical safety equipment is automatically an emergency system impairment.			
HAZARD CAUSES				
DIRECT CAUSE	**POTENTIAL CONSEQUENCES**	**MAJOR ESCALATING CONSEQUENCES**	**PROCEDURE FOR CONTROL AND PREVENTION**	**PROCEDURE FOR MITIGATION AND DETECTION**
EF 3.1 Material failure				
Corrosion Fatigue Defect Vibration	Loss of equipment function, potential escalation to process equipment failure (requires failure of safeguarding systems). Possible loss of containment leading to Gas Cloud/ Fire / Explosion / or Liquid Release	Fatalities Personnel injury Process Downtime Fire Environmental pollution	Design codes Common mode failure analysis Systems fail safe (to low energy state) Redundancy required for safety critical systems	Revealed failure analysis Inspection programme Routine testing Planned maintenance Procedures in the event of loss of safety equipment
Loss of Power (see CF4)				
EF 3.2 Human Error				

Operator Error Maintenance Error (software) Maintenance – Cable inadvertently cut	Loss of equipment function, potential escalation to process equipment failure (requires failure of safeguarding systems). Possible loss of containment leading to Gas Cloud/ Fire / Explosion / or Liquid Release	Fatalities Personnel injury Process Downtime Fire Environmental pollution	Operator Friendly, Ergonomic design Operational procedures Permit to work system Training and Competence Assessment	Procedures in the event of loss of safety equipment

DAMIETTA PORT METHANOL PROCESSING FACILITY HAZARD REGISTER HAZARD SUMMARY SHEETS				TABLE No.: EF4
HAZARD DESCRIPTION				
Hazard Number:	EF4	**Areas Affected:**		
Hazard Category:	Equipment Failure	Boilers		
System:	Safety			
Frequency:	Low			
Consequence	High			
Risk Rating:	Medium			
Outcome:	Assessed qualitatively, not carried forward for detailed QRA as outcome is as for Loss of Containment events above.			
Description:	Failure of steam drum, boiler feed water supply, boiler combustion interlocks, purging system, leakage from natural gas lines, etc.			
HAZARD CAUSES				
DIRECT CAUSE	**POTENTIAL CONSEQUENCES**	**MAJOR ESCALATING CONSEQUENCES**	**PROCEDURE FOR CONTROL AND PREVENTION**	**PROCEDURE FOR MITIGATION AND DETECTION**
EF 3.1 Material failure				
Corrosion Fatigue Defect Vibration	Boiler Explosion; however the damage is likely to be localised. No impact anticipated outside the boundary limits.	Fatalities Personnel injury Process Downtime Explosion	Boiler Design (ASME) codes Common mode failure analysis Systems fail safe (to low energy state) Provision of spare boiler Redundancy required for safety critical systems	Revealed failure analysis Inspection programme Routine testing Planned maintenance Procedures in the event of loss of safety equipment
Loss of Power (see CF4)				
EF 3.2 Human Error				

Operator Error Maintenance Error (software) Maintenance – Cable inadvertently cut	Loss of equipment function, potential escalation to process equipment failure (requires failure of safeguarding systems). Possible loss of containment leading to Gas Cloud/ Fire / Explosion / or Liquid Release	Fatalities Personnel injury Process Downtime Fire Environmental pollution	Operator Friendly, Ergonomic design Operational procedures Permit to work system Training and Competence Assessment	Procedures in the event of loss of safety equipment

10.5 RISK ASSESSMENT RESULTS

Table 10-2 summarises the result of the preliminary hazard identification process.

Table 10-2: Risk Assessment Results

Sheet No	Hazard Type / Description	Overall Risk Ranking	Carried forward to QRA Y/N
CL1	Containment Loss – Natural Gas	High	Y
CL2	Containment Loss – Reformed Gas	High	Y
CL3	Containment Loss – Methanol Synthesis	High	Y
CL4	Containment Loss – Methanol Distillation	High	Y
CL5	Containment Loss – Methanol Storage and Loading	High	Y
CL6	Containment Loss – Chemical Storage	Medium	N
CL7	Containment Loss – Diesel	Medium	Y
CL8	Containment Loss – Water Systems	Low	N
CL9	Containment Loss – Air Systems	Low	N
CF1	Control Failure – Process Systems	High[1]	N
CF2	Control Failure – Utility Systems	Low	N
CF3	Control Failure - Safety Systems	Medium	Y
CF4	Control Failure – Electrical Power Systems	Low	N
EF1	Equipment Failure - Electrical	Low	N
EF2	Equipment Failure - Machinery	Medium[1]	N
EF3	Equipment Failure - Safety	Medium	Y
EF4	Equipment Failure - Boilers	Medium[1]	N

Note 1 – Risks will be assessed under the QRA for loss of containment

10.6 RISK ACCEPTANCE CRITERIA

No risk criteria have yet been defined for this project and none are defined in Egyptian legislation or standards. In the absence of such criteria, if detailed QRA is to be carried out during the next stage of project development, it is recommended that the resulting risk levels are assessed against international criteria. As, an example, the UK criteria for industrial installations is set by the Health & Safety Executive, based on the typical levels of risk experienced in a wide range of industrial activities, particularly high risk activities such as fishing, mining and quarrying. It concluded that the highest level of individual risk that is normally tolerated under modern conditions for workers in the UK is 1 x10^{-3} per year, but that in practice actual fatality rates for workers even in the most hazardous industries are normally well below the upper limit of individual risk of a risk stipulated above. Acceptable risk levels for members of the public are generally set at one order lower than those for workers, i.e. at 1 x 10^{-4}, to account for the fact that members of the public have risk imposed on them 'in the wider interests of society' whereas it is generally accepted the workers voluntarily accept a certain level of risk in return for the rewards available to them for working at a site.

QRA uses fault frequency data from literature sources, taking medium or worst case values representing historic incident and accident rates. It is to be expected that a well engineered modern facility with a developed safety and asset integrity management system would be capable of achieving lower incident and accident rates than those recorded in the literature and therefore would meet a more stringent risk target than the levels quoted above, which represent the threshold of unacceptability for the highest risk occupations and for the public. Hence targets of 1 x 10^{-4} per year and 1 x 10^{-5} per year for the workforce and the public respectively are suggested as appropriate criteria for the proposed facility.

11 ENVIRONMENTAL CUMULATIVE IMPACT ASSESSMENT

11.1 Introduction to Cumulative Impact Assessment

A conventional project and site-specific approach to environmental assessment has its limitations when it comes to assessing potential cumulative effects on environmental resources. This is because the impact of a particular project on an environmental resource may be considered insignificant when assessed in isolation, but may be significant when evaluated in the context of the combined effect of all past, present, and reasonably foreseeable future activities that may have or have had an impact on the resources in question. Cumulative impact assessment also provides valuable and important inputs as an element of Strategic Environmental Assessment. For these reasons, the explicit assessment of cumulative effects is now considered desirable in environmental assessment practice.

Cumulative effects generally refer to impacts that are additive or interactive (synergistic) in nature and result from multiple activities over time, including the project being assessed. The US Council on Environmental Quality defines cumulative effects as "the impacts on the environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions".

Cumulative effects

- are caused by the aggregate of past, present, and future actions;
- are the total effect, including both direct and indirect effects, on a given resource, ecosystem, and human community of all actions taken, no matter who has taken the actions;
- need to be analyzed in terms of the specific resource, ecosystem, and human community being affected;
- cannot be practically analyzed beyond a reasonable boundary; the list of environmental effects must focus on those that are meaningful;
- rarely correspond to political or administrative boundaries;
- may result from the accumulation of similar effects or the synergistic interaction of different effects;
- may last for many years beyond the life of the project that caused the effects; and
- should be assessed in terms of the capacity of the affected resource, ecosystem, and/or human community to accommodate additional effects.

11.2 Background

The conditions at Damietta Port have attracted several companies to operate within its confines. Damietta is a first class transhipment port, which can accommodate the new generation of large container vessels (>6,000 tons) due to the deep draft (14.5 m), and the modern stevedoring equipment at the port. In addition to this, vessels can enter and leave the port any time without restrictions, and vessels transiting the Suez Canal can use Damietta port without any detours which can result in significant time savings.

EMETHANEX, SEGAS and UGD are among the companies that have looked to Damietta Port to assist in the development of their business.

EMETHANEX is a proactive company and has a strong focus on safety and the environment. Prior to the development of its project at Damietta Port, EMETHANEX knew the plans of SEGAS and UGD to develop similar projects at nearby plots. As a result of company policy, EMETHANEX stated the need to carry out an Environmental Cumulative Impact Assessment on the EMETHANEX, SEGAS and UGD projects to determine if there is a need to implement additional mitigation measures to reduce or avoid any environmental impact due to the synergy of the three projects.

11.2.1 SEGAS LNG LIQUEFACTION, Storage and Shipment Plant

The Spanish Egyptian Gas Company (SEGAS) had constructed a natural gas liquefaction plant (LNG) in Damietta Port in the Arab Republic of Egypt. The LNG will be exported on large container vessels. Komex was subcontracted to carry out the Environmental Impact Assessment (EIA) for the construction and operation of the LNG project (2001).

11.2.2 UGD Propane Storage and Shipment Plant

United Gas Derivatives Company (UGD) is operating new facilities for the extraction of Natural Gas Liquids (NGL) and for its storage and export via large Liquefied Petroleum Gas (LPG) sea tankers.

In November 2001 a meeting was held between the UGD project team and the EEAA. At that meeting it was agreed that the UGD project team would submit two EIAs. The first submission would cover initial work to prepare the sites to allow construction of the gas facilities to begin, and the second submission would be the full EIA covering the life cycle of the facilities.

The document on which this report is based is the Preliminary EIA (first submission) which covers the initial civil engineering work necessary to prepare the 2 main project sites which are located west of Port Said and at Damietta Port.

11.2.3 Background Information

The information used for the preparation of this section is based on the following documents:

- Komex (June 2001). Environmental Impact Assessment proposed LNG Plant Damietta Port, Egypt. Approved by the EEAA on 30 January 2002. Ref. Number 50645.
- Komex (November 2001). Environmental Impact Assessment LNG Loading Jetty Damietta Port, Egypt. Approved by the EEAA on 5 February 2002. Ref. Number 50645-1.
- Komex (January 2003). Environmental Impact Assessment Marine Outfall Damietta Port, Egypt. Submitted to the Damietta Port Authority (DPA) on 26 January 2003 (Ref Number DPA 003/03) and approved by the EEAA in 2003. Ref. Number 50626-1.
- Komex (June 2003). EIA Addendum: LNG Facility (as-built design) Damietta Port, Egypt Notification and EIA of Design Changes. Submitted to the Damietta Port Authority (DPA) on 26 January 2003 (Ref Number DPA 003/03) and approved by the EEAA in 2004. Ref. Number 50626-2.
- Komex (August 2004). Addendum: LNG Facility Damietta Port, Egypt EIA: Aromatic Removal Unit and Notification of Changes. Submitted September 2004. Ref. Number 50626-3
- UGD (February 2002). NGL Project. Preliminary EIA. UGD ENV 01.

11.3 Methodology

The same procedures and methodologies stated in section 6 will be followed. The difference resides in the global approach that takes into account SEGAS and UGD plants as well as EMETHANEX.

11.4 Particular Potential Impacts for EMethanex, SEGAS and UGD Plants

11.4.1 EMETHANEX

These impacts were widely discussed in section 6.

11.4.2 SEGAS

11.4.2.1 Potential Negative Impacts

During all phases of the project, adverse impacts may be encountered. These include:

- Loss of habitat where construction works take place. This includes the onshore landmass and the coastal fringes, plus the area lost for the construction of the jetty and outfall. In most cases this loss of habitat will be temporary, until recolonisation occurs.
- General litter and waste from human activity. General litter and waste could cause a significant impact if efforts are not made to keep the areas clean. The prevailing winds in this area suggest that there is the potential for 'garbage' to be blown along the site. Impacts may not be significant, but will be aesthetically unpleasant.
- Accidental spillage or release of hydrocarbons, LNG, chemicals and other hazardous materials. Whatever the cause, the effect will be highly dependent on the size of spill and the type of compound released. A major release could be devastating to all the VECs concerned, with the duration of impact in terms of tens of years.
- Increased turbidity and re-suspension of the bottom sediments will occur during offshore construction. These will be temporary and confined to the period of works. However, routine dredging will occur within the port.
- Air borne transport of particulates will occur during the construction phase. This increased particulate load can be prevented, and should be short-lived, providing the environmental protection plan guidelines, such as the dampening of roads are followed and enforced.
- Noise during construction and loss of habitat may have significant impacts on the feeding bird population. Shore birds will be the major group affected, but it is likely that many birds will move on to neighbouring feeding grounds.
- If construction wastes are correctly disposed, no significant adverse impacts to the VECs are predicted. Negative impacts can occur from inappropriate waste disposal.
- Accidental release of wastewater may result in contamination of the shallow coastal water. Nutrient increase in the seawater will have a major impact on the marine flora.

- Accidental release of fugitive air emissions may also have adverse environmental affects on the surrounding community and VECs during operation. Emergency response measures will be in place to mitigate such accidental events.

11.4.2.2 Potential Positive Impacts

- During both the construction and operation phases of the project, significant positive impacts will be gained by the local community through employment opportunities at the proposed plant.
- Employment prospects will exist for skilled and unskilled labour, administration staff, caterers and medical staff. Where available, these personnel will be pooled from the local community and within Egypt. Up to 6000 staff were required during the construction phases of the project, this will provide a large, positive employment boost for the governorate of Damietta.
- Potential positive effects may also occur through links with existing businesses and industries within Egypt, such as existing waste facilities for the re-use and recycling of many products such as paper, cardboard, glass, mineral oils and lubricants.

11.4.2.3 Summary of Potential Environmental Impacts

Table 11-1 shows the Potential Environmental Impacts caused by SEGAS LNG Plant prior to implementing mitigation measures.

Table 11-1: Potential Environmental Impacts SEGAS LNG Plant

SEGAS LNG Plant. Impact Assessment	CONSTRUCTION			OPERATION			ACCIDENTAL EVENTS. Environmental Non Compliance		
	BIOTIC	ABIOTIC	SOCIAL	BIOTIC	ABIOTIC	SOCIAL	BIOTIC	ABIOTIC	SOCIAL
Marine Outfall	3	3	4	3	4	4	2	3	3
Seawater Intake	3	3	4	3	3	4	3	4	4
Dredging at LNG Loading Terminal	3	3	3	3	3	3	2	3	3
Marine Traffic: Including dredging vessels, LNG Transporters	3	3	3	3	3	3	2	3	2
Roads	3	3	3	3	3	3	3	2	3
Stacks	3	3	3	3	3	3	2	3	2
Sanitation Water	3	3	3	3	3	3	2	3	3
Solid Waste	3	3	3	3	3	3	3	3	3
Sewers	3	3	3	3	3	3	2	3	2
Oily Waters	3	3	3	3	3	3	2	2	2
Hazardous Compounds	3	3	3	3	3	3	2	3	2

11.4.3 UGD

The scope of work covered by the preliminary EIA prepared for the UGD plant is such that there is no evaluation related to the production, storage or transportation of petroleum products or derivatives. The impacts associated with this preliminary stage of work are related to the civil engineering works necessary to clear the site, improve the soil conditions, and to provide the foundations on which the eventual facilities will be built.

For full Impact Assessment please refer to UGD (February 2002) - NGL Project. Preliminary EIA. UGD ENV 01.

In the absence of site specific information, and in order to be able to make a cumulative impact assessment, it is here assumed that the potential impacts at the UGD Propane Plant are very similar or even the same as those at the SEGAS LNG Plant.

11.4.3.1 Potential Negative Impacts

To summarize, the activities during the construction and operation phases in general result in minor impacts under normal operations, although dredging, a slight increase in marine traffic, construction traffic and wastewater impacts all have short term increases in potential negative impacts.

Accidental events during both the construction and operations phases of the project would be significant, due to the nature of the plants, with significant impacts possible from the following activities and facilities:

- Marine outfall: - loss of contaminated wastewater.
- Dredging at the Propane Loading Terminal: collision, destruction of habitats.
- Land and Marine Traffic incidents or accidents: loss of life, loss of waste products, hazardous chemicals, ballast water.
- Fugitive emissions or gas releases of Propane (GLP): local human health issues.
- Hazardous compounds release or leakage: local human health issues.
- Effluent (sanitation, sewer and oily water): contamination of ground and marine waters.

11.4.3.2 Potential Positive Impacts

Due to the similarities between SEGAS and UGD Plants, similar positive impacts are expected.

11.4.3.3 Summary of Potential Environmental Impacts

Table 11-2 shows the Potential Environmental Impacts caused by UGD LPG Plant prior to implementing mitigation measures.

Table 11-2: Potential Environmental Impacts UGD LPG Plant

UGD LPG Plant. Impact Assessment	CONSTRUCTION			OPERATION			ACCIDENTAL EVENTS. Environmental Non Compliance		
	BIOTIC	ABIOTIC	SOCIAL	BIOTIC	ABIOTIC	SOCIAL	BIOTIC	ABIOTIC	SOCIAL
Marine Outfall	3	3	4	3	4	4	2	3	3
Seawater Intake	3	3	4	3	3	4	3	4	4
Dredging at LPG Loading Terminal	3	3	3	3	3	3	2	3	3
Marine Traffic: Including dredging vessels, LPG Transporters	3	3	3	3	3	3	2	3	2
Roads	3	3	3	3	3	3	3	2	3
Stacks	3	3	3	3	3	3	2	3	2
Sanitation Water	3	3	3	3	3	3	2	3	3
Solid Waste	3	3	3	3	3	3	3	3	3
Sewers	3	3	3	3	3	3	2	3	2
Oily Waters	3	3	3	3	3	3	2	2	2
Hazardous Compounds	3	3	3	3	3	3	2	3	2

11.5 Cumulative Impact Assessment for EMethanex, SEGAS, and UGD Plants

Based on the respective potential environmental impacts caused by EMETHANEX, SEGAS and UGD Plants potential cumulative impacts are discussed in subsections below.

11.5.1 Marine Outfall

EMETHANEX, SEGAS and UGD marine outfalls will be located more than 500 m from the existing shoreline, as per Egyptian regulations. The diameter of the pipes is small. SEGAS and UGD pipes are emplaced by trenching but in EMETHANEX case trenching is not expected. The UGD marine outfall will be to the East of the SEGAS outfall. Mixing of the plumes from the three outfalls is likely based on the small extent of the initial dilution zone as shown in the prediction modelling,

11.5.1.1 Construction

There is a potential impact on benthic organisms as well as on water column quality due to the works for marine outfalls for the plants. The timing of construction of the three marine outfalls would result in differences in the resulting impact. If they are constructed concurrently the impact be of higher intensity, but the recovery will occur over a shorter timescale. If one outfall is constructed after the other, the total intensity of impact may be less, but the recovery period will extend. In a similar manner, if the outfalls are constructed at different times, the magnitude of total impact is less, but the overall recovery period will be longer. Furthermore growth and colonisation rate of the affected areas could be reduced due to the continuous activity in the area caused by the marine outfall works for each plant in different seasons.

Those impacts could be physical impacts and loss of habitat although both of them are expected to be minor.

During the construction phase, there will be positive benefits for the local community in terms of employment and the need for specialist local experience.

11.5.1.2 Operation

The existence of outfall structures may result in a change in the biological community along the corridor of the structure. Biofouling may also occur on the jetties and pipeline.

The quality of wastewater discharged through the SEGAS outfall will be monitored and will not exceed the limits for discharge to the marine environment, specified in Law No. 4 of 1994. The effluents will be monitored prior to discharge. In cases where discharge fails to meet the required specifications, off-spec effluent from the treatment units will be recycled for re-treatment.

The total amount of discharges may be tripled due to operation of the three plants, at least with respect to sanitary water treatment or treated oil contaminated drain fluids. However, since the UGD Propane plant is only storage and shipment plant, many of the liquefaction processes occurs at the Port Said facilities, which results in a lowering of the effluents by comparison with SEGAS plant.

11.5.1.3 Accidental Events

As discussed in previous sections accidental events related to the marine outfalls include fuel spills, which could occur during construction. Other events may be related to the discharge of off spec effluent through accidental discharges and/or leaks and accidental exceedance of certain parameter concentrations in sanitation water may lead to release of nutrients.

All those events are unlikely but the frequency could be increased resulting in a change of communities in the area caused by the creation of particular conditions that enhance the growth of opportunistic species with the subsequent reduction in biodiversity in the area. This could result in a moderate impact.

Abiotic components might be affected through seabed contamination but this would be a minor impact due to the low probability.

11.5.2 Seawater Intake

Water intake will be from the Nile River, therefore EMETHANEX will not contribute to a cumulative impact by this infrastructure. A seawater intake is present in Damietta Port for the SEGAS facility.

11.5.3 Dredging at Loading Terminals

Coastal construction and dredging for the three loading terminals will result in cumulative effects during construction and operation phases. The timing of the dredging operations will determine an impact increase either in intensity or in duration depending on whether operations are overlapped or sequential, respectively.

11.5.3.1 Construction and Operation

As discussed in marine outfall effects there is a potential impact on benthic organisms as well as on water column quality due to dredging activities for the plants. The timing of dredging works would result in differences in the resulting impact as discussed above. Unlike the marine outfall, the intensity of dredging works is much greater which results in a moderate impact on marine organisms. Positive social impacts are enhanced.

11.5.3.2 Accidental Events

Accidental fuel spills, collisions, general litter and wastes from human activities and boats during all phases of the development as well as ballast water release from dredgers may occur. The probability of these events occurring is enhanced due to the increased frequency of the dredging activities.

These events may impact a great number of VEC's and due to the greater probability the impact could be moderate.

11.5.4 Marine Traffic: Including dredging vessels and Transporters

Increased marine traffic will occur during the operational phase due to the activity of the three plants. The frequency of traffic will be increased approximately with two more vessels every 23 days. As stated, disturbances to the benthic community will be increased due to the operation of three terminals instead of one. Water quality, in terms of increased turbidity, will be reduced as a result of tripling the activity.

11.5.4.1 Construction

The timing of construction will result in different scenarios of impact. The greatest impact in terms of increased marine traffic would occur if the construction of all three facilities were conducted simultaneously.

The key VECs affected would be benthic organisms and water column quality. If construction activities occur simultaneously between at least two plants the impact could be moderate. Positive impact on social parameters will be enhanced.

11.5.4.2 Operation

The frequency of traffic will be increased resulting in a more frequest re-suspension of bottom sediments. This will affect a number of VEC's including plankton, crustaceans, molluscs, pelagic and demersal fish, and potentially the local fishing industry if turbid waters extend to the Mediterranean Sea. The negative impact on biota and the fishing community will be minor, with a positive impact on social parameters due to the increased economic activity.

11.5.4.3 Accidental Events

Shipping accidents will be a major concern. These may not only cause hydrocarbon spills, loss of Methanol, LNG or Propane, but may also result in human injury and loss of life. Major impacts may also arise in the event of accidental leakage or release of Methanol, LNG or Propane to the marine environment. Accidental spills of hydrocarbon fuel (diesel) or raw product (Methanol, LNG or Propane) may lead to serious environmental problems and health and safety implications, if not immediately contained.

All these effects are magnified in two ways:

- There is an increase in probability: three times more likely.
- The effects are greater due to the existence of three plants containing flammable products as Methanol, LNG and Propane.

Propane is more dangerous than Methane as Propane fires tend to persist within the leakage area due to its liquid and heavier than air states. Methane has relatively low combustion temperatures and its fire hazard does not persist due to the buoyant and dispersive nature of the fuel.

Methanol poses less fire risk than hydrocarbon fuels, for several reasons:

- o In room-temperature air, methanol's lower flammability limit (LFL) is 6 percent, compared to one and four-tenths percent for gasoline.

- Methanol will not ignite at temperatures below 54 degrees, while gasoline will ignite well below freezing.
- Methanol vapour is less dense than gasoline vapour, it does not collect at ground level where ignition is most likely. When methanol does ignite, it is easier to control because it radiates significantly less heat than a gasoline blaze.

The resulting impact in case of fire or explosion would be major. Nevertheless, this event is unlikely according to the respective industry record. However, full contingency plans would be in place to minimize adverse actions.

11.5.5 Roads

It is clear that during the construction and operation phases of the three plants, traffic will significantly increase, resulting in the effects described below:

11.5.5.1 Construction

Road construction is not a cumulative activity as it will only occur once and then be used by the other agents. There is no need to double or triple the roads based on the number of facilities.

11.5.5.2 Operation

During the operational stages, increased traffic, noise, dust as well as light during night-time operations will be expected. Increased traffic caused by the operation of the three plants will result in a significant impact to the small village close to the port mainly because of increased noise and dust and possibly causing occasional road delays.

11.5.5.3 Accidental Events

Road accidents could include collisions, fuel spillage, fire, fatalities and spills and leaks from sanitation and wastewater container vehicles. The potential of accidental events is increased by the operation of the three plants due to the increased traffic. Based on the likelihood of traffic increase the impact could be moderate.

11.5.6 Stacks

Under this section the main activities associated with processing, power generation and product storage, loading and unloading within the facilities are assessed.

A small increase in cumulative impact is expected from the construction and operation of the three plants given that UGD is proposed to have only a reduced level of air emissions during normal operations.

11.5.6.1 Construction

As in previous sections, the timing of construction of the three facilities would result in different impacts. If they are constructed concurrently the impact would be of higher significance ranking, but the recovery will occur over a shorter timescale.

Minor cumulative impacts are expected on biotic and abiotic parameters due to a decrease in air quality caused by an increase in dust and noise.

Positive impacts on employment is expected from the construction activities. This will be enhanced due to the three facilities. As discussed the timing is very important: if one facility is constructed after the other the impact on social parameters will be more beneficial than if they are constructed at the same time.

If facilities are constructed one after the other the number of workers required, the services and the associated activities would be better absorbed because the increase is lower and the time those resources are needed is extended.

Alternatively, if the three plants are constructed at the same time more many workers would be required in a short period of time and after that they would be in the area but possibly unemployed.

11.5.6.2 Operation

The three facilities will cause increased air emissions, increased light from flares and increased noise during normal operations.

UGD will not generate a significant decrease in air quality given that its activities are partially completed in Port Said. Nevertheless, EMETHANEX and SEGAS emissions, even complying with law and standards, could decrease air quality beyond the limits.

Regarding contaminants, NO_2 is the most important given that SO_2 and CO emissions are not expected or at a lower rate to be considered negligible. Baseline measurements show that NO_2 concentration in the area is very low but there have been complaints from farmers in the vicinity follwoing leaf damage in their crops. At least three facilities will operate in the area in the short to

long term and each one will comply with the permissible limits. The cumulative impact due to the additive effects of their emissions will reduce air quality in a significant way. Their single contribution will (probably) be less than half of the limit although the addition of concentrations will be very close or beyond the limit.
During the field survey noise levels were measured and sound levels ranged between 50 and 62 dB(A). At that time only one train from SEGAS was active. It can be assumed that future activities such as UGD and EMETHANEX will increase noise levels very close or beyond the limits in certain locations due to the addition of each plant.

Air contamination and noise could result in a moderate impact to vegetation and crops as well as neighbouring population.

11.5.6.3 Non Routine Operations and Accidental Events

Maintenance activities as a non routine operation could result in impacts on air quality through an increase in contaminant concentration and in sound pressure. Those activities for each plant could result in moderate impact but if the three plants carry out maintenance activities simultaneously this could result in a major impact. During start-up and commissioning, air emissions and sound pressure are much higher than during routine operations. The likelihood of this event is medium and the impact has moderate significance.

With regard to accidental events, leaks, fire and explosions may also cause significant impacts to the local community, including human fatality. Accidental events are the most important issue when assessing the cumulative impacts due to the operation of the three plants. The potential for accidental events is increased because of an increase of high risk activities, however the increase in the cumulative effects could be much higher than the increase in the likelihood of the accidental event.

11.5.7 Sanitation Water

Cumulative impacts will arise from the routine operation of the three plants as a result of the increased effluent that might be increased approximately triplicate. Nevertheless, this results in a minor impact due to the small flow in comparison to the seawater mass and the absorption capacity of the sea with regard to these effluents.

There is an increase in the likelihood of accidental spills due to the increase in facilities which could lead to a moderate impact.

11.5.8 Solid Waste

The operation of the three plants may increase the potential of leakage and disposal of wastes by a factor of 3. However, a significant increase in the effect is not expected following appropriate disposal.

As stated above, the likelihood of accidental events is increased, but a significant increase in the effect due to the operation of the three plants is not expected. Leakage from hazardous waste containers is the main concern.

11.5.9 Sewers

Cumulative impacts will arise from the operation of the three plants as a result of the increased effluent that might be increased approximately by a factor of 3. However, this will not increase the impact significance if proper preventive measures are in place.

Likelihood of accidental events is increased due to the increased volume and the increase in infrastructure, the operation of the three plants might have a significant increase in the cumulative effects of such events that could lead to a moderate impact.

11.5.10 Oily Waters

Construction and operation of oily water collection and treatment systems for the three plants will mean a small increase in the effects but not to a significant level.

The likelihood of accidental events would be increased, which means frequency could be tripled, a significant impact change due to the operation of the three plants is expected if appropriate preventive measures are not in place. Those effects could lead to a moderate impact on biotic, abiotic and social components.

11.5.11 Hazardous Compounds

In general, construction and operation will mean an increased volume of hazardous wastes because of the three plants operation.

The likelihood of occurrence of an accidental event is increased because of the activities on the three plants. Nevertheless, although likelihood is only increased by a factor of 3, the effects of accidents involving hazardous substances might be much greater because of the nature of the plants.

Accidental events due to presence of hazardous compounds are some of the most significant impacts which could possibly occur. This may result from spillages on site and at the Methanol, LNG or Propane loading facilities. Spilled compounds may also leach to the Mediterranean Sea. Fires and explosions of hazardous compounds may result in significant adverse impacts to all of the identified VECs. As mentioned above, the latter could be magnified owing to the presence of the three plants which means the storage of flammable product such as methanol, LNG and Propane.

11.5.12 SUMMARY OF POTENTIAL CUMULATIVE IMPACTS

Table 11-3 shows the Potential Cumulative Environmental Impacts caused by EMETHANEX Methanol, SEGAS LNG Plant and UGD LPG Plant prior to implementing mitigation measures.

Table 11-3: Potential Cumulative Environmental Impacts EMETHANEX Methanol Plant, SEGAS LNG Plant and UGD LPG Plant

EMETHANEX, UGD and SEGAS Plants. Cumulative Impact Assessment	CONSTRUCTION			OPERATION			ACCIDENTAL EVENTS. Environmental Non Compliance		
	BIOTIC	ABIOTIC	SOCIAL	BIOTIC	ABIOTIC	SOCIAL	BIOTIC	ABIOTIC	SOCIAL
Marine Outfall	3	3	6	3	4	4	2	3	3
Seawater Intake	3	3	6	3	3	4	3	4	3
Dredging at Loading Terminals	2	3	6	2	3	6	2	3	3
Marine Traffic: Including dredging vessels and Transporters	2	3	6	3	3	6	1	2	1
Roads	3	3	2	3	3	2	3	2	2
Stacks	3	3	6	2	3	2	1	2	1
Sanitation Water	3	3	3	3	3	3	2	3	3
Solid Waste	3	3	3	3	3	3	3	3	3
Sewers	3	3	3	3	3	3	2	3	2
Oily Waters	3	3	3	3	3	3	2	2	2
Hazardous Compounds	3	3	3	3	3	3	1	2	1

11.6 Mitigation Measures for Cumulative Impacts

To implement all the mitigation measures mentioned in the mitigation measures section would reduce or avoid most of the impacts arising from the activities of the EMETHANEX Methanol Plant, SEGAS LNG Plant and UGD Propane Plant.

Nevertheless there are still some impacts which are very difficult to reduce or avoid. In order to lower the risk of these impacts to a manageable level, additional measures have to be implemented. These measures mainly affect activities in the design and operation phase. Encouraging good communications between EMETHANEX, SEGAS and UGD is essential in order to properly implement all the mitigation measures and to share information regarding their results and difficulties during the process of putting these measures into practice. Another important point for the success of these mitigation measures is the ability, and foremost, the existence of a culture prone to negotiation and to reaching agreements on how to implement the mitigating measures.

11.6.1 Design Phase

During the design phase, efforts should be directed towards reaching a design that takes into account both present and future plant conditions and planning of the three plants. These efforts can be summarized as follows:

- To design a layout such that incompatible facilities from plants are placed as far from each other as possible to lower risk. Examples include hazardous storage areas, tanks and flares.
- To model marine outfall taking into account all the planned or already existing infrastructure to avoid the concentration of liquid wastes, to favour dilution; and to design the marine outfall according to the model results.
- To model stack height and position taking into account all the planned or already existing infrastructure to avoid any concentration of air emissions in the neighbouring areas, to favour air dispersion; and to design the stacks and flares according to the predictive model results.
- To model sound pressure on the neighbouring village taking into account the three plants to assess whether equipment isolation, sound barriers or any other methods to lower sound pressure are required both inside the plants and in the neighbouring village.
- To plan the activities to avoid time overlapping between those which cause greater effects such as dredging or marine trenching (marine outfall) in order to minimize the impact.

11.6.2 Construction Phase

During the construction phase communication between EMETHANEX, SEGAS and UGD is highly encouraged to plan and even to share activities which will result in environmental and economic benefits.

- To carry out some activities which cause greater effects such as dredging or marine trenching (marine outfall) without a time overlap in order to minimize their impacts.

11.6.3 Operation Phase

Communication is highly recommended to minimize risk and environmental impacts:

- To encourage awareness on safety procedures.
- To plan tank filling in order to keep the lowest fuel levels in tanks near the boundary between the three facilities.
- To plan tank emptying in order to empty closest tanks between plants first.
- To reach an agreement between the Port, EMETHANEX, SEGAS and UGD shipments so as to minimize coincidence between tankers and shipment activities from the three companies.
- To plan maintenance activities for each plant to minimize coincidence during start-up and commissioning

11.7 RESIDUAL CUMULATIVE IMPACT

After appropriate application of the mitigation measures to the different assessed activities and pathways; proper implementation of the monitoring plan; and ensuring normal efficient operation, the vast majority of residual construction and operation impacts are expected to be insignificant during both the construction and operation phases.

During the construction and operation phases transportation through the road nearby the small village constitutes a residual minor impact

During the operation phase there are two residual impacts due to a high concentration of contaminants (mainly NOx) which is very close to the limits and also a high noise pressure in the vicinity of the industrial area, very close to the limits.

Nevertheless, accidental events still exists and may cause significant negative impact. Although the likelihood of occurrence is very low the cumulative effects can be very serious. The highest residual cumulative impacts are due to marine traffic, stacks and hazardous compounds.

Table 11-4 shows the Residual Cumulative Environmental Impacts caused by EMETHANEX Methanol, SEGAS LNG Plant and UGD LPG Plant after implementing mitigation measures.

Table 11-4: Residual Cumulative Environmental Impacts EMETHANEX Methanol Plant, SEGAS LNG Plant and UGD LPG Plant

EMETHANEX, UGD and SEGAS Plants. Cumulative Impact Assessment after Mitigation Measures	CONSTRUCTION			OPERATION			ACCIDENTAL EVENTS. Environmental Non Compliance		
	BIOTIC	ABIOTIC	SOCIAL	BIOTIC	ABIOTIC	SOCIAL	BIOTIC	ABIOTIC	SOCIAL
Marine Outfall	4	4	6	4	4	4	3	4	4
Seawater Intake	4	4	6	4	4	4	4	4	4
Dredging at Loading Terminals	4	4	6	3	4	6	3	4	4
Marine Traffic: Including dredging vessels and Transporters	4	4	6	4	4	6	2	3	2
Roads	4	4	3	4	4	3	4	3	3
Stacks	4	4	6	3	4	3	2	4	2
Sanitation Water	4	4	4	4	4	4	3	4	4
Solid Waste	4	4	4	4	4	4	4	4	4
Sewers	4	4	4	4	4	4	3	4	3
Oily Waters	4	4	4	4	4	4	3	3	3
Hazardous Compounds	4	4	4	4	4	4	2	3	2

12 REFERENCES

AGIS Consult, 2006. EMethanex Damietta Port Plant. Plant Area Geotechnical Analysis. February, 2006.

Annex to Law No.4 of the year 1994 promulgating the Environment Law, with Decree No.1741 of the year 2005 amending Decree No.338 of the year 1995 promulgating the Executive Regulations of the Environment Law. Arabic Version. Al Amiria Press (2005).

Biological analysis report, 2006. Environmental Sampling and analysis report. Marine Chemistry Lab. Suez Canal University.

Brunn, B. and Bahaa el Din, Sh., 1994. Common Birds of Egypt, revised edition. The American University in Cairo Press, ISBN 977 424 239 4, pp: 56.

COSMOS-E Engineers & Consultants, 2006. EMethanex Damietta Plant Factual Geotechnical Report. January, 2006.

E.E. Adams, D.R.F. Harleman, G.H. Jirka, and K.D. Stolzenbach. 1981. Heat Disposal in the Water Environment. Course Notes. R.M. Parsons Laboratory. Mass. Inst. of Techn.

Egyptian drinking water quality standards. Decree No.108 of the Year 1995. Egyptian Ministry of Health.

Egyptian Environmental Affairs Agency (EEAA), 1996. Guidelines for Egyptian Environmental Impact Assessment (October 1996).

Egyptian Environmental Affairs Agency (EEAA), 2001. EIA Guidelines for Oil and Gas Sector. Environmental Management Sector (October 2001).

Egyptian Environmental Affairs Agency (EEAA), 2005. EIA Guidelines for Oil and Gas Sector. Environmental Management Sector (January 2005).

Egyptian Environmental Affairs Agency (EEAA), 2005. EIA Guidelines for Development of Ports, Harbours, and Marinas. Environmental Management Sector (January 2005).

Egyptian Environmental Affairs Agency (EEAA), 2005. EIA Guidelines for Industrial Estates Development. Environmental Management Sector (January 2005).

Egyptian Environmental Affairs Agency (EEAA)-Law 4 of the year 1994 promulgating the Environment Law with its Executive Regulations. English Version. The Middle East Library for Economic Services (January 2006).

Egyptian Environmental Affairs Agency (EEAA)-Law 4 of the year 1994 promulgating the Environment Law with its Executive Regulations. Arabic Version. Al Amiria Press (1999).

Egyptian Ministry of Housing and Utilities and Urban Communities. Ministerial Decree No. 44/2000 Amending the Executive Statutes of Law No. 93/1962 on Drainage of Liquid Wastes. English Version: The Middle East Library for Economic Services (November, 2004). Arabic Version: Al Amiria Press (2004).

El-Gharbaly, Z. et al, 1982. Experience with grass carps for the control of aquatic weeds in irrigation canals in Egypt. Proc. 2nd Int. Symp. on herbivorous Fish EWRS Wageningen the Netherlands, pp: 17-26.

Equator Principles (July, 2006). The "Equator Principles". A financial industry benchmark for determining, assessing and managing environmental & social risk in project financing. www.equator-principles.com.

Equator Principles (March, 2006). The "Equator Principles". A financial industry benchmark for determining, assessing and managing environmental & social risk in project financing. EP FINAL DRAFT - March 2006. www.equator-principles.com.

European Investment Bank, 2004. Environmental Statement. http://www.equator-principles.com/documents/EIB_en.pdf

European Union (EU) Legislation. http://europa.eu.int/eur-lex/en/search/search_lif.html.

FAO (Food and Agriculture Organization of the United Nations), 2005. AQUASTAT. FAO's Information System on Water and Agriculture. Version 2005. http://www.fao.org/AG/agL/AGLW/aquastat/countries/egypt/index.stm

Hoath, R., 2003. A field Guide to the mammals of Egypt. The American University in Cairo Press. ISBN: 977 424 809 0, pp: 320.

Hughes, R.H. and J.S. Hughes. 1992. A Directory of African Wetlands. IUCN, Gland, Switzerland and Cambridge, UK.

International Institute of Seismology and Earthquake Engineering. http://iisee.kenken.go.jp.

IUCN, 2006. 2006 IUCN Red List of Threatened Species. www.iucnredlist.org.

Komex, August 2004. Addendum: LNG Facility Damietta Port, Egypt EIA: Aromatic Removal Unit and Notification of Changes. Submitted September 2004. Ref. Number 50626-3

Komex, January 2003. Environmental Impact Assessment Marine Outfall Damietta Port, Egypt. Submitted to the Damietta Port Authority (DPA) on 26 January 2003 (Ref Number DPA 003/03) and approved by the EEAA in 2003. Ref. Number 50626-1.

Komex, June 2001. Environmental Impact Assessment proposed LNG Plant Damietta Port, Egypt. Approved by the EEAA on 30 January 2002. Ref. Number 50645.

Komex, June 2003. EIA Addendum: LNG Facility (as-built design) Damietta Port, Egypt. Notification and EIA of Design Changes. Submitted to the Damietta Port Authority (DPA) on 26 January 2003 (Ref Number DPA 003/03) and approved by the EEAA in 2004. Ref. Number 50626-2.

Komex, November 2001. Environmental Impact Assessment LNG Loading Jetty Damietta Port, Egypt. Approved by the EEAA on 5 February 2002. Ref. Number 50645-1.

Law No. 102 of the Year 1983 concerning the natural reserves. English Version: The Middle East Library for Economic Services (November, 2004). Arabic Version: Al Amiria Press (1997).

Law No. 117 of the Year 1983, promulgating the Law on Protection of Antiquities. Al Amiria Press (2002).

Law No. 12 of the Year 2003 promulgating the Labour Law. The Middle East Library for Economic Services

Law No. 124 of the Year 1983 for fishing, aquatic life, and the regulation of fish farms in Egypt. Al Amiria Press (2006).

Law No. 48 of the Year 1982 concerning the protection of the River Nile and waterways against pollution. English Version: The Middle East Library for Economic Services (November, 2004). Arabic Version: Al Amiria Press (2004).

Mashaly, I.A. et al., 2001. Vegetation Analysis along Irrigation and Drain Canals in Damietta Province, Egypt, Online Journal of Biological Sciences 1(12): 1183-1189, 2001.

Shaltout, K. et al., 2002, Vegetation of the urban habitats in the Nile Delta region, Egypt. Urban Ecosystems, Springer Netherlands, Issue: Volume 6, Number 3, September 2002; pp: 205 – 221.

Ufisa Soluziona Servicios Profesionales, ALATEC Ingenerios Consultores y Arquitectos. (ufisa/ Alatec) 2000. Basic Project of the Loading LNG Terminal in Damietta Port (Egypt) – Data Collection.

UGD (United Gas Derivatives Company), February 2002. NGL (Natural Gas Liquids) Project. Preliminary EIA. UGD ENV 01.

Wikipedia 2006. http://en.wikipedia.org/wiki/Nile_Delta.

World Bank Group, 1998. Pollution Prevention and Abatement Handbook. Toward Cleaner Production. The World Bank Group. Washington, D.C. (July, 1998).

Youssef, S. El-Dididy, 2001. Notes on Earthquake Hazard Risk of Egypt. Prepared in conjunction with the International Workshop on Disaster Reduction, Reston, VA.

References referred to in the biological analysis report:

Abdel-Aziz, N.E. 1997. Zooplankton production along Egyptian Mediterranean coast at Alexandria, with special reference to like history of one copepod species. Ph.D. Thesis, Fac. Sci. Mansoura Univ., 234 pp.

Dowidar, N. M. 1984. Phytoplankton biomass and primary productivity of the southern Mediterranean . Deep Sea Res., 31(6-8A): 983-1000.

El-Bassat, R. A. 2000. Ecological studies on Zooplankton communities with particular references to free living Protozoans at Damietta branch of River Nile, Ph.D. Thesis, Fac. Girls., Ain Shams univ. 116pp

El-Rashidy, H. H. H. 1987. Ichthyoplankton of the south eastern Mediterranean Sea off the Egyptian coast. M.Sc. Thesis, Fac. Sci. Alexandria University, Egypt.

Ettewa, I. 1988. Report on the Egyptian fisheries focusing on the Mediterranean. General Fisheries Council for the Mediterranean. Report of the Second Technical Consultation on Stock assessment in the Eastern Mediterranean. Athens, Greece. Fish. Rep. No. 142. FAO Rome. 164-172.

Halim, Y. 1960. Observations on the Nile bloom of phytoplankton in the Mediterranean. J. Du. Conseil, 26 (1): 97-106.

Helal, H.A. 1981. Studies on zooplankton of Damietta branch of the River Nile north of El-Mansoura. M.Sc. Thesis, Fac. Sci., El-Mansoura Univ., 231 pp.

Hulings, N. C. 1971a. A quantitative study of the sand beach meio-fauna in Tunisia. Preliminary report, Bull. Inst. Oceanogr. Peche, 2: 237.

Hulings, N. C. 1971b. A comparative study of the sand beach meiofauna of Lebanon, Tunesia and Marocco, Thalassia jugoslavica, 7: 117.

Hulings, N. C. 197. A temporal study of Lebanese sand beach meiofauna, Cah. Biol. Mar., 15:319.

Nour El Din, N.M. 1987. Ecology and distribution of pelagic copepods in the Mediterranean waters of Egypt. M.Sc. Thesis, Fac. Sci. Alexandria Univ., 213pp.

Theil, H. 1978. Benthos in upwelling regions, in: "Upwelling ecosystems", R. Boje and M Tomczak, eds., Springer Verlag, Berlin, Heidelberg.

Vitiello, P. and Triki, S. 1978. Données écologiques sur la meiofaune interstitielle du bas des plages du golfe de Tunis. Arch. Inst. Pasteur Tunis, 55:383.

APPENDIX I – COMMERCIAL REGISTRY

وزارة التموين والتجارة الداخلية
مصلحة التسجيل التجاري

طلب قيد في السجل التجاري

السيد أمين مكتب السجل التجاري ... بمحافظة

تحية طيبة وبعد

أنا الموقع على هذا / الأستاذ/ عمرو عبد الرحيم – جاد علي محمد
المقيم ٥ شارع اسماعيل محمد الزمالك – القاهرة.
الطالب (بنفسي / أو الوكيل) وكيل المؤسسين ... قيد إسمي عن الشركة الآتي
بياناتها فيما بعد وأقر أن جميع البيانات الواردة في هذا الطلب صحيحة وعلى مسئوليتي
تحريراً في / / ١٩

وكيل المؤسسين
توقيع الطالب
عمرو عبد الرحيم

البيانات

١ – نوع الشركة — شركة مساهمة مصرية بنظام المناطق الحرة الخاصة وفقاً لأحكام القانون رقم ٨ لسنة ١٩٩٧ قانون ضمانات وحوافز الاستثمار ولائحته التنفيذية

٢ – عنوان الشركة أو اسمها التجاري — الشركة المصرية ميثانكس لإنتاج الميثانول (إيميثانكس)

٣ – السمة التجارية

٤ – الغرض من تأسيس الشركة — إقامة وإنشاء وتشغيل مجمع متكاملة متضمناً خطوط الأنابيب لنقل الغاز ومحطات التحكم إلى موقع المشروع وكافة منشآت وتسهيلات التحميل والتخزين والتصدير اللازمة لإنتاج الميثانول ومشتقاته وعلى الشركة الحصول على كافة التراخيص اللازمة لمباشرة نشاطها

٥ – عنوان المركز العام للشركة — مدينة دمياط الجديدة

٦ – عناوين الفروع أو الوكالات التابعة للشركة —

٧ – رأس مال الشركة المرخص به — ستون مليون دولار أمريكي

(أ) مقدار رأس المال المصدر — ستة مليون دولار أمريكي

(ب) المبالغ المؤداة منه — ستمائة ألف دولار أمريكي

(جـ) المبالغ التي تعهد الشركاء بأدائها — الباقي

(د) قيمة الحصص العينية —

مدة الشركة ٥٠ عاماً تبدأ من تاريخ القيد بالسجل التجاري

١٠ - تاريخ الترخيص لوزارة التجارة أو موافقة هيئة الاستثمار

١١ - أعضاء مجلس الإدارة في شركات المساهمة ووكلائهم المديرون وصفة كل منهم ومدى سلطته في الإدارة والتوقيع

الاسم واللقب	الصفة	تاريخ الميلاد	محل الميلاد	الجنسية
١ - عضو ممثل لشركة ميثانكس	عضو			جزر كايمن
٢ - عضو ممثل لشركة ميثانكس	عضو			جزر كايمن
٣ - عضو ممثل لشركة ميثانكس	عضو			جزر كايمن
٤ - عضو ممثل الشركة المصرية القابضة للبتروكيماويات (ايكم)	رئيس عضو			مصري
٥ - عضو ممثل الشركة المصرية القابضة للبتروكيماويات (ايكم)	عضو			مصرية

وله حق التوقيع عن الشركة مجتمعين عضوين من أعضاء مجلس الإدارة أحدهما ممثل شركة ميثانكس والآخر ممثل شركة ايكم

١٢ - رقم تسجيل العلامات التجارية وبراءات الاختراع والرسوم والنماذج الصناعية المسجلة باسم الشركة

١٣ - مدير الفرع الرئيسي ، أو الوكالة العامة بالجمهورية (إذا كان المركز العام للشركة في الخارج)

الاسم واللقب .... تاريخ الميلاد .... جنسيته

بيانات خاصة بمكتب السجل التجاري

أودع هذا الطلب برقم ٢٠٥ في ١٤/١٢/٢٠٠٥

وتم القيد في السجل التجاري برقم ١٢١٠٤

دمياط

في / / ١٩

APPENDIX II – MWRI APPROVAL

وزارة الموارد المائية والري
مكتب
رئيس قطاع الري

السيد الدكتور/ محمود صفوت بدير
نائب رئيس الشركة المصرية القابضة للبتروكيماويات

تحية طيبة وبعد ،،

بالاشارة للطلب المقدم من الشركة المصرية القابضة للبتروكيماويات بخصوص الموافقة على تدبير احتياجات مشروعى الميثانول والامونيا من مياه نهر النيل فرع دمياط وما تم الاتفاق عليه فى الاجتماع الذى تم عقده مع السادة مندوبى الشركة بهذا الخصوص.

يرجى التكرم بالاحاطة بأن السيد الاستاذ الدكتور الوزير قد وافق على توفير كمية من المياه من فرع دمياط للمشروعين بمعدل ١٢٠٠ متر مكعب/ الساعة.

رجاء التكرم بالاحاطة...

وتفضلوا بقبول فائق الاحترام ،،،

رئيس قطاع الري

(مهندس / رفقى البنداري

APPENDIX III – INVESTOR ASSOCIATION DECREE

الهيئة العامة للاستثمار
والمناطق الحرة

قرار
نائب رئيس الهيئة العامة للاستثمار والمناطق الحرة
رقم ٢٠١٢ / ١ لسنة ٢٠٠٥
بشأن الترخيص بتأسيس الشركة المصرية ميثانكس لإنتاج الميثانول (ايميثانكس)
شركة مساهمة مصرية بنظام المناطق الحرة الخاصة

بعد الاطلاع على الدستور

- وعلى قانون التجارة
- وعلى القانون رقم ٣٤ لسنة ١٩٧٦ فى شأن السجل التجارى ولائحته التنفيذية .
- وعلى قانون سوق رأس المال الصادر بالقانون رقم ٩٥ لسنة ١٩٩٢ ولائحته التنفيذية .
- وعلى قانون ضمانات وحوافز الاستثمار الصادر بالقانون رقم ٨ لسنة ١٩٩٧ ولائحته التنفيذية .
- وعلى قرار رئيس جمهورية مصر العربية رقم ٢٨٤ لسنة ١٩٩٧ بإنشاء الهيئة العامة للاستثمار والمناطق الحرة المعدل بالقرار رقم ٣١٦ لسنة ٢٠٠٤ .
- وعلى قرار رئيس جمهورية مصر العربية رقم ٢٣١ لسنة ٢٠٠٤ بتنظيم وزارة الاستثمار .
- وعلى قرار رئيس مجلس الوزراء رقم (١) لسنة ١٩٩٠ بإصدار نموذج النظام الأساسي للشركات المساهمة .
- وعلى قرار السيد الأستاذ الدكتور رئيس الهيئة العامة للاستثمار والمناطق الحرة رقم ٣٨٩١/٤/أ لسنة ٢٠٠٤ .

(١)

صحيفة الاستثمار – العدد

الهيئة العامة للاستثمار
والمناطق الحرة

وعلى قرار السيد الأستاذ الدكتور رئيس الهيئة العامة للاستثمار والمناطق الحرة رقم ٣٦٢٤/١/ع/٢٠٠٤ بالموافقة على أقامة الشركة المصرية ميثانيكس لإنتاج الميثانول (ايميثانكس) ش.م.م بنظام المناطق الحرة الخاصة .

وعلى موافقة السيد الأستاذ نائب رئيس الهيئة بتاريخ ٢٠٠٥/١/٤ على طلب الشركة إجراء بعض التعديلات في (اسم الشركة- النشاط – راس المال) .

وعلى قرار السيد الاستاذ نائب رئيس الهيئة العامة للاستثمار والمناطق الحرة رقم ١٩٣٦ /١/لسنة ٢٠٠٥ بتاريخ ٢٠٠٥/٣/٢٧ بالترخيص بتاسيس الشركة المصرية ميثانيكس لإنتاج الميثانول (ايميثانكس) ش.م.م بنظام المناطق الحرة الخاصة ،

قررت الهيئة العامة للاستثمار والمناطق الحرة

(المادة الأولى)

يلغى قرار نائب رئيس الهيئة العامة للاستثمار والمناطق الحرة رقم ١٩٣٦/١/لسنة ٢٠٠٥ بالترخيص بتأسيس الشركة المصرية ميثانيكس لإنتاج الميثانول (ايميثانكس) ش.م.م بنظام المناطق الحرة الخاصة لوجود خطأ مادي .

(المادة الثانية)

يرخص بتأسيس الشركة المصرية ميثانيكس لإنتاج الميثانول (ايميثانكس) ش.م.م بنظام المناطق الحرة الخاصة وفقاً لأحكام القانون رقم ٨ لسنة ١٩٩٧ بإصدار قانون ضمانات وحوافز الاستثمار ولائحته التنفيذية وبياناتها الأساسية على النحو التالي :-

أولاً : أسم الشركة :- المصرية ميثانيكس لإنتاج الميثانول (ايميثانكس)

(٢)

صحيفة الاستثمار – العدد

الهيئة العامة للاستثمار
والمناطق الحرة

شركة مساهمة مصرية بنظام المناطق الحرة الخاصة

ثانياً : رأسمال الشركة :- حدد رأسمال الشركة المرخص به
بمبلغ: ٦٠٠٠٠٠٠٠$ (ستون مليون) دولار امريكي، وحدد راسما ل
الشركة المصدر بمبلغ ٦٠٠٠٠٠٠$ (ستة ملايين) دولار امريكي ،
وتبلغ نسبة المساهمة المصرية ٢٤ % وأن المؤسسون والمكتتبون
قد سددوا نسبة ١٠ % من القيمة الاسمية للأسهم عند الاكتتاب على
ان تزاد الى ٢٥% خلال مدة لا تجاوز ثلاثة اشهر من تاريخ قيد
الشركة بالسجل التجاري ، وتلتزم الشركة بإخطار الهيئة العامة
للاستثمار والمناطق الحرة بشهادة بنكية تفيد تمام هذه الزيادة خلال المدة
المشار إليها .

– ثالثاً :غرض الشركة :هو القيام فى المنطقة الحرة الخاصة بمدينة دمياط
الجديدة بإقامة وانشاء وتشغيل مجمع ومشتملاته متضمنا خطوط الانابيب
لنقل الغاز ومحطات الدفع الى موقع المشروع وكافة مستلزمات وتسهيلات
التحميل والشحن والتصدير اللازمة لانتاج وبيع الميثانول ومشتقاته.
وعلى الشركة الحصول على كافة التراخيص اللازمة لمباشرة نشاطها.

رابعاً : موقع ممارسة النشاط والمركز الرئيسي للشركة: مدينة دمياط الجديدة
تلتزم الشركة بمراعاة احكام المادة الرابعة من اللائحة التنفيذية لقانون رقم ٨
لسنة ١٩٩٧ .

خامساً:- تشكيل مجلس الادارة كما ذكر فى النظام الاساسى للشركة .

(٣)

صحيفة الاستثمار – العدد

الهيئة العامة للاستثمار
والمناطق الحرة

م	الاسم	الجنسية	الصفة
١	عضو ممثل لشركة ميثانيكس	جزيرة كايمن	عضو
٢	عضو ممثل لشركة ميثانيكس	جزيرة كايمن	عضو
٣	عضو ممثل لشركة ميثانيكس	جزيرة كايمن	عضو
٤	عضو ممثل للشركة المصرية القابضة للبتروكيماويات (ايكم)	مصرية	عضو
٥	عضو ممثل الشركة المصرية القابضة للبتروكيماويات (ايكم)	مصرية	عضو

وقد ورد استعلام أمني طيب عن الشركة الأجنبية من جهتي الأمن

سادساً: مدة الشركة: (خمسون سنة) تبدأ من تاريخ قيدها في السجل التجاري .

سابعاً: حق الإدارة والتوقيع: - يملك حق التوقيع عن الشركة مجتمعين عضوين من أعضاء مجلس الإدارة احدهما يمثل شركة ميثانيكس والآخر يمثل شركة ايكم .

تشهد الهيئة العامة للاستثمار والمناطق الحرة أنها اطلعت على العقد الذي بمقتضاه وكل المؤسسين المذكورين [illegible] نيابة وكيلين عنهم في تأسيس الشركة وإيداع الإجراءات اللازمة لذلك وقد تم التصديق على العقد الابتدائي والنظام الأساسي للشركة بمكتب توثيق [illegible] بتاريخ [illegible] / ٢٠٠٥ وذلك بموجب محضر تصديق رقم ٢٣٨٨ هـ لسنة ٢٠٠٥ .

(٤)

صحيفة الاستثمار – العدد

الهيئة العامة للاستثمار
والمناطق الحرة

تشهد الهيئة العامة للاستثمار والمناطق الحرة بأن كافة مستندات تأسيس هذه الشركة مودعة طرفيا .

(المادة الثالثة)

تلتزم الشركة بكافة الضوابط والشروط الواردة بقرار الموافقة على اقامة الشركة، رقم ٣٦٢٤/١ لسنة ٢٠٠٤ وموافقة السيد الاستاذ نائب رئيس الهيئة المؤرخة فى ٢٠٠٥/١/٤ وفى حالة عدم التزام الشركة بها ستقوم الهيئة باتخاذ اجراءات سحب القرار .

(المادة الرابعة)

يترتب على هذا القرار منح الشخصية الاعتبارية للشركة بعد قيدها فى السجل التجاري ولا ينشئ هذا القرار اى حق للشركة فى مزاولة غرضها الا بعد الحصول على كافة التراخيص اللازمة لمزاولة غرضها من الجهات المختصة .

(المادة الخامسة)

لا يترتب على هذا الترخيص منح أى احتكار أو امتياز للشركة .

(المادة السادسة)

ينشر هذا القرار فى صحيفة الاستثمار .

[illegible]
نائب رئيس الهيئة العامة
للاستثمار والمناطق الحرة

(٢)

صحيفة الاستثمار - العدد

APPENDIX IV – METHANEX AWARDS

Awards

Methanex has received numerous awards that recognize the Company's commitment to Responsible Care practices. These awards show how employees, working together, make Responsible Care a regular part of our daily business.

2005	
North America	**BNSF and CSX Product Stewardship Award** Berlington Northern Santa Fe Railway and CSX Corporation award for having zero non-accidental releases on their railroads
North America	**CCPA SHARE (Safety and Health Analysis Recognition and Exchange) Award for Excellence in Safety** Excellent safety performance as measured by total recordable incidents over five years
Asia Pacific	**Corporate Environmental Award/Massey University** Winner of the above award, out of 39 NZ companies, for management systems, policies, objectives and communication
2004	
Asia Pacific	**Corporate Environmental Award/Massey University** In the top 5 of New Zealand companies for management systems, policies, objectives and communication
Asia Pacific	**Responsible Care Re-verification**
Europe	**Responsible Care Re-verification**
Latin America	**ASIQUIM Corporate Social Responsibility Award** Excellence in Corporate Social Responsibility
Latin America	**Responsible Care Re-verification**
North America	**Emergency Preparedness for Industry and Commerce Council** Excellence in Emergency Preparedness - Company Award
North America	**Responsible Care Re-verification**
North America	**CCPA SHARE (Safety and Health Analysis Recognition and Exchange) Award for Excellence in Safety** Excellent safety performance as measured by total recordable incidents over five years
2003	
Asia Pacific	**Corporate Environmental Award/Massey University** Management systems, policies, objectives and communication
Latin America	**Asociaci6n Chilena de Seguridad (ACHS) Merit Award 2002** Outstanding loss prevention performance

North America	**CCPA SHARE (Safety and Health Analysis Recognition and Exchange) Award for Excellence in Safety** Excellent safety performance as measured by total recordable incidents over five years
2002	
Asia Pacific	**Corporate Environmental Award/Massey University** Management systems, policies, objectives and communication
Asia Pacific	**Equal Employment Opportunities Trust Award for Work/Life Balance** Excellent innovative systems, policies, and procedures in place to ensure work life balance for employees
North America	**CCPA SHARE (Safety and Health Analysis Recognition and Exchange) Award for Excellence in Safety** Excellent safety performance as measured by total recordable incidents over five years
2001	
Asia Pacific	**Brookfields Business Ethics Award** Ethical business practices and positive effect on the community
Asia Pacific	**Corporate Environmental Award/Massey University** Management systems, policies, objectives and communication
Asia Pacific	**Responsible Care Re-verification**
Europe	**Responsible Care Re-verification**
Latin America	**Responsible Care Re-verification**
North America	**CN Railroad Safe Product Handling Award** Shippers who move over 5,000 loads of hazardous shipments on CN with a maximum of one non-accident release
North America	**Responsible Care Re-verification**
2000	
Asia Pacific	**Gold Prince Award from NZCIC** Commitment to superior EHS performance
Asia Pacific	**Korean Government Super Merit Award** Over 260,000 hours at Yosu Terminal with no serious or major injuries
Latin America	**ASIQUIM Responsible Care Award** Responsible Care management systems
Latin America	**Carlos Vial Espantoso Foundation Award** Excellence in employee relations
Latin America	**Oxygen AwardISantiago University** Successful environmental protection
North America	**CCPA Award for Most Improvement in Employee Injury Frequency Rate**

APPENDIX V – METEOROLOGICAL DATA

ARAB REPUBLIC OF EGYPT
EGYPTIAN METEOROLOGICAL AUTHORITY
CLIMATE DEPART

DATE : 13 / 3 / 2005
REQ NO : 49
FILE NO: 36

Hourly Readings For 0000& 0400& 0800&1200&1600&2000 G. M . T From 1/1/2004 TO 31/10/2004 .
For Dry Temperature , Relative Humidity and Pressure to Mean Sea Level

STATION : DEMIATTA .

TD = Dry Temperature (c°) .

RH = Relative Humidity (%) .

PRESS = Pressure to mean sea level (H . PQ) .

Prepared by

Hassan
13-3-2005

Director of climate
13-3-2005

DATE	TIME	RH	PRESS.	TD
20040101	0	83	1017.2	13.2
20040101	4	84	1016.8	12.2
20040101	8	93	1017.7	10.4
20040101	12	53	1016.2	18.4
20040101	16	47	1014.3	19
20040101	20	88	1014.3	12.2
20040102	0	87	1012.9	11.4
20040102	4	94	1010.9	9.3
20040102	8	88	1010.6	10
20040102	12	47	1008.9	17.4
20040102	16	42	1007.8	17.9
20040102	20	61	1009.9	13.5
20040103	0	74	1010.5	10
20040103	4	83	1011.6	9
20040103	8	80	1013.1	9
20040103	12	48	1012.8	17.5
20040103	16	50	1012.1	17.5
20040103	20	73	1013.5	12.1
20040104	0	70	1013.7	10.7
20040104	4	77	1013.6	9
20040104	8	76	1013.9	9.6
20040104	12	39	1011.8	18.1
20040104	16	41	1010.9	18.9
20040104	20	60	1011	13.9
20040105	0	62	1011.6	12.1
20040105	4	61	1011.8	12.2
20040105	8	71	1013.3	11.2
20040105	12	45	1014	19.7
20040105	16	46	1014.7	19.1
20040105	20	61	1016	14.9
20040106	0	70	1015.6	13.5
20040106	4	78	1014.3	11.7
20040106	8	76	1015	12.1
20040106	12	45	1014.1	19.1
20040106	16	54	1012.9	16.6
20040106	20	59	1013.8	14.1
20040107	0	73	1013.2	12.3
20040107	4	69	1011.6	11.9
20040107	8	75	1011.5	11.3
20040107	12	60	1012.8	14.3
20040107	16	57	1013.9	15
20040107	20	73	1015.7	11.6
20040108	0	64	1015.7	10
20040108	4	89	1015.7	9.9
20040108	8	90	1017.3	10.5
20040108	12	66	1016.9	14.8
20040108	16	62	1017.1	15
20040108	20	82	1018.6	11.9
20040109	0	88	1018	10.9
20040109	4	90	1017.4	10.2
20040109	8	91	1017.6	9.2
20040109	12	65	1016.2	15.8
20040109	16	59	1015.4	16
20040109	20	78	1015.9	13
20040110	0	88	1015.4	12
20040110	4	88	1014.8	11.4
20040110	8	86	1015.3	12
20040110	12	64	1014.5	18.1
20040110	16	65	1013.3	15.6
20040110	20	88	1013.2	12.1

DATE	TIME	RH	PRESS.	TD
20040111	0	82	1012.3	12.1
20040111	4	78	1010.6	11.7
20040111	8	72	1011.2	11.8
20040111	12	57	1010.7	14.9
20040111	16	52	1009.9	16.6
20040111	20	57	1009.8	15.1
20040112	0	55	1008.7	14.4
20040112	4	77	1007	12
20040112	8	79	1007.7	11.1
20040112	12	74	1007	11.5
20040112	16	84	1006.1	11.8
20040112	20	82	1006.9	12.4
20040113	0	70	1009.9	13.6
20040113	4	69	1011.2	14.3
20040113	8	83	1013.8	12.1
20040113	12	68	1014.4	15
20040113	16	75	1013.3	15.9
20040113	20	89	1012.5	13.8
20040114	0	89	1011	12.8
20040114	4	99	1009	11.7
20040114	8	95	1010.4	12.2
20040114	12	84	1011.2	17.2
20040114	16	81	1011.1	17.7
20040114	20	92	1011.7	15.6
20040115	0	94	1011.7	14.6
20040115	4	0	1011.1	11.9
20040115	8	88	1012.3	11.2
20040115	12	68	1012.2	18.3
20040115	16	64	1011.8	19.1
20040115	20	86	1012.7	14.7
20040116	0	91	1012.7	12.3
20040116	4	89	1012.4	11.8
20040116	8	88	1013.9	11.2
20040116	12	55	1013.8	18.9
20040116	16	57	1013.1	19.4
20040116	20	79	1014.8	15
20040117	0	91	1014.9	13.5
20040117	4	93	1014.9	12.3
20040117	8	91	1016.9	12.8
20040117	12	64	1016.9	18.3
20040117	16	62	1016.9	17.2
20040117	20	79	1017.5	13.7
20040118	0	82	1017.9	12.6
20040118	4	98	1017.7	9.7
20040118	8	89	1019	11.7
20040118	12	59	1018.8	17.5
20040118	16	66	1018.1	15.7
20040118	20	77	1019.5	13.9
20040119	0	86	1019.5	12.3
20040119	4	88	1019.1	12.4
20040119	8	86	1020	13
20040119	12	63	1020	17
20040119	16	64	1019	16.8
20040119	20	83	1018.4	13.4
20040120	0	85	1018	13.1
20040120	4	84	1017.5	13.3
20040120	8	81	1019	14
20040120	12	60	1018.8	17.8
20040120	16	64	1017.4	17.1
20040120	20	89	1017.7	12.5

(1)

DATE	TIME	RH	PRESS.	TD
20040121	0	93	1016.9	11.7
20040121	4	99	1015.5	10.8
20040121	8	93	1016	12.3
20040121	12	79	1012.9	17.1
20040121	16	79	1010.9	16.8
20040121	20	88	1008.9	15.2
20040122	0	79	1005.9	15.6
20040122	4	84	1001.1	14.6
20040122	8	89	1001.7	13.6
20040122	12	70	1001.7	15
20040122	16	64	1001.1	14.7
20040122	20	70	1001.3	13.7
20040123	0	71	1001.4	13.7
20040123	4	79	1002.8	11
20040123	8	83	1004.9	10
20040123	12	65	1005.9	11.7
20040123	16	63	1006	12.4
20040123	20	64	1007.7	11.2
20040124	0	65	1007.9	10.5
20040124	4	70	1008.5	9.8
20040124	8	80	1010.7	8.4
20040124	12	75	1011.5	12
20040124	16	55	1010.1	14.6
20040124	20	74	1011.1	10.2
20040125	0	77	1010.8	8.2
20040125	4	81	1008.8	7.1
20040125	8	70	1009	9.2
20040125	12	48	1008.1	15.6
20040125	16	57	1007.7	15
20040125	20	70	1009.5	12
20040126	0	78	1011.3	9.5
20040126	4	84	1011.7	8.6
20040126	8	82	1013.6	8.5
20040126	12	52	1014.9	15
20040126	16	45	1014.2	15.6
20040126	20	74	1014.3	9.8
20040127	0	66	1012.7	11
20040127	4	70	1012.7	11
20040127	8	74	1015.7	11
20040127	12	58	1016.3	17.3
20040127	16	63	1016.3	15.7
20040127	20	80	1017.7	12.7
20040128	0	85	1018.5	11.7
20040128	4	89	1018.1	10.6
20040128	8	91	1018.7	11
20040128	12	60	1018.7	17
20040128	16	66	1017.7	15.6
20040128	20	83	1017.8	13.3
20040129	0	87	1017.6	12.8
20040129	4	90	1016.1	12.2
20040129	8	85	1015.1	13.6
20040129	12	70	1014.1	18
20040129	16	73	1012.8	17.6
20040129	20	96	1013.6	12.9
20040130	0	95	1013.3	12
20040130	4	92	1012.5	11.5
20040130	8	87	1013.9	11
20040130	12	70	1015.8	18.9
20040130	16	71	1016.1	18.2
20040130	20	83	1018	14.3

DATE	TIME	RH	PRESS.	TD
20040131	0	78	1018.3	12.8
20040131	4	85	1018.2	9.4
20040131	8	78	1019.1	10.5
20040131	12	44	1017.7	17.4
20040131	16	42	1016.2	16.6
20040131	20	74	1016.3	11.6
20040201	0	80	1015.9	10.1
20040201	4	83	1014.9	10
20040201	8	86	1016.8	10
20040201	12	62	1016.8	15.8
20040201	16	55	1017.5	16.9
20040201	20	68	1018.8	14
20040202	0	72	1018.8	13.4
20040202	4	70	1018	12.9
20040202	8	75	1019.4	12.4
20040202	12	49	1019.8	16.8
20040202	16	55	1019.2	16.1
20040202	20	69	1020.4	13.1
20040203	0	74	1020	11.9
20040203	4	74	1018.9	10.6
20040203	8	73	1019.2	11.1
20040203	12	62	1019	16.6
20040203	16	67	1017.9	16
20040203	20	77	1018.4	13.6
20040204	0	83	1017.9	11.3
20040204	4	89	1014.9	10
20040204	8	91	1014.1	9.5
20040204	12	86	1013.3	11.9
20040204	16	89	1009.9	11.6
20040204	20	93	1008.6	11
20040205	0	94	1008.5	10.7
20040205	4	0	1009.2	0
20040205	8	95	1010.9	11
20040205	12	83	1013.7	14
20040205	16	71	1015.6	15.3
20040205	20	80	1017.8	13.5
20040206	0	82	1019.8	13.2
20040206	4	87	1020.1	12.8
20040206	8	79	1022.1	13.8
20040206	12	64	1023.9	16.7
20040206	16	64	1023.1	16.9
20040206	20	81	1023.9	13.6
20040207	0	89	1024.3	11.9
20040207	4	95	1023.9	11
20040207	8	93	1025	11.2
20040207	12	60	1025.4	18.6
20040207	16	63	1024.7	18.3
20040207	20	83	1025	14.7
20040208	0	88	1025.6	13
20040208	4	94	1024.7	11.3
20040208	8	99	1025	10.3
20040208	12	67	1025	18
20040208	16	67	1023	16.7
20040208	20	86	1022.9	12.9
20040209	0	85	1022.1	13
20040209	4	89	1019.9	12.6
20040209	8	81	1021.6	14
20040209	12	69	1021.2	17.4
20040209	16	71	1019.5	17.1
20040209	20	81	1019.8	14.6

(2)

DATE	TIME	RH	PRESS.	TD
20040210	0	80	1019.7	15
20040210	4	85	1017.9	13.9
20040210	8	85	1018.1	14.4
20040210	12	74	1016.9	16.4
20040210	16	75	1016.1	15.8
20040210	20	80	1017.3	15
20040211	0	85	1017.6	14
20040211	4	89	1017	13
20040211	8	88	1017.7	13
20040211	12	68	1018.8	18.2
20040211	16	55	1018.9	17.6
20040211	20	73	1019.7	14.3
20040212	0	89	1019.6	11.5
20040212	4	90	1018.6	11.6
20040212	8	90	1018.5	11.6
20040212	12	57	1017.7	17.6
20040212	16	62	1014.9	17.2
20040212	20	77	1013.9	14.4
20040213	0	74	1011.9	14
20040213	4	83	1010.4	11.9
20040213	8	84	1011.1	11.7
20040213	12	46	1010.1	18.8
20040213	16	62	1009.8	17.2
20040213	20	78	1011.8	12.9
20040214	0	85	1012.4	10.5
20040214	4	87	1011.6	9.6
20040214	8	82	1012.8	7.6
20040214	12	90	1015.2	9
20040214	16	93	1016	7.6
20040214	20	95	1016.9	7
20040215	0	95	1016.9	7.3
20040215	4	95	1017.6	8
20040215	8	90	1019.8	8.7
20040215	12	65	1020	14
20040215	16	57	1019.9	13.4
20040215	20	86	1020.5	10.1
20040216	0	87	1020.8	9.6
20040216	4	88	1018.8	9.6
20040216	8	84	1020.1	9
20040216	12	58	1021.2	17.3
20040216	16	70	1020.1	16.1
20040216	20	77	1020.6	13.3
20040217	0	82	1020.6	11.7
20040217	4	90	1019.8	5.4
20040217	8	97	1020.5	8.7
20040217	12	60	1019.6	17.2
20040217	16	59	1016.6	17.2
20040217	20	79	1016.8	13.5
20040218	0	90	1018.7	11.8
20040218	4	98	1015.8	11
20040218	8	91	1014	12
20040218	12	48	1013.5	19.5
20040218	16	54	1012.7	18.6
20040218	20	89	1015.2	13
20040219	0	92	1018.6	11.5
20040219	4	90	1018.4	10
20040219	8	56	1017.8	19.1
20040219	12	58	1019.2	19.7
20040219	16	54	1020.5	18.5
20040219	20	67	1020.5	11.7

DATE	TIME	RH	PRESS.	TD
20040220	0	74	1023.8	13
20040220	4	88	1023.6	10.1
20040220	8	83	1025.9	11.8
20040220	12	59	1025.6	16.1
20040220	16	57	1024.3	16.7
20040220	20	77	1023.9	12.7
20040221	0	78	1023.6	12.2
20040221	4	79	1022.2	12
20040221	8	80	1022.8	11.6
20040221	12	58	1022.2	17.7
20040221	16	57	1020	17.6
20040221	20	75	1019.4	14.4
20040222	0	76	1018.8	12.7
20040222	4	84	1018.5	12.7
20040222	8	65	1021.8	11.7
20040222	12	50	1022.3	13.7
20040222	16	52	1022.2	13
20040222	20	66	1023.5	10.4
20040223	0	77	1022.7	8.7
20040223	4	77	1021.7	8.2
20040223	8	72	1023.2	10.2
20040223	12	58	1023.2	15
20040223	16	59	1021.2	15.2
20040223	20	78	1021.6	11.8
20040224	0	79	1021.1	12.1
20040224	4	80	1019.6	12.5
20040224	8	72	1019.7	14.3
20040224	12	53	1018.5	21.5
20040224	16	61	1017.8	20.8
20040224	20	63	1017.8	18.7
20040225	0	88	1018.1	15
20040225	4	86	1018.7	14.6
20040225	8	87	1021	14.8
20040225	12	71	1021.7	19.4
20040225	16	71	1020.7	18.6
20040225	20	93	1021.7	14.7
20040226	0	87	1023.1	13.5
20040226	4	88	1021.1	13.1
20040226	8	86	1021.1	14.9
20040226	12	75	1021.9	18.8
20040226	16	80	1019.4	16.5
20040226	20	94	1019.3	14.6
20040227	0	84	1019.6	14.6
20040227	4	88	1018.5	14.7
20040227	8	84	1018.8	15.6
20040227	12	60	1018.8	21.1
20040227	16	67	1016.8	20.6
20040227	20	80	1019.7	18.2
20040228	0	90	1019.6	15
20040228	4	92	1019.5	15
20040228	8	92	1015.8	17.6
20040228	12	48	1014.5	26.1
20040228	16	51	1013.6	25.1
20040228	20	79	1014	19.5
20040229	0	84	1013.8	16.8
20040229	4	93	1012	15.6
20040229	8	86	1012.9	17.6
20040229	12	46	1012.9	28.2
20040229	16	34	[illegible]	32
20040229	20	51	[illegible]	26.7

(3)

DATE	TIME	RH	PRESS.	TD
20040301	0	83	1014.3	18.2
20040301	4	88	1014.3	17.3
20040301	8	87	1016.1	17.8
20040301	12	71	1016.7	21
20040301	16	72	1016.5	19.8
20040301	20	87	1017	16.5
20040302	0	90	1017.2	16
20040302	4	91	1014.9	16.3
20040302	8	85	1015.9	17.3
20040302	12	63	1015.5	20.5
20040302	16	0	1015.1	0
20040302	20	79	1015.6	17.4
20040303	0	83	1013.9	17
20040303	4	86	1012.4	16.4
20040303	8	85	1011.9	17.6
20040303	12	72	1011.3	22.4
20040303	16	68	1009.2	23.8
20040303	20	84	1008.7	19
20040304	0	75	1008.3	19.2
20040304	4	79	1008.9	18.2
20040304	8	62	1008.9	20.6
20040304	12	45	1006.1	28.7
20040304	16	41	1003.9	29.6
20040304	20	64	1003.4	23.8
20040305	0	66	1003.9	23
20040305	4	61	1004.9	21.7
20040305	8	75	1008.4	19.4
20040305	12	75	1009.8	18.9
20040305	16	70	1009.9	17.5
20040305	20	93	1012.8	14.5
20040306	0	91	1013.8	14.9
20040306	4	82	1015	14.7
20040306	8	78	1017.5	15
20040306	12	65	1019.8	17.1
20040306	16	64	1019.9	16.6
20040306	20	86	1021.4	14
20040307	0	89	1022.8	13.6
20040307	4	85	1022.7	12.6
20040307	8	78	1024.8	13.4
20040307	12	70	1025.3	14.8
20040307	16	78	1024.9	13.9
20040307	20	88	1025.9	12.2
20040308	0	86	1025.9	12.1
20040308	4	90	1024.7	11.8
20040308	8	65	1025.5	12.2
20040308	12	55	1025.9	15.8
20040308	16	55	1024.2	16
20040308	20	68	1025.2	12.4
20040309	0	70	1025.6	12.6
20040309	4	73	1024.6	11.7
20040309	8	68	1025.6	13.2
20040309	12	59	1026.1	16.4
20040309	16	69	1025.4	16
20040309	20	82	1025.7	11.9
20040310	0	90	1025.7	10.7
20040310	4	96	1023.9	10
20040310	8	84	1024.3	12
20040310	12	63	1022.9	19
20040310	16	57	1021.6	20.6
20040310	20	84	1021.1	15.6

DATE	TIME	RH	PRESS.	TD
20040311	0	85	1020.5	14
20040311	4	89	1020.1	14
20040311	8	82	1020.5	15.6
20040311	12	65	1020.3	18.3
20040311	16	65	1019.1	17.2
20040311	20	81	1019.5	13.8
20040312	0	83	1019.4	13.4
20040312	4	86	1018.8	12.8
20040312	8	78	1019.5	15
20040312	12	63	1019.2	17.3
20040312	16	65	1018	18.7
20040312	20	86	1018.5	12.6
20040313	0	92	1017.4	12.1
20040313	4	88	1016.9	13.2
20040313	8	81	1018.1	14.7
20040313	12	68	1018.6	17.1
20040313	16	73	1018	15.8
20040313	20	84	1018.8	14
20040314	0	82	1019.8	13.7
20040314	4	87	1019.6	13
20040314	8	75	1020.9	15.3
20040314	12	63	1021.1	17.4
20040314	16	64	1020.1	16.6
20040314	20	71	1021.4	13.8
20040315	0	71	1022.2	13.5
20040315	4	74	1021.7	13.5
20040315	8	65	1023.8	14.8
20040315	12	45	1024.9	17.7
20040315	16	42	1024	17.4
20040315	20	58	1025.6	13
20040316	0	68	1025.6	12.3
20040316	4	73	1025.6	11.1
20040316	8	59	1026.1	14.8
20040316	12	49	1025.5	17.8
20040316	16	48	1023.8	17.3
20040316	20	69	1023.3	12.8
20040317	0	80	1022.8	11.5
20040317	4	75	1020.7	12.2
20040317	8	75	1020	12.9
20040317	12	62	1019.5	17.7
20040317	16	64	1017.8	16.5
20040317	20	82	1018.7	14
20040318	0	89	1018.9	13
20040318	4	89	1018.1	12
20040318	8	71	1019.3	15.6
20040318	12	60	1019.6	18.3
20040318	16	64	1018.8	17.3
20040318	20	79	1019.7	14.5
20040319	0	83	1019.9	14.2
20040319	4	88	1019.6	12.6
20040319	8	80	1021	15
20040319	12	58	1021.9	19.2
20040319	16	54	1021.2	18.6
20040319	20	79	1022.2	14.2
20040320	0	90	1022.9	12.6
20040320	4	82	1021.9	11.7
20040320	8	80	1022.8	15.2
20040320	12	55	1023.2	19.8
20040320	16	59	1022.1	18.3
20040320	20	79	1022.9	14

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DATE	TIME	RH	PRESS.	TD
20040321	0	83	1023.2	13.6
20040321	4	88	1022.7	12.7
20040321	8	71	1023.9	15.7
20040321	12	57	1023.9	18.8
20040321	16	57	1022.5	17.8
20040321	20	74	1022.8	14.5
20040322	0	86	1022.6	13.7
20040322	4	88	1021.1	13.5
20040322	8	80	1021.1	16.5
20040322	12	69	1021.8	19.8
20040322	16	70	1019.7	19.4
20040322	20	87	1019.3	16
20040323	0	88	1018.7	15.2
20040323	4	91	1016.3	15
20040323	8	78	1015.7	18.3
20040323	12	66	1014.9	23.2
20040323	16	63	1013	23.3
20040323	20	86	1012.7	18.5
20040324	0	94	1013.7	16.4
20040324	4	98	1014.1	15.4
20040324	8	88	1017.1	16.7
20040324	12	57	1018.8	20.7
20040324	16	50	1018.3	21
20040324	20	81	1019.7	16.4
20040325	0	88	1020.5	14.8
20040325	4	0	1019.2	12.4
20040325	8	89	1020.2	16.3
20040325	12	59	1019.9	21
20040325	16	72	1018.8	19.1
20040325	20	88	1018.6	15.8
20040326	0	90	1018.6	14.6
20040326	4	89	1017.2	14
20040326	8	78	1017.8	16.1
20040326	12	65	1017.9	18.7
20040326	16	73	1016	18.8
20040326	20	81	1016.4	15.1
20040327	0	86	1014.7	14.3
20040327	4	89	1013.7	14
20040327	8	79	1014.8	16.4
20040327	12	76	1015.5	18.7
20040327	16	73	1012.5	19.1
20040327	20	90	1013	16
20040328	0	91	1013.5	16
20040328	4	94	1012.1	15.6
20040328	8	84	1013.9	18.2
20040328	12	61	1014	21.8
20040328	16	66	1011.9	21.2
20040328	20	85	1012.9	17.6
20040329	0	91	1013.1	16.5
20040329	4	96	1012.1	15.5
20040329	8	88	1013	18.6
20040329	12	49	1013.1	27.7
20040329	16	47	1011.8	26.3
20040329	20	76	1012	20.4
20040330	0	80	1011.7	19.7
20040330	4	82	1011.4	18.3
20040330	8	80	1013.6	19.5
20040330	12	66	1014.1	21.6
20040330	16	75	1013.1	20.1
20040330	20	88	1014	17.7

DATE	TIME	RH	PRESS.	TD
20040331	0	93	1013.9	16.7
20040331	4	93	1014.2	16.3
20040331	8	84	1015.2	18.3
20040331	12	48	1014.7	22.4
20040331	16	57	1012.9	21.7
20040331	20	90	1013.9	17
~~20040401~~	~~0~~	~~91~~	~~1014.2~~	~~16.6~~
20040401	0	91	1014.2	16.6
20040401	4	98	1012.6	15
20040401	8	81	1012.9	18.4
20040401	12	67	1012.2	23
20040401	16	70	1009.9	21.4
20040401	20	76	1007.8	19.7
20040402	0	71	1004.3	21
20040402	4	79	1004.8	19.4
20040402	8	78	1008.8	19.1
20040402	12	67	1011	20.9
20040402	16	69	1011.1	20.2
20040402	20	87	1012	17.2
20040403	0	86	1011.3	16.4
20040403	4	87	1011	16.2
20040403	8	82	1011.9	16.9
20040403	12	62	1011.5	20.2
20040403	16	68	1010.8	19
20040403	20	81	1011.6	16.7
20040404	0	87	1012.3	16.3
20040404	4	87	1012.6	15.3
20040404	8	71	1015	17.5
20040404	12	56	1016.4	20.4
20040404	16	58	1016.5	19.8
20040404	20	84	1017.1	15.1
20040405	0	90	1018.7	14
20040405	4	94	1017.9	12.7
20040405	8	61	1019	16.9
20040405	12	56	1018.6	19.2
20040405	16	55	1017.1	18.8
20040405	20	71	1016.5	14.6
20040406	0	81	1017.5	14
20040406	4	82	1015.9	13.7
20040406	8	63	1016.8	16.8
20040406	12	54	1015.1	19
20040406	16	55	1018.1	18.3
20040406	20	72	1019.5	15
20040407	0	82	1020	13.7
20040407	4	81	1019.3	14
20040407	8	67	1021	16.8
20040407	12	61	1021.6	19.4
20040407	16	67	1020.2	17.6
20040407	20	81	1020.7	14.3
20040408	0	91	1021.2	13
20040408	4	90	1019.9	12.6
20040408	8	73	1020.7	15.6
20040408	12	61	1020.6	18.7
20040408	16	63	1019.6	18.1
20040408	20	80	1019.5	15.2
20040409	0	82	1019.7	14.8
20040409	4	84	1018.5	13.9
20040409	8	73	1018.9	16.8
20040409	12	68	1018	19.7
20040409	16	73	1018.2	18.8

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DATE	TIME	RH	PRESS.	TD
20040409	20	87	1016.2	15.7
20040410	0	92	1016.3	15
20040410	4	94	1015.2	14.6
20040410	8	83	1016.3	17.6
20040410	12	58	1015.9	21.6
20040410	16	62	1014.9	21
20040410	20	83	1015.7	16.8
20040411	0	85	1016.1	16
20040411	4	89	1015.9	15
20040411	8	70	1017.9	19.2
20040411	12	51	1018.4	24
20040411	16	56	1016.8	22.2
20040411	20	73	1017.5	18.9
20040412	0	83	1018	15.4
20040412	4	91	1017.5	14.3
20040412	8	76	1017.9	19.3
20040412	12	42	1018.6	25.2
20040412	16	40	1017	24.7
20040412	20	85	1017.2	17.6
20040413	0	85	1017.3	16.1
20040413	4	93	1016	14.3
20040413	8	69	1017.7	19.9
20040413	12	37	1016.8	26
20040413	16	43	1015.4	25.4
20040413	20	72	1015.6	18.5
20040414	0	80	1016	17.3
20040414	4	92	1014.2	15.4
20040414	8	69	1015.2	20.7
20040414	12	37	1015.6	26.8
20040414	16	43	1014.9	24.6
20040414	20	70	1015.9	18.6
20040415	0	74	1016.4	18.6
20040415	4	81	1015.9	18.2
20040415	8	77	1017.1	18.8
20040415	12	60	1017.7	21.2
20040415	16	55	1018.2	21
20040415	20	71	1018.7	18.2
20040416	0	73	1018.9	17.2
20040416	4	86	1015.8	14.6
20040416	8	66	1018.7	17.7
20040416	12	56	1017.5	19
20040416	16	60	1017	18.7
20040416	20	70	1018.4	16.5
20040417	0	72	1018.2	15.7
20040417	4	76	1016.5	14.3
20040417	8	59	1017.7	18.5
20040417	12	55	1017.9	21
20040417	16	58	1015	20.1
20040417	20	79	1014.4	15.7
20040418	0	84	1014.1	14.9
20040418	4	85	1011.7	14.7
20040418	8	70	1010.7	17.8
20040418	12	47	1008.7	25
20040418	16	57	1005.4	24
20040418	20	72	1003.7	19.8
20040419	0	80	1002.9	18.2
20040419	4	80	1001.9	18
20040419	8	69	1004.1	19.1
20040419	12	61	1005.8	21.4
20040419	16	64	1005.7	21

DATE	TIME	RH	PRESS.	TD
20040419	20	81	1007.9	16
20040420	0	87	1008.7	17
20040420	4	95	1007.9	15
20040420	8	81	1009	18.7
20040420	12	58	1009.9	23.6
20040420	16	71	1009.1	21.8
20040420	20	80	1009.6	19.4
20040421	0	82	1009.8	18.7
20040421	4	85	1009.4	18
20040421	8	67	1009.7	20.8
20040421	12	59	1010.1	22.7
20040421	16	67	1010.1	21
20040421	20	81	1010.9	18
20040422	0	86	1010.9	16.8
20040422	4	90	1008.9	15.4
20040422	8	83	1008.2	17.8
20040422	12	41	1008.9	23.3
20040422	16	74	1008.9	16.7
20040422	20	72	1007.2	16.1
20040423	0	78	1008.3	15.2
20040423	4	87	1007.7	13
20040423	8	79	1008.8	15.7
20040423	12	55	1009.2	20.7
20040423	16	59	1009.3	20.3
20040423	20	74	1010.6	17.2
20040424	0	85	1011.2	15.2
20040424	4	89	1011.2	14.4
20040424	8	72	1012.9	17.7
20040424	12	48	1013.5	20.8
20040424	16	54	1012.8	20.4
20040424	20	74	1013.7	18
20040425	0	81	1014.5	14.5
20040425	4	85	1013	13.6
20040425	8	66	1013.8	18.6
20040425	12	50	1012.4	22.3
20040425	16	54	1010.2	21.6
20040425	20	72	1010.7	17.9
20040426	0	77	1010.9	17.2
20040426	4	81	1007.8	16.9
20040426	8	69	1007.6	20.1
20040426	12	59	1006.5	24
20040426	16	61	1004.4	23.7
20040426	20	79	1005.7	20.7
20040427	0	61	1007.6	21
20040427	4	89	1007.9	16.4
20040427	8	72	1010.6	20.3
20040427	12	35	1011.6	27.5
20040427	16	45	1011.7	25.1
20040427	20	62	1012.4	20.8
20040428	0	69	1012.5	19.6
20040428	4	84	1011.3	17.5
20040428	8	68	1013.2	21.8
20040428	12	52	1012.9	25
20040428	16	56	1011.5	23.4
20040428	20	77	1010.9	19.2
20040429	0	82	1011.7	18.2
20040429	4	88	1010.7	17.3
20040429	8	74	1012.1	19.5
20040429	12	64	1011.9	21.4
20040429	16	68	1010.8	19.8

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DATE	TIME	RH	PRESS.	TD
20040429	20	80	1010.9	17.8
20040430	0	78	1011.2	17.5
20040430	4	81	1010.9	17
20040430	8	72	1011.8	19.1
20040430	12	55	1010.8	23.5
20040430	16	58	1010.3	22
20040430	20	80	1010.4	17.7
20040501	0	87	1010.7	16.9
~~20040501~~	~~0~~	~~87~~	~~1010.7~~	~~16.9~~
20040501	4	91	1008.9	16
20040501	8	75	1009.4	19.5
20040501	12	64	1009.3	20.9
20040501	16	70	1007.1	20.6
20040501	20	76	1006.9	19
20040502	0	74	1004	19.1
20040502	4	73	1003.5	19
20040502	8	70	1006.2	21.2
20040502	12	56	1007.9	23
20040502	16	56	1007.9	22.8
20040502	20	74	1009.1	19
20040503	0	77	1010.1	17.6
20040503	4	82	1009.9	16.2
20040503	8	70	1011.5	19.3
20040503	12	57	1012.1	22.5
20040503	16	57	1012.2	21.5
20040503	20	72	1013.8	18.3
20040504	0	78	1014.9	17.4
20040504	4	83	1014.8	16.5
20040504	8	71	1016	19.3
20040504	12	57	1016.5	24.3
20040504	16	57	1015.8	23.1
20040504	20	80	1016.1	18.6
20040505	0	86	1016.5	17.7
20040505	4	82	1015.2	16.4
20040505	8	69	1016.1	21.3
20040505	12	55	1015.7	25
20040505	16	53	1013.9	24.5
20040505	20	69	1013.1	20.7
20040506	0	80	1012.5	20.3
20040506	4	87	1010.5	19.6
20040506	8	79	1009.6	22.4
20040506	12	47	1008.6	30.4
20040506	16	41	1007.8	33
20040506	20	61	1010.1	24
20040507	0	68	1011.5	22.6
20040507	4	83	1011.1	20.3
20040507	8	68	1013.1	23.2
20040507	12	49	1014.1	25.5
20040507	16	58	1013.4	24.5
20040507	20	80	1014	20.2
20040508	0	79	1014.2	19.7
20040508	4	82	1012.5	19
20040508	8	60	1013.5	22.7
20040508	12	43	1013.9	26.4
20040508	16	44	1012.5	26.3
20040508	20	69	1012.8	21.3
20040509	0	66	1011.9	21.1
20040509	4	67	1009.8	20.5
20040509	8	61	1009.9	23.3
20040509	12	48	1007.9	26.2

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DATE	TIME	RH	PRESS.	TD
20040509	16	54	1003.2	23.7
20040509	20	62	1001.3	22.5
20040510	0	72	999.8	22.3
20040510	4	75	999.3	20.7
20040510	8	47	1001.9	25.2
20040510	12	38	1004.5	29.6
20040510	16	59	1005.2	24.6
20040510	20	71	1008	21.2
20040511	0	72	1009.9	20.3
20040511	4	82	1010.8	18.3
20040511	8	67	1012.8	21.7
20040511	12	55	1012.9	25
20040511	16	62	1011.9	22.6
20040511	20	74	1012.6	19.3
20040512	0	77	1012.8	18.3
20040512	4	81	1012.3	17.7
20040512	8	65	1013.8	21.2
20040512	12	50	1014	23.8
20040512	16	55	1013.2	22.7
20040512	20	75	1013.9	19.3
20040513	0	82	1014.2	18.3
20040513	4	88	1012.2	17
20040513	8	75	1013.3	21
20040513	12	59	1011.9	24.7
20040513	16	58	1010.1	25.8
20040513	20	75	1009.8	21.5
20040514	0	76	1008.6	21.2
20040514	4	71	1003.9	21.1
20040514	8	52	1006.1	25.2
20040514	12	56	1007.5	26
20040514	16	57	1008.1	23.7
20040514	20	76	1009.7	19.9
20040515	0	78	1010.7	19.4
20040515	4	85	1009.7	18.4
20040515	8	68	1011.4	20.9
20040515	12	59	1011.6	23.9
20040515	16	67	1010.9	22.6
20040515	20	81	1011.1	19.6
20040516	0	84	1010.9	18.8
20040516	4	91	1009.6	17.8
20040516	8	74	1010.3	20.6
20040516	12	62	1010.5	23.5
20040516	16	64	1010.4	22.7
20040516	20	78	1011.9	19.5
20040517	0	85	1011.8	18.6
20040517	4	94	1011.5	16.7
20040517	8	86	1013.4	19.2
20040517	12	65	1014.6	23.2
20040517	16	63	1013.5	23.1
20040517	20	74	1015.1	20
20040518	0	77	1014.9	19.6
20040518	4	85	1014.1	19
20040518	8	75	1016	21.3
20040518	12	76	1017	22.7
20040518	16	74	1016.8	22
20040518	20	80	1016.9	20.6
20040519	0	89	1016.7	20.1
20040519	4	89	1013.4	20
20040519	8	74	1014.4	22.3
20040519	12	54	1014.1	25.1

DATE	TIME	RH	PRESS.	TD
20040519	16	74	1013.2	22.3
20040519	20	83	1014.8	20.5
20040520	0	82	1015.6	19.6
20040520	4	83	1014.9	17.7
20040520	8	71	1016.4	20.3
20040520	12	56	1016.3	22.4
20040520	16	56	1015	22.5
20040520	20	71	1015.8	19.4
20040521	0	76	1015.9	18.3
20040521	4	78	1015.5	17.7
20040521	8	64	1016.8	20.4
20040521	12	67	1017.1	22.2
20040521	16	67	1016.6	22.1
20040521	20	83	1016.7	18.6
20040522	0	84	1017.1	18
20040522	4	91	1016.4	16.9
20040522	8	77	1017.3	20.2
20040522	12	64	1017.3	22.7
20040522	16	65	1016.1	21.9
20040522	20	81	1015.7	18.3
20040523	0	90	1015.9	17
20040523	4	97	1014.9	16
20040523	8	74	1015.7	20
20040523	12	66	1015.3	22
20040523	16	62	1013.8	22
20040523	20	77	1014.8	18.8
20040524	0	89	1014.5	17.8
20040524	4	0	1012.5	15.6
20040524	8	75	1013	20.8
20040524	12	63	1013.5	22.7
20040524	16	63	1012.7	23.3
20040524	20	83	1012.9	19.5
20040525	0	91	1013.5	18
20040525	4	96	1011.7	17.4
20040525	8	73	1012.9	21.5
20040525	12	61	1011.9	23.9
20040525	16	63	1011.6	23.7
20040525	20	82	1011.3	20
20040526	0	86	1011.5	18.8
20040526	4	91	1010.1	18
20040526	8	70	1010.7	22.5
20040526	12	62	1010.1	24.8
20040526	16	52	1009.8	24.3
20040526	20	79	1009.8	21.3
20040527	0	85	1009.7	20.7
20040527	4	92	1008.9	19.7
20040527	8	75	1009.9	22.8
20040527	12	61	1010.6	25.8
20040527	16	67	1010.2	24.5
20040527	20	84	1011	21
20040528	0	93	1011.6	19.8
20040528	4	96	1011.1	19.1
20040528	8	79	1012.5	21.7
20040528	12	57	1012.6	25.5
20040528	16	63	1012.1	24.4
20040528	20	83	1012.7	20.6
20040529	0	69	1012.5	19.8
20040529	4	94	1011.6	18.6
20040529	8	75	1012.9	22.8
20040529	12	64	1011.3	20.8

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DATE	TIME	RH	PRESS.	TD
20040529	16	60	1009.7	27.2
20040529	20	68	1008.5	24.2
20040530	0	80	1007.3	22.7
20040530	4	85	1005.3	21.8
20040530	8	70	1005.8	25.9
20040530	12	59	1006.7	28.3
20040530	16	73	1008.9	24.8
20040530	20	79	1010.9	22
20040531	0	88	1012.1	21
20040531	4	94	1011.7	19.4
20040531	8	78	1013.9	22.7
20040531	12	63	1015.5	24.8
20040531	16	68	1015	23.7
20040531	20	83	1016.5	20.5
~~20040601~~	~~0~~	~~87~~	~~1017.1~~	~~19.1~~
20040601	0	87	1017.1	19.1
20040601	4	93	1016.7	17.8
20040601	8	74	1018.2	21.9
20040601	12	56	1017.9	25
20040601	16	55	1017.7	24
20040601	20	78	1018.2	20.6
20040602	0	81	1018.8	19.9
20040602	4	89	1017.9	18.8
20040602	8	74	1018.6	22
20040602	12	62	1018.4	24.5
20040602	16	63	1017.6	23.8
20040602	20	79	1017.5	20.4
20040603	0	86	1017.7	19.4
20040603	4	90	1016.5	18.7
20040603	8	70	1016.8	22.7
20040603	12	61	1016.6	24.8
20040603	16	54	1016	24
20040603	20	79	1016	20.5
20040604	0	85	1016.4	19.6
20040604	4	89	1015.1	18.8
20040604	8	71	1015.8	22.6
20040604	12	71	1015.6	24.3
20040604	16	69	1014.4	24.1
20040604	20	85	1014.7	20.9
20040605	0	91	1014.9	20
20040605	4	91	1013.5	19.8
20040605	8	76	1013.9	23
20040605	12	64	1013.2	25.1
20040605	16	61	1012.2	25.4
20040605	20	79	1012.7	21.5
20040606	0	83	1013.1	20.6
20040606	4	89	1011.6	19.5
20040606	8	69	1012.3	24.2
20040606	12	58	1012.2	28.4
20040606	16	58	1012.1	27.7
20040606	20	76	1012.6	23
20040607	0	83	1013.3	22
20040607	4	91	1013.1	21
20040607	8	67	1014.7	26.6
20040607	12	48	1014.9	30.6
20040607	16	54	1014.4	27.5
20040607	20	76	1014.1	23.2
20040608	0	94	1014	21.7
20040608	4	94	1013.2	20.9
20040608	8	80	1013.9	23.7

DATE	TIME	RH	PRESS.	TD
20040608	12	70	1013.9	25
20040608	16	72	1012.7	24.3
20040608	20	83	1012.9	22
20040609	0	84	1013.4	21
20040609	4	86	1012.5	20.6
20040609	8	76	1013	22.9
20040609	12	62	1012.6	25.8
20040609	16	64	1011.7	25
20040609	20	76	1011.8	22
20040610	0	80	1011.7	21.5
20040610	4	86	1010.8	20.7
20040610	8	77	1011.8	23.6
20040610	12	60	1012.2	26.5
20040610	16	66	1011.9	25.2
20040610	20	83	1012.4	22.2
20040611	0	81	1012.7	21.6
20040611	4	87	1011.7	21
20040611	8	69	1013.1	24.4
20040611	12	52	1013.9	28.2
20040611	16	58	1013.4	26.8
20040611	20	76	1013.9	23.1
20040612	0	84	1013.9	21.9
20040612	4	91	1013.8	21
20040612	8	86	1015.9	22
20040612	12	58	1015.9	28.9
20040612	16	57	1015	28.1
20040612	20	79	1015.3	23.5
20040613	0	86	1015.7	22.2
20040613	4	91	1014.9	21.4
20040613	8	76	1015.6	25.4
20040613	12	50	1015.2	28.6
20040613	16	52	1013.1	28.8
20040613	20	72	1013.6	23.6
20040614	0	82	1013.3	22.1
20040614	4	85	1012.1	21.4
20040614	8	66	1012.8	25.2
20040614	12	57	1013.1	27.9
20040614	16	51	1011.5	28
20040614	20	76	1011.3	23.3
20040615	0	80	1011	22.6
20040615	4	91	1009.0	20.4
20040615	8	73	1009.8	24.7
20040615	12	42	1009	30.2
20040615	16	58	1007	28.4
20040615	20	80	1006.8	24.5
20040616	0	84	1006.9	23.4
20040616	4	89	1006.3	22
20040616	8	76	1007.4	25.5
20040616	12	60	1007.8	29
20040616	16	63	1006.9	28
20040616	20	82	1007.8	23.8
20040617	0	83	1008	22.9
20040617	4	88	1007.9	21.8
20040617	8	77	1009.1	24.9
20040617	12	49	1009.9	29.5
20040617	16	55	1009	28.5
20040617	20	65	1009.5	25.6
20040618	0	76	1009.7	23.7
20040618	4	82	1008.4	22.7
20040618	8	68	1009	25.8

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DATE	TIME	RH	PRESS.	TD
20040618	12	52	1008.8	31.5
20040618	16	49	1007.4	31.5
20040618	20	77	1007.8	25.3
20040619	0	90	1007.8	23
20040619	4	86	1005.6	23.5
20040619	8	65	1005.3	27.9
20040619	12	55	1006.8	30
20040619	16	61	1005.6	28.3
20040619	20	88	1006.9	23.6
20040620	0	84	1007.8	23.3
20040620	4	88	1007.5	22.7
20040620	8	77	1008.7	24.8
20040620	12	58	1008.4	28.6
20040620	16	62	1008.2	27.3
20040620	20	76	1009	23.6
20040621	0	79	1010.6	23
20040621	4	88	1010.9	22.4
20040621	8	68	1012.3	25.7
20040621	12	57	1013.2	28
20040621	16	64	1012.8	27.1
20040621	20	81	1013.6	23.5
20040622	0	83	1013.5	22.7
20040622	4	87	1013	22.2
20040622	8	76	1013.6	25.7
20040622	12	48	1012.8	29.9
20040622	16	55	1011.6	28.8
20040622	20	77	1011.8	24.2
20040623	0	79	1011.6	23.6
20040623	4	81	1010.7	23
20040623	8	70	1010.7	25.8
20040623	12	54	1009.8	29
20040623	16	57	1009	28.6
20040623	20	73	1008.9	24.6
20040624	0	79	1008.8	23.6
20040624	4	90	1007.1	21.6
20040624	8	75	1007.4	24.4
20040624	12	63	1007.7	27.7
20040624	16	64	1007.2	26.8
20040624	20	78	1009	23.6
20040625	0	78	1008.8	23.2
20040625	4	87	1008.3	21.7
20040625	8	75	1009.9	24.5
20040625	12	65	1010.2	27.5
20040625	16	69	1010.6	26.8
20040625	20	84	1011.9	23.2
20040626	0	87	1011.9	22.6
20040626	4	96	1011.2	21
20040626	8	77	1012.7	25
20040626	12	69	1012.2	27.7
20040626	16	64	1011.4	27.9
20040626	20	87	1011.9	23.8
20040627	0	89	1011.9	23
20040627	4	95	1011.6	22.3
20040627	8	72	1011.8	26.4
20040627	12	60	1011.4	29.8
20040627	16	60	1011.1	28.3
20040627	20	79	1011.9	24.7
20040628	0	86	1011.2	23.7
20040628	4	90	1010.2	23
20040628	8	84	1011.1	25.1

DATE	TIME	RH	PRESS.	TD
20040628	12	53	1010.6	30.7
20040628	16	58	1009.6	29
20040628	20	83	1010.1	24.6
20040629	0	87	1009.9	23.2
20040629	4	89	1009.6	22.6
20040629	8	78	1010.2	25.2
20040629	12	66	1010.1	29
20040629	16	62	1005.7	28.6
20040629	20	80	1010	24.7
20040630	0	91	1010.1	23.8
20040630	4	91	1009.8	23.2
20040630	8	79	1010.5	26.1
20040630	12	62	1010.7	29.2
20040630	16	59	1009.8	30.1
20040630	20	79	1010.2	25.7
~~20040701~~	~~8~~	~~88~~	~~1010~~	~~24~~
20040701	0	88	1010	24
20040701	4	91	1009.2	22.5
20040701	8	71	1009.9	26.5
20040701	12	52	1009.9	30.6
20040701	16	53	1009.3	30.3
20040701	20	79	1009.5	25
20040702	0	85	1009.6	23.5
20040702	4	94	1008.3	21.5
20040702	8	82	1009	25.5
20040702	12	57	1009.2	31.6
20040702	16	62	1007.9	29.2
20040702	20	84	1008	25
20040703	0	86	1007.9	24
20040703	4	96	1007.1	22.2
20040703	8	80	1007.5	25.2
20040703	12	60	1006.9	30.6
20040703	16	66	1006.2	28.3
20040703	20	84	1006.2	24.6
20040704	0	89	1006.7	23.8
20040704	4	89	1006.2	23.5
20040704	8	77	1007.4	26
20040704	12	57	1007.8	29.5
20040704	16	65	1007.1	28.5
20040704	20	76	1006.9	25.4
20040705	0	86	1006.9	24.2
20040705	4	92	1005.9	22.7
20040705	8	86	1006.9	24.8
20040705	12	65	1006.9	31.4
20040705	16	61	1006.1	30.1
20040705	20	77	1006.6	26.3
20040706	0	93	1006.7	24.3
20040706	4	96	1005.2	23.8
20040706	8	81	1007.5	27
20040706	12	60	1006.9	32.4
20040706	16	62	1005.8	31.3
20040706	20	81	1006.3	26.6
20040707	0	90	1006.9	25.1
20040707	4	90	1006.7	24.8
20040707	8	81	1007	27.3
20040707	12	67	1007.1	30.3
20040707	16	65	1006.5	30.2
20040707	20	85	1006.4	25.9
20040708	0	90	1007.5	24.9
20040708	4	93	1007	24.1

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DATE	TIME	RH	PRESS.	TD
20040708	8	85	1007.5	25.9
20040708	12	67	1007.4	30
20040708	16	70	1006.9	29
20040708	20	82	1007	26
20040709	0	90	1007.4	24.3
20040709	4	86	1005.9	24.5
20040709	8	80	1006.1	26.3
20040709	12	70	1006.2	29
20040709	16	70	1006	28.4
20040709	20	85	1006.1	26.5
20040710	0	87	1006	24.9
20040710	4	90	1005.1	24.2
20040710	8	82	1005.8	26.4
20040710	12	64	1005.4	30
20040710	16	60	1004.2	30.5
20040710	20	84	1004.3	25.8
20040711	0	89	1003.6	24.8
20040711	4	94	1002.7	23.5
20040711	8	82	1003.5	26
20040711	12	58	1002.7	32
20040711	16	62	1002.1	29.9
20040711	20	81	1002.4	26.2
20040712	0	87	1002.4	24.7
20040712	4	92	1002.1	24
20040712	8	81	1003.4	26.7
20040712	12	57	1003.6	33.6
20040712	16	57	1003.3	33
20040712	20	83	1004.6	26.7
20040713	0	90	1005.2	25.4
20040713	4	98	1005.2	23.6
20040713	8	91	1006.9	25.2
20040713	12	60	1007	32.7
20040713	16	58	1006.3	32.3
20040713	20	68	1006.8	27.3
20040714	0	91	1007.5	25
20040714	4	99	1007	23.8
20040714	8	87	1007.9	28.1
20040714	12	52	1007.7	34.8
20040714	16	55	1007.1	33
20040714	20	80	1007.9	27
20040715	0	94	1007.9	25.4
20040715	4	0	1007.1	24.8
20040715	8	88	1007.6	26.8
20040715	12	72	1008.2	29.5
20040715	16	71	1007.3	28.8
20040715	20	84	1007.8	26.1
20040716	0	87	1008.8	24.2
20040716	4	91	1007.8	23.5
20040716	8	75	1009.9	26.3
20040716	12	70	1010	27.9
20040716	16	67	1009.9	27.3
20040716	20	75	1010.8	25.2
20040717	0	88	1011.5	23.4
20040717	4	90	1010.8	22.6
20040717	8	75	1012	25.3
20040717	12	64	1012.3	27.8
20040717	16	64	1011.2	27.6
20040717	20	81	1011.9	24.4
20040718	0	89	1011.9	23.4
20040718	4	88	1011.1	23.2

DATE	TIME	RH	PRESS.	TD
20040718	8	71	1011.9	26.6
20040718	12	68	1011.5	28.3
20040718	16	67	1010.5	28
20040718	20	84	1010.4	24.9
20040719	0	89	1010.6	24
20040719	4	92	1009.6	23.6
20040719	8	66	1010.3	27.3
20040719	12	57	1010.2	29.6
20040719	16	60	1009.2	28.8
20040719	20	74	1009.1	25.3
20040720	0	83	1009.1	24.1
20040720	4	85	1008.6	23.5
20040720	8	73	1009.1	25.7
20040720	12	63	1009.3	28.7
20040720	16	68	1008.7	28.6
20040720	20	81	1008.9	25.3
20040721	0	89	1008.9	24
20040721	4	89	1007.7	23.3
20040721	8	76	1009	25.7
20040721	12	52	1008.9	30.6
20040721	16	65	1008.6	28.7
20040721	20	82	1009	25.7
20040722	0	91	1008.8	24.1
20040722	4	88	1007.6	23.9
20040722	8	78	1008.7	28.4
20040722	12	67	1008.2	29.3
20040722	16	65	1007.6	29.1
20040722	20	81	1007.6	26
20040723	0	88	1007.9	24.2
20040723	4	95	1007	23
20040723	8	83	1007.9	25.5
20040723	12	62	1007.8	29
20040723	16	68	1007.2	28.5
20040723	20	82	1007.8	25.2
20040724	0	89	1007.4	24
20040724	4	97	1006.1	22.3
20040724	8	85	1006.5	25.1
20040724	12	61	1006.3	30.6
20040724	16	67	1005.9	29.4
20040724	20	82	1006.4	25.6
20040725	0	89	1005.9	24.2
20040725	4	95	1005.2	23
20040725	8	82	1005.8	25.8
20040725	12	62	1005.5	31.4
20040725	16	64	1005.2	30.5
20040725	20	74	1005.9	27.2
20040726	0	85	1006.1	25.7
20040726	4	92	1005.9	24
20040726	8	81	1006.8	26.9
20040726	12	50	1007.1	32.1
20040726	16	52	1007	31.8
20040726	20	74	1008.5	27
20040727	0	79	1008.8	26
20040727	4	84	1008.3	25
20040727	8	77	1010.1	27
20040727	12	64	1010.6	30
20040727	16	62	1010.5	30
20040727	20	78	1011.1	26.6
20040728	0	79	1011.5	25.9
20040728	4	89	1010	24

DATE	TIME	RH	PRESS.	TD
20040728	8	76	1011.1	27.6
20040728	12	63	1010.8	30.8
20040728	16	61	1009.8	30.2
20040728	20	78	1010.5	26.6
20040729	0	87	1010.6	24.7
20040729	4	87	1008.7	24.7
20040729	8	64	1008.7	28.7
20040729	12	54	1009.4	32
20040729	16	52	1008.2	31.7
20040729	20	71	1008.8	27.6
20040730	0	85	1008.8	25.6
20040730	4	83	1008	24.7
20040730	8	72	1009	28.6
20040730	12	68	1009.3	31.1
20040730	16	69	1008.2	29.9
20040730	20	86	1008.6	25.8
20040731	0	90	1008.9	25
20040731	4	92	1007.9	24.3
20040731	8	79	1008.8	27.3
20040731	12	68	1008.2	30
20040731	16	67	1007.3	28.6
20040731	20	85	1007.9	25.7
~~20040801~~	~~8~~	~~90~~	~~1008.5~~	~~24.8~~
20040801	0	90	1008.5	24.8
20040801	4	90	1007.8	24.3
20040801	8	78	1007.9	26.7
20040801	12	62	1007.9	29.2
20040801	16	63	1006.8	28.8
20040801	20	75	1007.4	25.5
20040802	0	79	1007.8	25.2
20040802	4	86	1007.1	23.7
20040802	8	74	1007.3	26.6
20040802	12	62	1007.3	29.3
20040802	16	64	1006.9	28.7
20040802	20	77	1007.5	25.8
20040803	0	79	1007.7	25.3
20040803	4	91	1006.3	23.1
20040803	8	76	1006.8	26.2
20040803	12	53	1006.9	30.4
20040803	16	56	1006.6	29.8
20040803	20	69	1006.8	26.5
20040804	0	82	1007	24.1
20040804	4	90	1006.7	22.2
20040804	8	76	1007	25.1
20040804	12	58	1007.6	30
20040804	16	58	1007	29.7
20040804	20	74	1007.8	26
20040805	0	77	1008.6	25
20040805	4	83	1007.4	23.8
20040805	8	77	1008.7	25.7
20040805	12	66	1008.5	29.9
20040805	16	64	1008.1	30.1
20040805	20	81	1008.8	26.2
20040806	0	84	1009.5	25.4
20040806	4	89	1009.1	24.6
20040806	8	78	1009.9	27.2
20040806	12	50	1010.2	31.2
20040806	16	50	1009.9	30.9
20040806	20	76	1010.1	26.6
20040807	0	76	1009.9	25.9

(11)

DATE	TIME	RH	PRESS.	TD
20040807	4	80	1009.4	25
20040807	8	68	1010	27.8
20040807	12	60	1010.1	30.6
20040807	16	55	1009.1	30.0
20040807	20	77	1009.3	27.2
20040808	0	78	1008.7	26.3
20040808	4	89	1007.9	24
20040808	8	78	1008.9	27.4
20040808	12	54	1007.9	31.8
20040808	16	60	1007.6	30.7
20040808	20	74	1007.9	26.8
20040809	0	84	1008.1	25.1
20040809	4	92	1007.1	23.4
20040809	8	70	1007.9	26.6
20040809	12	62	1008.4	30
20040809	16	70	1007.6	28.9
20040809	20	85	1007.9	25.8
20040810	0	85	1008.3	25.2
20040810	4	88	1007.4	24.4
20040810	8	80	1008.6	26.3
20040810	12	64	1008	30
20040810	16	68	1007.8	29.8
20040810	20	78	1008	26.8
20040811	0	88	1008.2	25
20040811	4	92	1006.8	24.4
20040811	8	70	1007.9	27.7
20040811	12	58	1007.9	31
20040811	16	62	1007.5	30.6
20040811	20	78	1007.8	26.8
20040812	0	87	1007.9	25
20040812	4	91	1006.9	23.8
20040812	8	78	1007.5	26.3
20040812	12	66	1007.8	30
20040812	16	68	1006.9	29.3
20040812	20	85	1007.3	26
20040813	0	90	1008	25
20040813	4	95	1007.2	24
20040813	8	80	1007.9	26.8
20040813	12	68	1008.4	29.6
20040813	16	73	1007.6	28.6
20040813	20	82	1008.8	25.5
20040814	0	94	1008	24.7
20040814	4	95	1008.5	24
20040814	8	78	1009.3	28.1
20040814	12	71	1009.6	30.4
20040814	16	84	1008.6	29.5
20040814	20	87	1008.9	25.7
20040815	0	92	1008.8	24.7
20040815	4	9	1005.6	22
20040815	8	87	1007.5	26.4
20040815	12	72	1006.8	29.8
20040815	16	87	1005.8	29.2
20040815	20	88	1006.2	24.8
20040816	0	87	1006.4	23
20040816	4	[illegible]	1005.2	21.7
20040816	8	85	1008.8	25.7
20040816	12	62	1007.4	29.8
20040816	16	84	1006.9	29.4
20040816	20	83	1008	24.7
20040817	0	88	1008.4	23.8

DATE	TIME	RH	PRESS.	TD
20040817	4	92	1008.5	23
20040817	8	78	1010	25.7
20040817	12	69	1011.1	29.1
20040817	16	68	1011.1	28.7
20040817	20	79	1012.8	25.3
20040818	0	90	1013.6	24.2
20040818	4	89	1012.8	23.4
20040818	8	76	1014	26.2
20040818	12	65	1014.7	28.2
20040818	16	65	1012.7	27.4
20040818	20	80	1013.8	24.8
20040819	0	85	1015.6	23.7
20040819	4	90	1011.6	23.5
20040819	8	74	1011.5	25.4
20040819	12	58	1010.9	28.4
20040819	16	57	1008.5	28.4
20040819	20	71	1008.9	25.4
20040820	0	77	1008.5	24.3
20040820	4	94	1008.8	22.8
20040820	8	74	1008.6	25.2
20040820	12	64	1006.4	29.3
20040820	16	68	1005.1	28.6
20040820	20	82	1005.9	25
20040821	0	89	1006.4	24
20040821	4	97	1005.9	22
20040821	8	82	1007.7	25.6
20040821	12	52	1008.1	30.6
20040921	16	57	1007.8	30
20040821	20	77	1008.6	25.4
20040822	0	89	1008.6	23
20040822	4	98	1008.2	20.8
20040822	8	71	1009.7	27
20040822	12	55	1009.8	30.8
20040822	16	60	1009.1	29.8
20040822	20	80	1009.8	25.6
20040823	0	91	1009.9	23.2
20040823	4	99	1009.6	21.1
20040823	8	82	1010.8	25.4
20040823	12	55	1011	30.6
20040823	16	61	1010.6	29.3
20040823	20	80	1011.1	25.2
20040824	0	85	[illegible]	24
20040824	4	98	1010.7	22.8
20040824	8	81	1011.3	25.8
20040824	12	65	1011	30.2
20040824	16	70	1011	29
20040824	20	68	1010.7	28.6
20040825	0	91	1010.8	24.7
20040825	4	93	1009.8	23.6
20040825	8	85	1010.8	25.6
20040825	12	68	1010.6	29.4
20040825	16	69	1009.6	28
20040825	20	88	1010	24.8
20040826	0	93	1010.1	23.7
20040826	4	98	1008.6	22.5
20040826	8	85	1008.6	25.4
20040826	12	63	1008.8	29
20040826	16	62	1007.6	28.3
20040826	20	76	1008.1	25.4
20040827	0	90	1008.2	24.8

(12)

DATE	TIME	RH	PRESS.	TD
20040827	4	95	1007.6	21.5
20040827	8	77	1008.2	25.6
20040827	12	61	1007.9	30.7
20040827	16	62	1006.8	29.7
20040827	20	78	1007.8	25.8
20040828	0	88	1007.6	25.1
20040828	4	97	1007.2	22.4
20040828	8	97	1008.7	23.2
20040828	12	58	1008.7	32
20040828	16	68	1008	29.8
20040828	20	80	1009.7	26.2
20040829	0	83	1010.2	25
20040829	4	84	1010.6	24.3
20040829	8	69	1011.9	26.6
20040829	12	58	1012.5	28.7
20040829	16	59	1011.9	28.1
20040829	20	73	1012.6	24.5
20040830	0	77	1013.2	23.7
20040830	4	83	1011.9	22.6
20040830	8	73	1012.6	25
20040830	12	59	1012.9	28.4
20040830	16	60	1011.2	27.9
20040830	20	70	1011.8	25
20040831	0	75	1011.2	23.8
20040831	4	87	1010.5	21.9
20040831	8	73	1010.8	25.6
20040831	12	65	1010.6	27.7
20040831	16	62	1009.9	27.6
20040831	20	77	1010.9	24.5
~~20040901~~	~~0~~	~~80~~	~~1010.6~~	~~23.9~~
20040901	0	80	1010.6	23.9
20040901	4	88	1010	22.4
20040901	8	74	1010.4	25.6
20040901	12	61	1010	28.8
20040901	16	66	1009.8	27.9
20040901	20	77	1009.9	25
20040902	0	86	1010	24.1
20040902	4	94	1009.9	22.4
20040902	8	81	1010.1	25.2
20040902	12	64	1009.9	28.6
20040902	16	64	1009.5	28.6
20040902	20	77	1010	25.6
20040903	0	87	1010	23.6
20040903	4	96	1009.6	21.7
20040903	8	78	1010.7	25.3
20040903	12	60	1010.9	30.3
20040903	16	67	1009.9	28.6
20040903	20	81	1010.6	25.1
20040904	0	89	1010.5	23.8
20040904	4	97	1009.3	22.4
20040904	8	84	1009.6	24.7
20040904	12	60	1008.9	29.8
20040904	16	66	1008.1	28.5
20040904	20	81	1008.2	25.9
20040905	0	87	1007.9	24.6
20040905	4	94	1006.9	23.2
20040905	8	81	1007.3	26.2
20040905	12	65	1007.2	31
20040905	16	71	1006.3	29
20040905	20	85	1006.9	25.8

DATE	TIME	RH	PRESS.	TD
20040906	0	89	1006.9	25
20040906	4	96	1006.8	23.7
20040906	8	82	1007.8	26.6
20040906	12	66	1008.4	30.4
20040906	16	71	1008	28.8
20040906	20	92	1009.4	25
20040907	0	96	1009.9	24
20040907	4	98	1009.9	22.6
20040907	8	82	1011.1	25.8
20040907	12	68	1011	29.7
20040907	16	71	1010.9	28.2
20040907	20	85	1012	25
20040908	0	93	1011.9	24
20040908	4	97	1010.9	23.3
20040908	8	87	1011.6	25.8
20040908	12	67	1011.5	29.6
20040908	16	68	1010.3	28.7
20040908	20	87	1011.1	24.8
20040909	0	89	1011.5	24
20040909	4	90	1011	23.5
20040909	8	75	1012.3	26.4
20040909	12	66	1012.7	27.7
20040909	16	66	1012.1	26.8
20040909	20	79	1013	23.6
20040910	0	89	1013.6	22
20040910	4	92	1012.8	21.3
20040910	8	80	1012.9	23.6
20040910	12	52	1012.7	27.7
20040910	16	53	1011.3	27.5
20040910	20	65	1012.2	24.1
20040911	0	78	1012.6	22
20040911	4	86	1011.2	20.2
20040911	8	75	1012.6	23.4
20040911	12	61	1012.7	27.4
20040911	16	65	1011.9	26.3
20040911	20	75	1012.8	24.6
20040912	0	78	1012.3	23.8
20040912	4	80	1011.6	23
20040912	8	70	1012.5	25.6
20040912	12	63	1012.7	27.7
20040912	16	60	1012	27.2
20040912	20	73	1012.7	23.4
20040913	0	85	1012.8	21.8
20040913	4	88	1012.6	20.1
20040913	8	63	1013.9	25.2
20040913	12	66	1015	26.1
20040913	16	63	1013.9	25.9
20040913	20	79	1015	22.1
20040914	0	90	1015.5	21.1
20040914	4	94	1015	20.2
20040914	8	74	1016.1	24.1
20040914	12	65	1015.8	27.3
20040914	16	70	1014.8	26
20040914	20	80	1015.3	23
20040915	0	86	1015.5	21.6
20040915	4	87	1014.8	21
20040915	8	74	1014.9	23.4
20040915	12	58	1014.5	26.5
20040915	16	63	1012.9	25.4
20040915	20	73	1013.2	22.5

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DATE	TIME	RH	PRESS.	TD
20040916	0	77	1013	21.7
20040916	4	88	1011.9	20
20040916	8	75	1012	23.4
20040916	12	55	1011.0	27
20040916	16	50	1010.6	28.2
20040916	20	73	1011	23
20040917	0	84	1010.7	21
20040917	4	88	1009.9	20
20040917	8	80	1010.1	22.4
20040917	12	57	1009.4	28.8
20040917	16	61	1008.3	26.9
20040917	20	83	1009.5	22.5
20040918	0	96	1009.3	20.4
20040918	4	96	1009.2	20.1
20040918	8	76	1010.2	24.2
20040918	12	61	1010.6	27.2
20040918	16	64	1009.9	26.8
20040918	20	87	1010.3	22.4
20040919	0	91	1011.1	21.7
20040919	4	97	1010.2	20
20040919	8	83	1011.5	24.2
20040919	12	60	1011.3	28.7
20040919	16	66	1010.8	27.8
20040919	20	83	1012	23.7
20040920	0	88	1012.7	22.7
20040920	4	96	1012.1	21.2
20040920	8	83	1013.9	25
20040920	12	52	1014.1	29.3
20040920	16	56	1013.5	26.1
20040920	20	84	1014.7	24
20040921	0	87	1014.6	22.7
20040921	4	98	1013.8	21.1
20040921	8	79	1014.7	25.5
20040921	12	57	1014.1	29.3
20040921	16	71	1013.9	27.7
20040921	20	88	1013.4	23.6
20040922	0	92	1013.1	23
20040922	4	98	1012.1	21.1
20040922	8	80	1012.7	24.8
20040922	12	59	1012	28.2
20040922	16	68	1010.6	27.3
20040922	20	84	1011.5	23.8
20040923	0	88	1012.1	22.7
20040923	4	94	1011.6	21.4
20040923	8	[illegible]	1012.6	24.8
20040923	12	56	1012.7	27.6
20040923	16	58	1012.1	25.5
20040923	20	82	1012.8	23.5
20040924	0	88	1013	22.7
20040924	4	91	1012.5	21.7
20040924	8	85	1013.2	24.3
20040924	12	63	1013.8	27.6
20040924	16	54	1012.7	27.3
20040924	20	85	1013.7	23.9
20040925	0	80	1014.[illegible]	23.1
20040925	4	96	1013.6	[illegible]
20040925	8	73	1013.1	28
20040925	12	56	1014.3	28.3
20040925	16	86	1014	28.2
20040925	20	85	1014.3	23.3

DATE	TIME	RH	PRESS.	TD
20040926	0	86	1015.1	23.2
20040926	4	91	1014.8	22.7
20040926	8	75	1014.6	26.4
20040926	12	61	1014.7	29.2
20040926	16	64	1013	28.7
20040926	20	83	1014.2	24.4
20040927	0	88	1014.7	23.4
20040927	4	92	1013.8	23.1
20040927	8	77	1015.3	26.8
20040927	12	57	1015.3	29.5
20040927	16	70	1014.7	28
20040927	20	91	1015.7	24
20040928	0	94	1016	22
20040928	4	97	1015.5	22.6
20040928	8	85	1015.8	26
20040928	12	68	1014.7	29.3
20040928	16	69	1012.3	28.4
20040928	20	90	1012.2	24.7
20040929	0	92	1012.8	24
20040929	4	97	1011.0	23
20040929	8	81	1013.1	26.3
20040929	12	64	1012.9	30.2
20040929	16	60	1011.9	29.4
20040929	20	85	1013	24.8
20040930	0	94	1013.0	23
20040930	4	97	1013.4	21.7
20040930	8	88	1014.4	25.5
20040930	12	61	1014.7	30.0
20040930	16	65	1013.7	29.2
20040930	20	88	1014.8	24.8
~~20041001~~	~~0~~	~~94~~	~~1015.4~~	~~22.9~~
20041001	0	94	1015.4	22.9
20041001	4	93	1014.7	23.3
20041001	8	84	1015.9	25.7
20041001	12	61	1016	30.9
20041001	16	71	1015.3	28.2
20041001	20	90	1015.9	24.4
20041002	0	91	1016.8	23.6
20041002	4	97	1015.1	22.7
20041002	8	76	1015.9	25.7
20041002	12	62	1015.8	27.8
20041002	16	67	1013.9	28.2
20041002	20	81	1013.8	23.2
20041003	0	83	1013.6	22.3
20041003	4	96	1012.9	20.4
20041003	8	78	1013.1	23.9
20041003	12	58	1012.8	27.9
20041003	16	61	1011.6	26.5
20041003	20	78	1011.8	23.1
20041004	0	85	1011.8	21.3
20041004	4	81	1011.2	20
20041004	8	80	1011.9	22.6
20041004	12	65	1012.2	26.5
20041004	16	63	1011.6	27.1
20041004	20	76	1012.2	23.2
20041005	0	88	1012.5	22
20041005	4	97	1011.9	20.2
20041005	8	91	1011.2	21.9
20041005	12	57	1012.8	28.2
20041005	16	66	1011.9	26.5

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DATE	TIME	RH	PRESS.	TD
20041005	20	73	1013.2	23.6
20041006	0	81	1013.8	21.6
20041006	4	88	1013.8	20.1
20041006	8	75	1014.9	22.2
20041006	12	50	1015	27.7
20041006	16	59	1014.8	25.6
20041006	20	69	1015.2	23.5
20041007	0	85	1015.8	20.7
20041007	4	84	1015	20.5
20041007	8	78	1015.9	21.4
20041007	12	46	1015.7	28.2
20041007	16	53	1014.9	26
20041007	20	65	1015.9	23.6
20041008	0	78	1015.7	21
20041008	4	80	1014.3	19.9
20041008	8	72	1015.5	21.4
20041008	12	47	1014.9	27.3
20041008	16	58	1013.9	25
20041008	20	70	1014.9	21.8
20041009	0	82	1014.9	19.7
20041009	4	79	1013.6	19.7
20041009	8	73	1014.9	21.6
20041009	12	52	1014.5	25.8
20041009	16	59	1013.8	24.3
20041009	20	70	1015	21.6
20041010	0	69	1015.2	20.7
20041010	4	75	1014.5	19.8
20041010	8	65	1015.6	22.8
20041010	12	48	1015.5	26.2
20041010	16	54	1015	24.9
20041010	20	68	1015.9	21.7
20041011	0	79	1015.7	20
20041011	4	83	1015.2	18.7
20041011	8	62	1016.2	23.2
20041011	12	54	1015.9	26.6
20041011	16	57	1014.9	25.3
20041011	20	77	1015.8	21.8
20041012	0	80	1015.5	21
20041012	4	87	1015.1	19.6
20041012	8	66	1015.9	23.6
20041012	12	55	1015.7	26.2
20041012	16	60	1014.7	25.2
20041012	20	73	1015.5	22.2
20041013	0	77	1015.6	21.7
20041013	4	85	1014.9	19.8
20041013	8	76	1015.6	22.1
20041013	12	62	1015.6	25.3
20041013	16	59	1014.8	25.7
20041013	20	75	1015.9	22.1
20041014	0	86	1016.5	20
20041014	4	91	1015.9	19
20041014	8	75	1017	22.4
20041014	12	58	1016.6	26.8
20041014	16	66	1015.7	25.2
20041014	20	81	1017	22
20041015	0	89	1017.6	20.8
20041015	4	97	1016.8	19
20041015	8	81	1017.7	22.5
20041015	12	58	1016.9	26.9
20041015	16	63	1015.7	26.3

DATE	TIME	RH	PRESS.	TD
20041015	20	83	1016.9	22.4
20041016	0	85	1017.2	22.3
20041016	4	90	1016.6	21.7
20041016	8	77	1016.8	24.5
20041016	12	65	1015.9	27.8
20041016	16	75	1014.5	26
20041016	20	88	1015.2	23.4
20041017	0	92	1015.5	22.8
20041017	4	92	1014.9	22.7
20041017	8	80	1016	25.1
20041017	12	64	1015.9	28.6
20041017	16	70	1015.1	27.2
20041017	20	89	1016.4	23.8
20041018	0	94	1016.7	22.7
20041018	4	97	1015.9	22
20041018	8	82	1017.7	25.6
20041018	12	64	1018.2	29
20041018	16	68	1017	28.1
20041018	20	84	1017.6	24.5
20041019	0	88	1018	23.5
20041019	4	94	1017.8	22.2
20041019	8	79	1018.7	25.8
20041019	12	63	1018.1	29
20041019	16	62	1016.9	28
20041019	20	84	1017.8	23.6
20041020	0	95	1016.9	21.6
20041020	4	98	1015.9	20.2
20041020	8	89	1015.9	23
20041020	12	60	1014.7	29.6
20041020	16	61	1012.9	27.3
20041020	20	87	1013	22.2
20041021	0	94	1012.9	20.7
20041021	4	98	1011.9	20
20041021	8	88	1013	22
20041021	12	47	1012.9	28
20041021	16	60	1011.9	26.6
20041021	20	81	1012.9	23.4
20041022	0	89	1013.3	22
20041022	4	96	1012.9	19.9
20041022	8	84	1014.7	22.9
20041022	12	61	1014.6	28
20041022	16	67	1013.9	26.6
20041022	20	81	1015.4	23
20041023	0	96	1015.5	20.7
20041023	4	0	1014.9	19.6
20041023	8	84	1015.6	23.3
20041023	12	63	1015.5	27.8
20041023	16	71	1014.9	25.6
20041023	20	84	1015.5	22.5
20041024	0	95	1015.2	21.2
20041024	4	98	1014.7	20.6
20041024	8	81	1016	23.6
20041024	12	67	1015.2	26.3
20041024	16	71	1013.9	25.6
20041024	20	83	1014.8	22.9
20041025	0	88	1014.7	21.7
20041025	4	97	1013.7	20.3
20041025	8	74	1016.2	23.9
20041025	12	68	1015.1	26
20041025	16	73	1014.1	25.2

(15)

DATE	TIME	RH	PRESS.	TD
20041025	20	82	1015	23
20041026	0	89	1014.8	22
20041026	4	96	1013.8	20.8
20041026	8	81	1014.7	23.6
20041026	12	71	1013.6	26.2
20041026	16	74	1012.9	25.5
20041026	20	89	1014	23.3
20041027	0	92	1014.7	22.7
20041027	4	91	1014.1	22.6
20041027	8	85	1015.9	23.9
20041027	12	68	1015.3	27
20041027	16	77	1014.7	25
20041027	20	85	1016	22.8
20041028	0	89	1016	22
20041028	4	92	1015.4	21.4
20041028	8	85	1016.2	22.6
20041028	12	69	1015.6	25.7
20041028	16	70	1014.2	24.6
20041028	20	88	1015.6	22
20041029	0	95	1015.5	20.8
20041029	4	99	1014	19.6
20041029	8	97	1014.8	21.7
20041029	12	68	1013.9	25.8
20041029	16	73	1012.9	24.6
20041029	20	90	1013.9	21.4
20041030	0	96	1013.7	20.2
20041030	4	0	1012.8	19
20041030	8	94	1013.5	20
20041030	12	45	1012.3	29.2
20041030	16	52	1010.9	28.4
20041030	20	76	1011.7	23.2
20041031	0	81	1012	21.8
20041031	4	94	1011.5	19
20041031	8	75	1012.8	22.1
20041031	12	68	1012.6	26.6
20041031	16	73	1012.1	25
20041031	20	81	1012.9	23.3
~~20041101~~	~~0~~	~~82~~	~~1013.4~~	~~23~~

(16)

Damietta Governorate December 2004 Meteorological Data

DATE	HH	RH	PRES.	TD
1/12	0	80	1024.1	16
1/12	4	80	1024.2	16
1/12	8	78	1025	17.5
1/12	12	64	1024.9	20
1/12	16	68	1024.2	18.8
1/12	20	81	1024.8	17.2
2/12	0	84	1025.1	16.6
2/12	4	90	1024.9	15
2/12	8	82	1025.5	17.7
2/12	12	67	1024.9	20.7
2/12	16	70	1023.9	19.6
2/12	20	97	1024.8	16
3/12	0	91	1024.8	16.2
3/12	4	86	1023.7	16.4
3/12	8	81	1024.2	17.5
3/12	12	57	1023.9	20.8
3/12	16	61	1022.9	19
3/12	20	72	1023.6	17
4/12	0	66	1023.1	17
4/12	4	69	1022	16.5
4/12	8	71	1023	17
4/12	12	54	1022.8	20.3
4/12	16	56	1022.1	19.3
4/12	20	71	1023	16.9
5/12	0	76	1022.7	16.3
5/12	4	77	1022.1	16.4
5/12	8	79	1022.7	16.8
5/12	12	50	1021.2	20.8
5/12	16	63	1020.3	18.9
5/12	20	74	1021.2	17
6/12	0	80	1020.9	16.2
6/12	4	88	1020.3	15.1
6/12	8	81	1020.8	17.2
6/12	12	68	1020.8	21.3
6/12	16	74	1020.3	19.8
6/12	20	94	1021.9	16.6
7/12	0	98	1021.7	15
7/12	4	97	1021.5	15.1
7/12	8	89	1022.7	16.7
7/12	12	64	1021.7	20.8
7/12	16	68	1020.5	19.9
7/12	20	79	1021	17.5
8/12	0	83	1020.7	17.3
8/12	4	89	1018.8	16
8/12	8	75	1019.7	17.6
8/12	12	61	1019.2	19.3

DATE	HH	RH	PRES.	TD
8/12	16	72	1019.9	17
8/12	20	72	1021.9	14.6
9/12	0	79	1022.2	14.7
9/12	4	84	1020.7	14.9
9/12	8	72	1021.3	17
9/12	12	59	1020.9	19
9/12	16	64	1019.8	18
9/12	20	77	1019.9	16
10/12	0	79	1019.7	15.6
10/12	4	83	1018.6	13.7
10/12	8	78	1019.4	13.8
10/12	12	71	1018.9	17.7
10/12	16	77	1017.3	17.2
10/12	20	85	1016.7	15.3
11/12	0	91	1016.8	13.5
11/12	4	92	1014.6	12.6
11/12	8	94	1014.7	14.3
11/12	12	69	1014.2	20.2
11/12	16	74	1013.6	19.7
11/12	20	86	1015.3	16.1
12/12	0	85	1015.9	16.3
12/12	4	86	1015.7	16.1
12/12	8	81	1017.8	17.2
12/12	12	67	1018.5	18.8
12/12	16	64	1018.2	17.9
12/12	20	81	1019.4	15.6
13/12	0	81	1019.8	15.2
13/12	4	83	1019.2	14.7
13/12	8	82	1020	14.9
13/12	12	65	1020.9	17.6
13/12	16	72	1020	17
13/12	20	91	1020.8	13.8
14/12	0	93	1019.7	14.4
14/12	4	91	1018.6	14
14/12	8	95	1018.9	13.8
14/12	12	88	1018.9	13.3
14/12	16	80	1017.9	15.2
14/12	20	85	1018.1	13.5
15/12	0	97	1018	12[illegible]
15/12	4	97	1017.2	1[illegible]
15/12	8	90	1017.4	12.[illegible]
15/12	12	62	1016.8	18.[illegible]
15/12	16	77	1016.5	15.3
15/12	20	88	1016.7	13.7
16/12	0	90	1016.9	13.5
16/12	4	97	1017.1	12

DATE	HH	RH	PRES.	TD
16/12	8	87	1018.8	13.5
16/12	12	70	1019.4	15
16/12	16	75	1020	13.3
16/12	20	86	1021.8	12.4
17/12	0	89	1022.9	12
17/12	4	96	1022.7	11.1
17/12	8	93	1023.8	11.2
17/12	12	54	1023.8	15.9
17/12	16	66	1023.1	14.2
17/12	20	76	1022.9	11.8
18/12	0	82	1021.8	11.2
18/12	4	84	1019.7	10.9
18/12	8	82	1018.7	11.2
18/12	12	64	1016.9	12
18/12	16	73	1014.8	11.7
18/12	20	77	1014.6	11.5
19/12	0	74	1014.4	11.4
19/12	4	81	1011.9	10.4
19/12	8	73	1011.9	11.2
19/12	12	48	1011	18
19/12	16	48	1009.6	18
19/12	20	67	1010.8	13.3
20/12	0	73	1010.8	11.5
20/12	4	72	1010.5	10.4
20/12	8	74	1012.1	10.2
20/12	12	55	1012.5	17.7
20/12	16	58	1012.8	17.8
20/12	20	68	1015	16.1
21/12	0	77	1015.9	13.8
21/12	4	79	1016	12
21/12	8	77	1017.5	12.5
21/12	12	54	1017.4	19.7
21/12	16	53	1016.7	19.8
21/12	20	81	1017.9	13.8
22/12	0	86	1017.8	12.7
22/12	4	82	1017.1	12.6
22/12	8	85	1018	12.2
22/12	12	61	1017.1	19.1
22/12	16	62	1015.8	18
22/12	20	78	1016	14.9
23/12	0	84	1015.9	13
23/12	4	84	1014.9	12
23/12	8	88	1015.1	11.3
23/12	12	57	1014.7	18.8
23/12	16	55	1012.1	19.3
23/12	20	78	1011.9	15.5
24/12	0	85	1010.9	14.3

DATE	HH	RH	PRES.	TD
24/12	4	90	1009.9	12.9
24/12	8	89	1009.6	12.7
24/12	12	80	1009.3	15.5
24/12	16	77	1009.8	15.3
24/12	20	85	1010.9	13.7
25/12	0	88	1011.9	13.1
25/12	4	95	1012.2	12
25/12	8	93	1014	11.7
25/12	12	68	1015.3	17.5
25/12	16	59	1016.5	16.8
25/12	20	87	1018.5	12.8
26/12	0	91	1020.1	11.8
26/12	4	99	1020.5	10.8
26/12	8	91	1022.7	12.6
26/12	12	57	1023.9	18.6
26/12	16	64	1023.7	17.8
26/12	20	93	1025	12.1
27/12	0	93	1026.2	11.6
27/12	4	96	1027.1	11
27/12	8	77	1027.7	13.9
27/12	12	49	1027.6	18.6
27/12	16	65	1026.9	17.3
27/12	20	88	1027.5	13.7
28/12	0	92	1026.9	12.7
28/12	4	97	1025.1	11.8
28/12	8	97	1025.7	12.6
28/12	12	74	1024.9	18.7
28/12	16	79	1022	17.8
28/12	20	97	1021.4	13.9
29/12	0	0	1019.9	13.6
29/12	4	0	1017.3	13.7
29/12	8	92	1018	14.4
29/12	12	63	1016.9	19
29/12	16	60	1015.9	18.6
29/12	20	85	1016.5	14.6
30/12	0	94	1016.9	13.6
30/12	4	89	1016.9	13
30/12	8	94	1018.1	12
30/12	12	47	1017.9	22.7
30/12	16	59	1016.9	19.7
30/12	20	85	1017.8	15.5
31/12	0	88	1017.4	15
31/12	4	91	1016.6	14
31/12	8	80	1017.6	14.6
31/12	12	50	1017.1	22.9
31/12	16	56	1017.6	21.6
31/12	20	66	1018.8	15.3

Damietta Governorate November 2004 Meteorological Data

DATE	HH	RH	PRES.	TD
1/11	0	82	1013.4	23
1/11	4	80	1012.7	23
1/11	8	74	1013.7	24.4
1/11	12	66	1013.4	26.4
1/11	16	65	1012.2	26
1/11	20	76	1013	24
2/11	0	79	1012.9	23.6
2/11	4	80	1012	23
2/11	8	70	1012.9	25.6
2/11	12	62	1013	27.4
2/11	16	68	1011.9	25.8
2/11	20	78	1012.8	23.6
3/11	0	84	1012.9	23
3/11	4	88	1012.5	22
3/11	8	69	1013.7	25.2
3/11	12	57	1012.9	26.8
3/11	16	65	1012.7	26
3/11	20	78	1013.6	23
4/11	0	86	1013.9	21.7
4/11	4	87	1013.1	21.7
4/11	8	81	1013.9	23.3
4/11	12	69	1013.7	26.2
4/11	16	72	1012.8	25.8
4/11	20	84	1013.4	23
5/11	0	90	1013	22
5/11	4	96	1012.6	20.5
5/11	8	84	1013	23
5/11	12	68	1012.7	27
5/11	16	65	1011.6	26.6
5/11	20	85	1012	22.8
6/11	0	92	1011.6	21.3
6/11	4	96	1010.4	20.2
6/11	8	91	1010.7	22.4
6/11	12	67	1009.9	26.5
6/11	16	75	1008.7	24.6
6/11	20	83	1010.1	22.2
7/11	0	94	1010.2	20.8
7/11	4	98	1009.7	20.2
7/11	8	92	1010.5	20.9
7/11	12	66	1010	25.7
7/11	16	72	1009.7	23.8
7/11	20	79	1010.8	22.5
8/11	0	89	1010.7	20.5
8/11	4	92	1010.4	19.6
8/11	8	84	1011.3	21
8/11	12	49	1011.3	27
8/11	16	67	1010.9	23

DATE	HH	RH	PRES.	TD
8/11	20	76	1011.9	21
9/11	0	89	1011.9	19
9/11	4	86	1011.3	19
9/11	8	71	1012.7	21
9/11	12	47	1012.4	28
9/11	16	58	1011.4	26
9/11	20	80	1012.8	22
10/11	0	86	1012.7	21
10/11	4	93	1011.7	19
10/11	8	86	1012.9	22
10/11	12	70	1011.9	26
10/11	16	70	1011.7	25
10/11	20	80	1012.9	22
11/11	0	84	1013.3	21
11/11	4	88	1012.9	21
11/11	8	79	1013.7	23
11/11	12	67	1013.6	25
11/11	16	71	1013.4	25
11/11	20	83	1015.3	22
12/11	0	86	1016.5	21
12/11	4	91	1016.7	20
12/11	8	82	1017.9	22
12/11	12	69	1017.9	25
12/11	16	73	1016.9	24
12/11	20	88	1017.6	21
13/11	0	89	1017.6	21
13/11	4	91	1016.3	20
13/11	8	80	1017	22
13/11	12	63	1016.2	25
13/11	16	67	1015.3	24
13/11	20	83	1016.1	21
14/11	0	86	1015.9	21
14/11	4	87	1015.8	20
14/11	8	79	1016.4	23
14/11	12	66	1015.5	26
14/11	16	71	1014.5	25
14/11	20	83	1015.7	23
15/11	0	89	1014.9	22
15/11	4	91	1013.6	21
15/11	8	87	1014.4	23
15/11	12	60	1013.6	27
15/11	16	61	1012.3	27
15/11	20	77	1012.8	23
16/11	0	77	1013.1	23
16/11	4	81	1013.1	22
16/11	8	85	1014.9	21
16/11	12	67	1014	25

DATE	HH	RH	PRES.	TD
16/11	16	71	1012.9	23.3
16/11	20	75	1013.3	22
17/11	0	82	1013	20.7
17/11	4	89	1012	19.2
17/11	8	85	1012.9	19.5
17/11	12	67	1012.8	22.7
17/11	16	64	1012.4	22.6
17/11	20	82	1014.1	19.3
18/11	0	92	1014.8	17.4
18/11	4	99	1014.9	16.1
18/11	8	80	1016.3	17.8
18/11	12	61	1016.4	21.2
18/11	16	60	1016.2	21.6
18/11	20	79	1017.3	18.3
19/11	0	82	1017.6	16.9
19/11	4	86	1016.2	16
19/11	8	82	1016.9	16.3
19/11	12	60	1016	21.8
19/11	16	65	1015.7	20
19/11	20	74	1016.8	18.7
20/11	0	79	1016.9	16.8
20/11	4	81	1016.5	15.8
20/11	8	75	1017.7	17.1
20/11	12	58	1016.8	22.4
20/11	16	56	1014.9	22.3
20/11	20	85	1016.1	17.2
21/11	0	87	1015.9	15.2
21/11	4	89	1014.6	14.2
21/11	8	74	1015.6	15.9
21/11	12	49	1013.5	22.7
21/11	16	48	1011.7	21.9
21/11	20	76	1012.7	18.1
22/11	0	84	1013.5	16.7
22/11	4	88	1013.8	15.8
22/11	8	65	1015.1	16.3
22/11	12	73	1015.5	15
22/11	16	83	1015.7	13.3
22/11	20	65	1017.6	14
23/11	0	63	1018.9	13.6
23/11	4	66	1019.3	13.8
23/11	8	54	1021.5	14.6
23/11	12	45	1022.1	16.4
23/11	16	52	1022.1	16
23/11	20	65	1023.1	14
24/11	0	69	1023.3	12.6
24/11	4	68	1022.6	12.8
24/11	8	69	1023.1	13.7

DATE	HH	RH	PRES.	TD
24/11	12	51	1022.5	20
24/11	16	56	1020.8	18
24/11	20	78	1020.8	14
25/11	0	73	1020	14
25/11	4	80	1017.9	12
25/11	8	71	1017.9	13
25/11	12	54	1016.8	21
25/11	16	51	1014.7	21
25/11	20	75	1014.9	16
26/11	0	81	1014	14
26/11	4	90	1013	14
26/11	8	79	1015.9	14
26/11	12	66	1017.6	15
26/11	16	62	1017.9	14
26/11	20	62	1019.7	14
27/11	0	64	1020	14
27/11	4	76	1019.7	12
27/11	8	81	1021.2	12
27/11	12	54	1022.1	17
27/11	16	56	1021.9	16
27/11	20	64	1023.2	14
28/11	0	76	1023.9	13
28/11	4	78	1023.9	13
28/11	8	75	1025.4	14
28/11	12	67	1024.2	18
28/11	16	68	1023.2	18
28/11	20	86	1023.9	14
29/11	0	92	1024.1	13
29/11	4	83	1022.9	13
29/11	8	67	1023.2	15
29/11	12	58	1023.1	20
29/11	16	65	1022.3	19
29/11	20	77	1023.9	16
30/11	0	74	1022.7	16
30/11	4	77	1021.5	16
30/11	8	71	1022.8	17
30/11	12	64	1022.7	20
30/11	16	64	1022.4	19
30/11	20	76	1023.9	16

ARAB REPUBLIC OF EGYPT
The Egyptian Meteorological Authority
Climate Directory

date :27/9 /2000
req. no. : 274
file no. : 36

MONTHLY NORMAL FOR SOME METEOROLOGICAL ELEMENT

2000/10/13
浮部さんが EATCOから
受領したもの。(客として Final
と言っているもの)

STATION : DEMIATTA

Meteorological Element↓ Month →		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Maximume air temperature	(°C)	18.2	18.5	20.3	23.1	26.4	29.2	30.6	30.9	29.3	27.3	23.6	19.7
highest Maximume air temperature	(°C)	26.5	31.9	35.8	38.8	45.6	40.8	39.5	38.6	37.9	36.1	35.4	28.5
Date	(yy / dd)	87/18	58/28	31/16	93/17	41/10	33/30	34/16	36/15	39/29	51/6	41/7	62/3
lowest Maximume air temperature	(°C)	10.6	8.8	10.3	15.3	19.5	23.8	26.0	27.0	23.5	20.3	15.1	11.9
Date	(yy / dd)	74/23	92/24	83/6	94/3	87/1	90/4	69/15	68/24	70/30	65/30	94/29	71/22
Minimume air temperature	(°C)	8.6	9.0	11.0	13.6	16.8	20.0	21.4	21.6	20.2	18.4	15.1	10.7
highest Minimume air temperature	(°C)	17.0	15.6	17.6	21.7	23.4	24.8	25.8	26.4	25.0	24.4	23.2	17.7
Date	(yy / dd)	85/14	68/29	61/17	94/20	64/30	65/13	89/16	78/3	86/24	63/18	66/4	71/2
lowest Minimume air temperature	(°C)	1.5	0.7	3.8	4.6	9.5	7.0	169	16.3	14.7	11.4	6.8	3.7
Date	(yy / dd)	53/14	34/17	49/5	49/19	65/5	93/3	49/26	49/22	49/30	59/21	48/28	31/31
Relative humidity	(%)	76	75	73	71	71	71	72	76	75	75	76	76
highest Relative humidity	(%)	100	100	100	100	100	100	100	100	100	100	100	100
Date	(yy / dd)	s.d	s.d	s.d	s.d	s.d	s.d	s.d	s.d	s.d	s.d	s.d	s.d
lowest Relative humidity	(%)	26	24	20	16	13	21	24	25	31	29	25	31
Date	(yy / dd)	85/1	71/28	75/22	66/14	65/26	95/7	94/3	63/18	66/22	77/10	95/5	80/4

REMARKS :-

- s.d = several dayes
- this data coverd area about 50 km .
- HIS DATA PROVIDED TO " UNICN FENOSA ACEX. FACTO " as requested on 20/9/20000

Prepared by : [illegible] MAKRAM Girgis Farg

30.9.2000
Director of Climate

ATTACHMENT: 2

ARAB REPUBLIC OF EGYPT
The Egyptian Meteorological Authority
Climate Directory

date :27 /9 /200
req. no. : 274
file no. : 36

MONTHLY NORMAL FOR SOME METEOROLOGICAL ELEMENT

STATION : DEMIATTA

Meteorological Element↓ Month →		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Amount Of Rainfall	(mm / month)	26	19.7	13.0	4.6	1.5	0.2	trace	trace	0.4	7.1	15.7	24.0
highest Amount Of Rainfall	(mm / month)	37.0	29.0	44.3	31.8	15.8	8.5	trace	trace	18.0	35.0	55.0	40.1
Date	(yy / dd)	32/28	93/13	91/22	86/1	61/6	79/4	34/21	42/19	57/30	37/27	53/5	93/22
Dry temperature	(°C)	12.9	13.4	15.3	18.1	21.0	24.5	25.8	26.0	24.5	22.4	18.4	14.6
highest Dry temperature	(°C)	17.1	17.5	19.4	22.0	25.1	28.2	29.2	29.9	28.4	26.2	22.6	18.8
lowest Dry temperature	(°C)	9.8	9.9	11.3	14.0	16.5	19.9	21.3	21.4	20.2	18.4	15.3	11.5
presssure on mean sea level		1018.5	1017.0	1015.3	1013.6	1021.6	1011.2	1008.4	1008.5	1012.5	1015.6	1015.4	1018.2
highest presssure on mean sea level		1032.5	1029.9	1028.8	1026.3	1024.4	1019.4	1016.4	1016.3	1028.3	1024.8	1028.4	1028.8
Date	(yy / dd)	92/4	89/3	92/3	83/20	95/8	90/5	79/11	72/24	92/28	91/27	88/14	63/26
lowest presssure on mean see level		929.9	997.9	1000.8	993.6	999.4	1000.1	999.7	1001.8	1003.6	1001.5	1000.5	999.3
Date	(yy / dd)	69/21	86/5	93/6	71/11	92/7	88/11	95/2	77/7	67/8	69/9	76/24	62/18
nember of dayes fog		0.2	0.1	0.1	0.0	0.0	0.0	0.03	0.0	0.1	0.03	0.2	0.1

REMARKS :-

- this data coverd area about 50 km .
- Trace = amount of rainfall < ٠,١ m m .

THIS DATA PROVIDED TO " UNICN FENOSA ACEX. FACTO " as requested on 20/9/20000

Prepared by : ABD EL AZIZ ma KRAm

Cringis Farg

30-9-2000
Director of Climat

E..PT. METEOROLOGICAL AUTHORITY
CLIMATOLOGICAL AVERAGES OF SOME ELEMENTS,
OCCURRENCE OF SOME PHENOMENA,AND WIND ROSE
FOR
STATION DEMIATTA 330
PERIOD : 68-99

2000/10/13 澤部さんがEATCOから受領したもの.

*** MONTH : 01 ***

PATH:4 PERCENTAGE OF HOURS OF OCCURRENCE OF CONCURRENT SURFACE WIND AND DIRECTION WITHIN SPECIFIED RANGES

DIREC./SPEED	01-03	04-06	07-10	11-16	17-21	22-27	28-33	34-40	41-47	48-55	56-63	>63	ALL SPEEI
CALM													05.2
VARIABL	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0
345-014	01.5	01.2	01.0	00.4	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	04.1
015-044	01.8	02.1	02.4	01.3	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	07.7
045-074	01.5	01.5	01.8	01.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	06.0
075-104	01.1	00.8	00.8	00.3	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	03.1
105-134	01.6	01.1	00.6	00.2	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	03.5
135-164	01.6	01.2	00.7	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	03.7
165-194	02.4	01.2	01.2	00.4	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	05.2
195-224	04.3	06.3	03.8	01.5	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	15.9
225-254	04.3	08.5	06.9	02.3	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	22.1
255-284	02.1	02.3	01.9	01.1	00.2	00.1	00.0	00.0	00.0	00.0	00.0	00.0	07.6
285-314	01.6	01.6	02.3	01.6	00.3	00.0	00.0	00.0	00.0	00.0	00.0	00.0	07.4
315-344	02.8	02.0	02.4	01.1	00.2	00.0	00.0	00.0	00.0	00.0	00.0	00.0	08.6
ALL DIRE	26.7	29.8	25.8	11.4	00.9	00.2	00.0	00.0	00.0	00.0	00.0	00.0	00.0

EGYPT. METEOROLOGICAL AUTHORITY
CLIMATOLOGICAL AVERAGES OF SOME ELEMENTS,
OCCURRENCE OF SOME PHENOMENA,AND WIND ROSE
FOR
STATION DEMIATTA 330
PERIOD : 68-99

*** MONTH : 02 ***

PATH:4 PERCENTAGE OF HOURS OF OCCURRENCE OF CONCURRENT SURFACE WIND AND DIRECTION WITHIN SPECIFIED RANGES

DIREC./SPEED	01-03	04-06	07-10	11-16	17-21	22-27	28-33	34-40	41-47	48-55	56-63	>63	ALL SPEEI
CALM													04.0
VARIABL	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0
345-014	01.9	01.4	01.4	00.8	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	05.5
015-044	01.6	02.4	03.2	01.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	08.3
045-074	01.3	02.2	02.9	01.5	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	08.0
075-104	01.2	01.2	01.3	00.5	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	04.3
105-134	01.4	01.5	01.0	00.2	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	04.1
135-164	01.5	01.4	00.9	00.2	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	04.0
165-194	01.9	01.2	01.1	00.3	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	04.5
195-224	03.3	04.0	02.9	01.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	11.4
225-254	03.4	06.7	05.8	02.1	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	18.2
255-284	01.6	02.0	02.2	01.9	00.2	00.1	00.0	00.0	00.0	00.0	00.0	00.0	08.1
285-314	01.5	01.7	03.0	02.9	00.3	00.0	00.0	00.0	00.0	00.0	00.0	00.0	09.4
315-344	02.6	02.4	03.2	01.9	00.2	00.0	00.0	00.0	00.0	00.0	00.0	00.0	10.3
ALL DIRC	23.2	28.2	29.0	14.5	01.0	00.2	00.0	00.0	00.0	00.0	00.0	00.0	00.0

EGYPT. METEOROLOGICAL AUTHORITY
CLIMATOLOGICAL AVERAGES OF SOME ELEMENTS,
OCCURRENCE OF SOME PHENOMENA, AND WIND ROSE
FOR
STATION DEMIATTA 330
PERIOD : 68-99

*** MONTH : 03 ***

PATH:4 PERCENTAGE OF HOURS OF OCCURRENCE OF CONCURRENT SURFACE WIND AND DIRECTION WITHIN SPECIFIED RANGES

DIREC./SPEED	01-03	04-06	07-10	11-16	17-21	22-27	28-33	34-40	41-47	48-55	56-63	>63	ALL SPEEDS
CALM													02.8
VARIABL	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0
345-014	01.9	01.9	02.1	00.8	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	06.7
015-044	01.5	03.1	04.2	02.0	00.2	00.1	00.0	00.0	00.0	00.0	00.0	00.0	11.1
045-074	01.2	02.7	04.1	02.1	00.2	00.0	00.0	00.0	00.0	00.0	00.0	00.0	10.1
075-104	01.3	01.5	02.4	01.4	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	06.7
105-134	00.9	01.5	01.2	00.4	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	04.0
135-164	00.7	01.0	01.0	00.2	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	03.0
165-194	00.9	00.8	00.8	00.2	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	02.8
195-224	01.9	02.5	02.2	00.8	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	07.5
225-254	02.6	04.2	04.0	01.8	00.2	00.0	00.0	00.0	00.0	00.0	00.0	00.0	12.7
255-284	01.4	01.6	02.0	02.1	00.3	00.1	00.0	00.0	00.0	00.0	00.0	00.0	07.5
285-314	01.2	01.8	03.6	04.8	00.5	00.0	00.0	00.0	00.0	00.0	00.0	00.0	11.9
315-344	02.7	02.7	04.5	03.1	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	13.1
ALL DIRC	18.2	25.4	32.0	19.7	01.7	00.2	00.0	00.0	00.0	00.0	00.0	00.0	00.0

EGYPT. METEOROLOGICAL AUTHORITY
CLIMATOLOGICAL AVERAGES OF SOME ELEMENTS,
OCCURRENCE OF SOME PHENOMENA, AND WIND ROSE
FOR
STATION DEMIATTA 330
PERIOD : 68-99

*** MONTH : 04 ***

PATH:4 PERCENTAGE OF HOURS OF OCCURRENCE OF CONCURRENT SURFACE WIND AND DIRECTION WITHIN SPECIFIED RANGES

DIREC./SPEED	01-03	04-06	07-10	11-16	17-21	22-27	28-33	34-40	41-47	48-55	56-63	>63	ALL SPEEDS
CALM													02.2
VARIABL	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0
345-014	01.8	02.3	03.0	01.3	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	08.6
015-044	02.0	03.6	05.3	02.5	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	13.5
045-074	01.5	02.9	04.4	02.3	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	11.3
075-104	01.5	01.5	02.1	01.5	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	06.8
105-134	01.0	01.5	01.7	00.4	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	04.7
135-164	00.7	01.2	00.7	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	02.7
165-194	00.7	00.7	00.4	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	01.9
195-224	01.5	01.3	01.0	00.2	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	04.1
225-254	02.1	02.8	01.9	00.7	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	07.6
255-284	00.9	01.2	01.3	01.3	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	04.8
285-314	01.3	02.3	04.1	05.0	00.4	00.0	00.0	00.0	00.0	00.0	00.0	00.0	13.1
315-344	03.1	04.1	06.3	04.9	00.3	00.0	00.0	00.0	00.0	00.0	00.0	00.0	18.7
ALL DIRC	18.1	25.6	32.0	20.4	01.5	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0

EGYPT. METEOROLOGICAL AUTHORITY
CLIMATOLOGICAL AVERAGES OF SOME ELEMENTS,
OCCURRENCE OF SOME PHENOMENA,AND WIND ROSE
FOR
STATION DEMIATTA 330
PERIOD : 68-99

*** MONTH : 05 ***

PATH:4 PERCENTAGE OF HOURS OF OCCURRENCE OF CONCURRENT SURFACE WIND AND DIRECTION WITHIN SPECIFIED RANGES

DIREC./SPEED	01-03	04-06	07-10	11-16	17-21	22-27	28-33	34-40	41-47	48-55	56-63	>63	ALL SPEEDS
CALM													02.8
VARIABL	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0
345-014	02.5	03.0	04.4	01.8	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	11.8
015-044	02.3	03.8	04.5	02.1	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	12.8
045-074	01.7	02.3	02.9	01.3	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	08.2
075-104	01.2	01.3	01.4	00.7	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	04.8
105-134	01.0	01.1	00.8	00.3	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	03.2
135-164	00.8	00.9	00.4	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	02.1
165-194	00.5	00.2	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.9
195-224	01.7	00.6	00.1	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	02.6
225-254	02.6	01.8	00.6	00.2	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	05.2
255-284	01.4	01.3	00.9	00.6	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	04.3
285-314	02.1	03.1	04.3	03.9	00.2	00.0	00.0	00.0	00.0	00.0	00.0	00.0	13.6
315-344	05.5	06.2	09.4	06.5	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	27.8
ALL DIRC	23.3	25.6	29.8	17.7	00.8	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0

EGYPT. METEOROLOGICAL AUTHORITY
CLIMATOLOGICAL AVERAGES OF SOME ELEMENTS,
OCCURRENCE OF SOME PHENOMENA,AND WIND ROSE
FOR
STATION DEMIATTA 330
PERIOD : 68-99

*** MONTH : 06 ***

PATH:4 PERCENTAGE OF HOURS OF OCCURRENCE OF CONCURRENT SURFACE WIND AND DIRECTION WITHIN SPECIFIED RANGES

DIREC./SPEED	01-03	04-06	07-10	11-16	17-21	22-27	28-33	34-40	41-47	48-55	56-63	>63	ALL SPEED
CALM													03.1
VARIABL	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0
345-014	01.9	02.0	02.8	00.9	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	07.7
015-044	01.7	02.0	01.7	00.5	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	06.0
045-074	01.0	01.1	00.8	00.3	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	03.2
075-104	00.7	00.4	00.2	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	01.5
105-134	00.7	00.3	00.3	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	01.4
135-164	00.9	00.4	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	01.4
165-194	00.8	00.2	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	01.0
195-224	02.3	00.6	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	03.0
225-254	03.3	02.2	00.6	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	06.2
255-284	02.2	02.0	01.2	00.7	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	06.1
285-314	03.8	05.4	07.6	06.3	00.2	00.0	00.0	00.0	00.0	00.0	00.0	00.0	23.2
315-344	07.8	08.5	12.8	07.1	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	36.3
ALL DIRC	27.1	25.2	28.2	16.2	00.3	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0

EGYPT. METEOROLOGICAL AUTHORITY
CLIMATOLOGICAL AVERAGES OF SOME ELEMENTS,
OCCURRENCE OF SOME PHENOMENA,AND WIND ROSE
FOR
STATION DEMIATTA 330
PERIOD : 68-99

*** MONTH : 07 ***

PATH:4 PERCENTAGE OF HOURS OF OCCURRENCE OF CONCURRENT SURFACE WIND AND DIRECTION WITHIN SPECIFIED RANGES

DIREC./SPEED	01-03	04-06	07-10	11-16	17-21	22-27	28-33	34-40	41-47	48-55	56-63	>63	ALL SPEEDS
CALM													02.2
VARIABL	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0
345-014	01.6	01.4	01.3	00.5	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	04.8
015-044	00.8	00.7	00.3	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	01.9
045-074	00.3	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.4
075-104	00.2	00.1	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.4
105-134	00.2	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.3
135-164	00.4	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.6
165-194	00.8	00.2	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	01.1
195-224	03.6	01.0	00.2	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	04.8
225-254	06.1	03.7	00.7	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	10.6
255-284	03.5	02.9	01.9	01.2	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	09.5
285-314	05.4	07.4	09.1	06.7	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	28.6
315-344	07.4	09.0	13.4	05.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	34.9
ALL DIRC	30.5	26.7	27.1	13.5	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0

EGYPT. METEOROLOGICAL AUTHORITY
CLIMATOLOGICAL AVERAGES OF SOME ELEMENTS,
OCCURRENCE OF SOME PHENOMENA,AND WIND ROSE
FOR
STATION DEMIATTA 330
PERIOD : 68-99

*** MONTH : 08 ***

PATH:4 PERCENTAGE OF HOURS OF OCCURRENCE OF CONCURRENT SURFACE WIND AND DIRECTION WITHIN SPECIFIED RANGES

DIREC./SPEED	01-03	04-06	07-10	11-16	17-21	22-27	28-33	34-40	41-47	48-55	56-63	>63	ALL SPEEDS
CALM													02.8
VARIABL	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0
345-014	02.0	01.9	01.1	00.3	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	05.4
015-044	00.9	01.2	00.4	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	02.5
045-074	00.4	00.3	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.8
075-104	00.2	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.3
105-134	00.2	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.4
135-164	00.4	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.5
165-194	01.0	00.2	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	01.3
195-224	04.8	01.0	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	05.9
225-254	08.6	03.2	00.3	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	12.1
255-284	03.7	02.5	01.0	00.5	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	07.6
285-314	05.3	07.0	07.8	04.2	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	24.2
315-344	09.2	09.9	13.5	03.6	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	36.3
ALL DIRC	36.7	27.4	24.5	08.5	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0

EGYPT. METEOROLOGICAL AUTHORITY
CLIMATOLOGICAL AVERAGES OF SOME ELEMENTS,
OCCURRENCE OF SOME PHENOMENA,AND WIND ROSE
FOR
STATION DEMIATTA 330
PERIOD : 68-99

*** MONTH : 09 ***

PATH:4 PERCENTAGE OF HOURS OF OCCURRENCE OF CONCURRENT SURFACE WIND AND DIRECTION WITHIN SPECIFIED RANGES

DIREC./SPEED	01-03	04-06	07-10	11-16	17-21	22-27	28-33	34-40	41-47	48-55	56-63	>63	ALL SPEEDS
CALM													05.5
VARIABL	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0
345-014	03.9	03.3	03.0	00.6	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	10.9
015-044	01.8	02.6	02.2	00.6	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	07.2
045-074	00.9	00.7	00.5	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	02.2
075-104	00.4	00.2	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.7
105-134	00.4	00.3	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.8
135-164	00.5	00.3	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.8
165-194	00.8	00.2	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	01.1
195-224	03.1	00.9	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	04.1
225-254	06.9	02.8	00.3	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	10.0
255-284	02.7	00.9	00.4	00.2	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	04.3
285-314	04.6	03.4	04.3	02.7	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	15.0
315-344	11.0	09.8	13.0	03.6	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	37.4
ALL DIRC	37.1	25.5	24.0	07.8	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0

EGYPT. METEOROLOGICAL AUTHORITY
CLIMATOLOGICAL AVERAGES OF SOME ELEMENTS,
OCCURRENCE OF SOME PHENOMENA,AND WIND ROSE
FOR
STATION DEMIATTA 330
PERIOD : 68-99

*** MONTH : 10 ***

PATH:4 PERCENTAGE OF HOURS OF OCCURRENCE OF CONCURRENT SURFACE WIND AND DIRECTION WITHIN SPECIFIED RANGES

DIREC./SPEED	01-03	04-06	07-10	11-16	17-21	22-27	28-33	34-40	41-47	48-55	56-63	>63	ALL SPEEDS
CALM													05.7
VARIABL	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0
345-014	05.1	03.7	03.8	01.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	13.8
015-044	02.8	05.1	05.8	01.8	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	15.5
045-074	01.1	01.6	01.7	00.6	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	05.0
075-104	00.6	00.6	00.4	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	01.7
105-134	00.7	00.8	00.4	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	01.9
135-164	00.7	00.5	00.2	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	01.5
165-194	00.9	00.4	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	01.4
195-224	02.4	01.4	00.3	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	04.2
225-254	04.5	03.7	00.9	00.2	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	09.3
255-284	02.5	01.4	00.7	00.3	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	04.9
285-314	02.7	02.0	02.7	01.7	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	09.2
315-344	08.7	06.7	07.7	02.7	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	25.9
ALL DIRC	32.8	28.0	24.7	08.6	00.2	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0

EGYPT. METEOROLOGICAL AUTHORITY
CLIMATOLOGICAL AVERAGES OF SOME ELEMENTS,
OCCURRENCE OF SOME PHENOMENA,AND WIND ROSE
FOR
STATION DEMIATTA 330
PERIOD : 68-99

*** MONTH : 11 ***

PATH:4 PERCENTAGE OF HOURS OF OCCURRENCE OF CONCURRENT SURFACE WIND AND DIRECTION WITHIN SPECIFIED RANGES

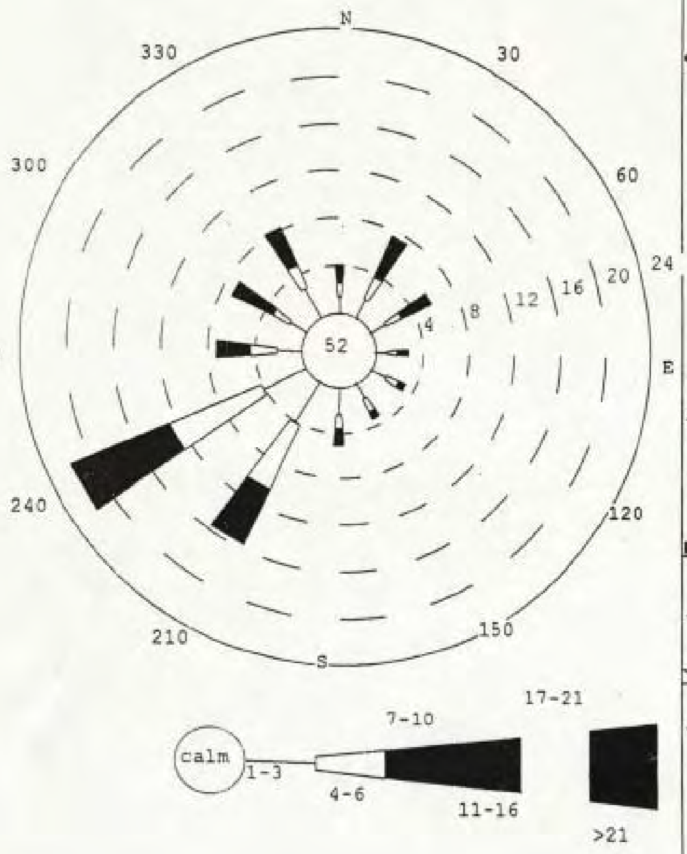
DIREC./SPEED	01-03	04-06	07-10	11-16	17-21	22-27	28-33	34-40	41-47	48-55	56-63	>63	ALL SPEED
CALM													05.7
VARIABL	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0
345-014	03.3	03.0	03.1	01.3	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	10.8
015-044	03.1	04.5	05.6	02.3	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	15.6
045-074	01.4	01.7	01.8	00.6	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	05.4
075-104	00.7	00.5	00.4	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	01.7
105-134	00.8	00.6	00.2	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	01.7
135-164	01.2	00.8	00.4	00.2	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	02.5
165-194	01.6	00.7	00.7	00.3	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	03.4
195-224	03.3	02.9	01.4	00.6	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	08.2
225-254	04.8	06.1	02.7	00.6	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	14.3
255-284	02.5	02.2	01.2	00.6	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	06.5
285-314	02.5	01.9	02.7	01.6	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	08.8
315-344	05.2	04.1	04.4	01.7	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	15.4
ALL DIRC	30.3	29.1	24.6	09.9	00.4	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0

EGYPT. METEOROLOGICAL AUTHORITY
CLIMATOLOGICAL AVERAGES OF SOME ELEMENTS,
OCCURRENCE OF SOME PHENOMENA, AND WIND ROSE
FOR
STATION DEMIATTA 330
PERIOD : 68-99

*** MONTH : 12 ***

PATH:4 PERCENTAGE OF HOURS OF OCCURRENCE OF CONCURRENT SURFACE WIND AND DIRECTION WITHIN SPECIFIED RANGES

DIREC./SPEED	01-03	04-06	07-10	11-16	17-21	22-27	28-33	34-40	41-47	48-55	56-63	>63	ALL SPEE
CALM													06.0
VARIABL	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0
345-014	02.0	01.5	01.4	00.6	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	05.5
015-044	01.8	02.9	03.7	01.3	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	09.7
045-074	01.1	01.5	01.6	00.5	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	04.6
075-104	00.7	00.6	00.5	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	01.9
105-134	01.0	00.9	00.4	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	02.3
135-164	01.5	01.2	00.4	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	03.1
165-194	02.5	01.2	01.0	00.4	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	05.1
195-224	04.8	06.1	03.8	01.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	15.8
225-254	04.6	09.4	05.8	01.7	00.1	00.1	00.0	00.0	00.0	00.0	00.0	00.0	21.6
255-284	02.6	03.0	02.0	00.9	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	08.8
285-314	01.9	01.6	02.3	01.3	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	07.3
315-344	02.9	02.3	02.3	00.7	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0	08.3
ALL DIRC	27.4	32.1	25.3	08.6	00.5	00.1	00.0	00.0	00.0	00.0	00.0	00.0	00.0



E.M.A

COMPUTER DEPARTMENT

STATION:

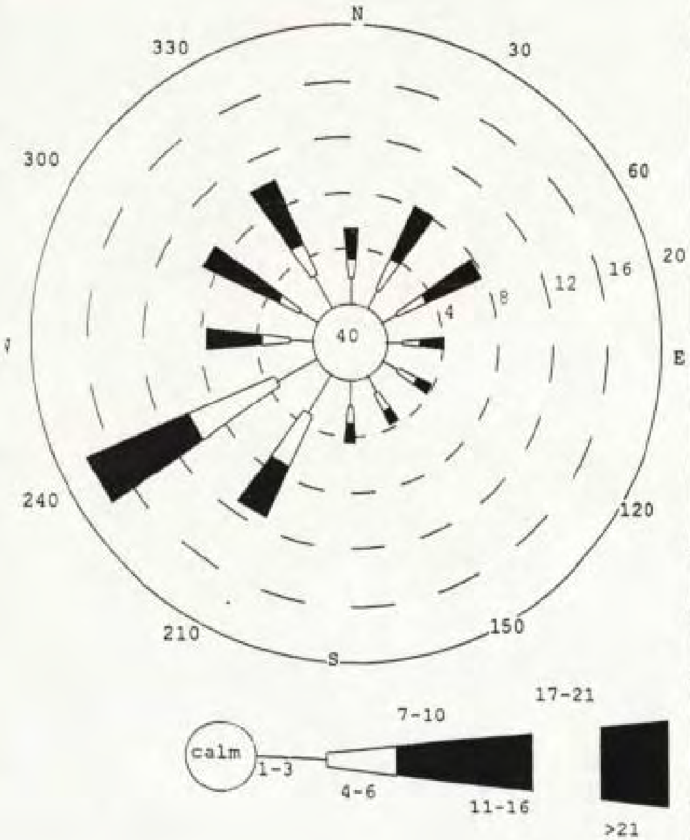
DAMIETTA

MONTHE(S) NO.:

1

YEARS:

1968-1999



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STATION:

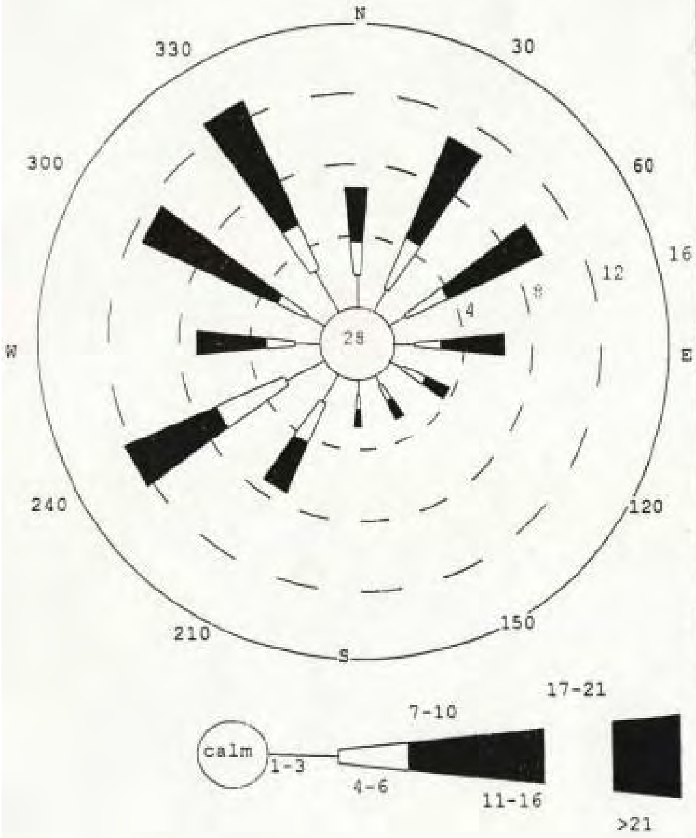
DAMIETTA

MONTHE(S) NO.:

2

YEARS:

1968-1999



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STATION:

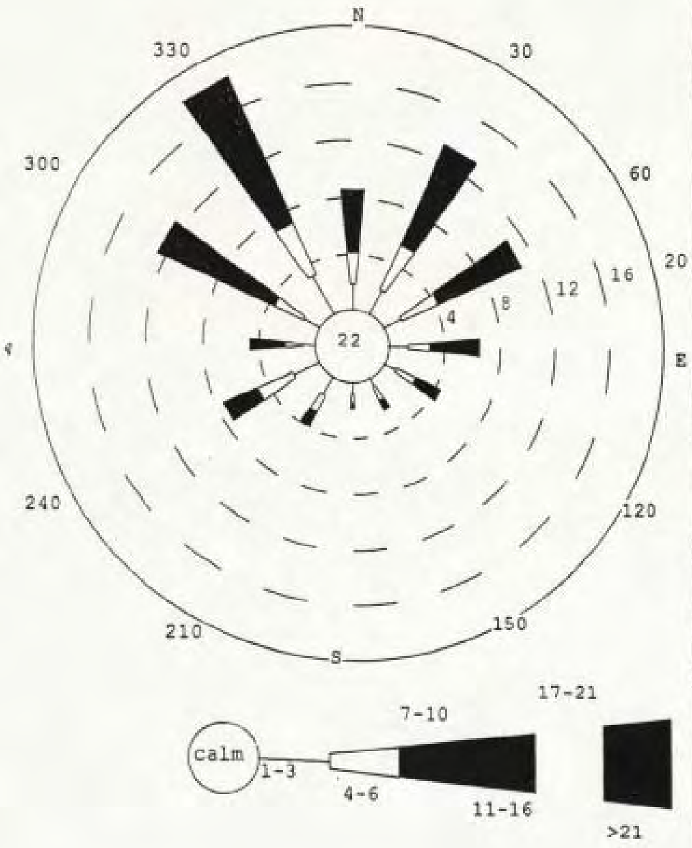
DAMIETTA

MONTHE(S) NO.:

3

YEARS:

1968-1999



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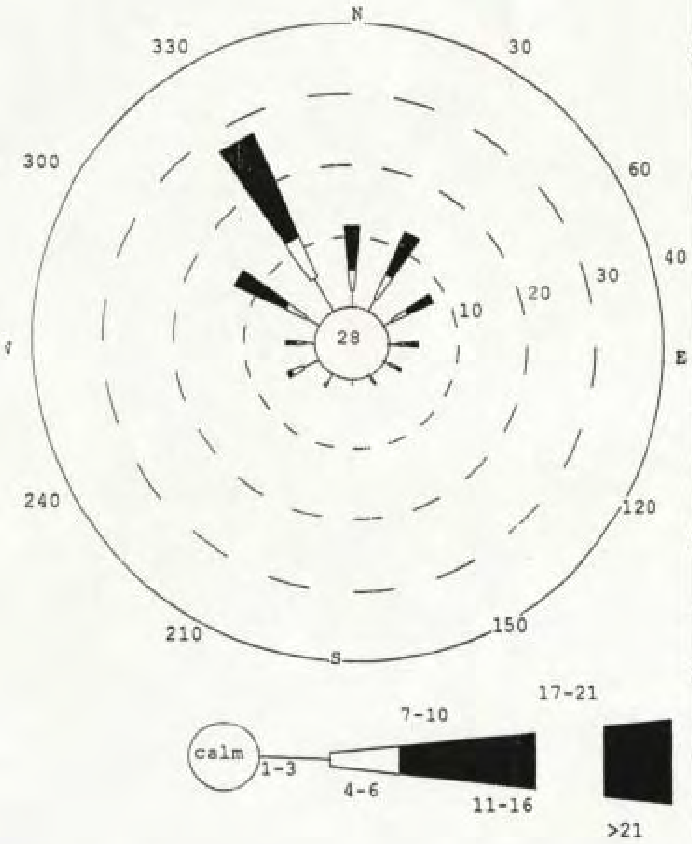
YEARS:

1968-1999



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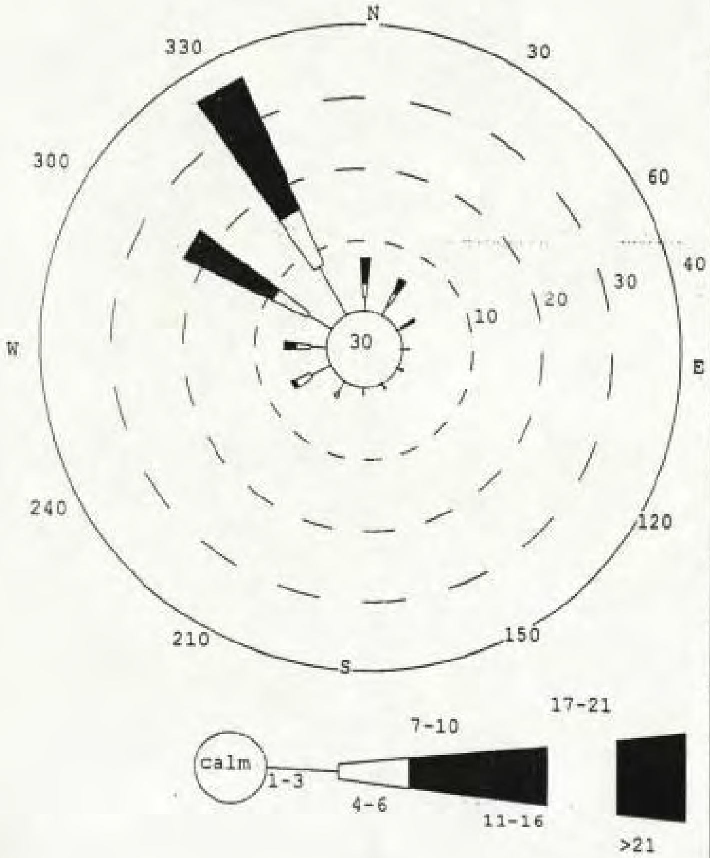
MONTHE(S) NO.:

5

YEARS:

1968-1999



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STATION:

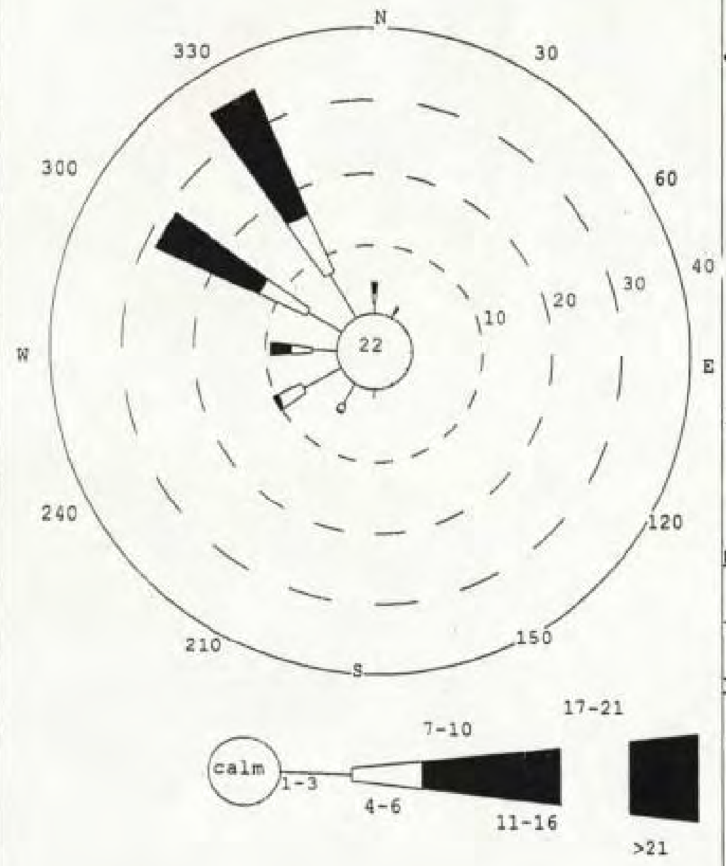
DAMIETTA

MONTHE(S) NO.:

6

YEARS:

1968-1999



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STATION:

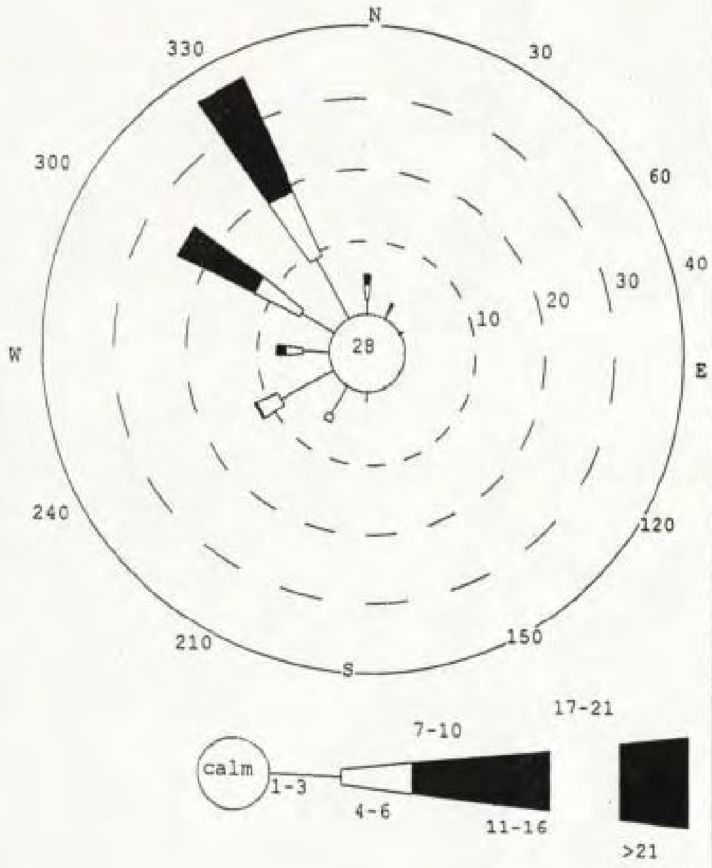
DAMIETTA

MONTHE(S) NO.:

7

YEARS:

1968-1999



E.M.A

COMPUTER DEPARTMENT

STATION:

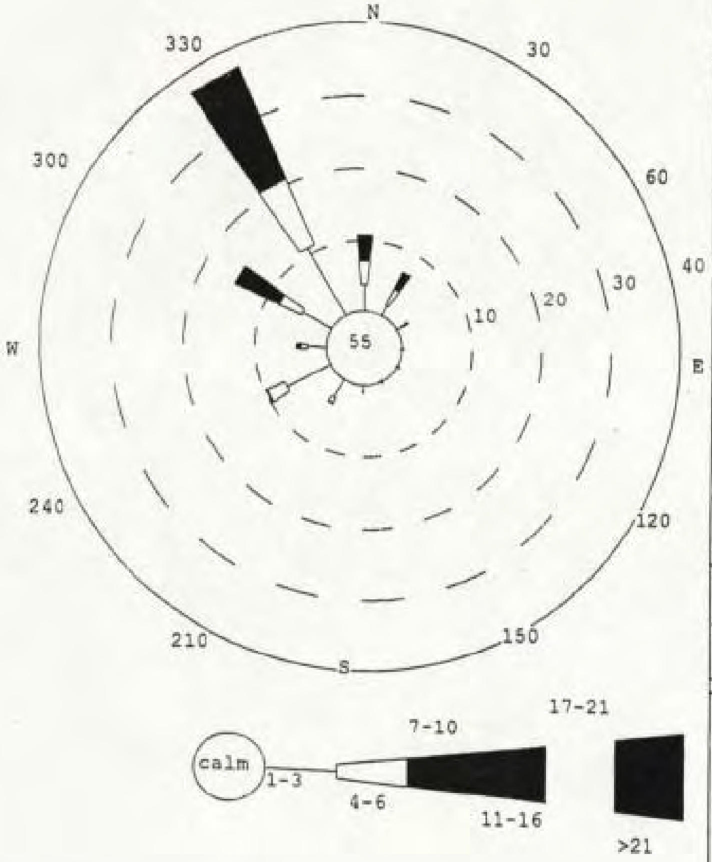
DAMIETTA

MONTHE(S) NO.:

8

YEARS:

1968-1999



E.M.A

COMPUTER DEPARTMENT

STATION:

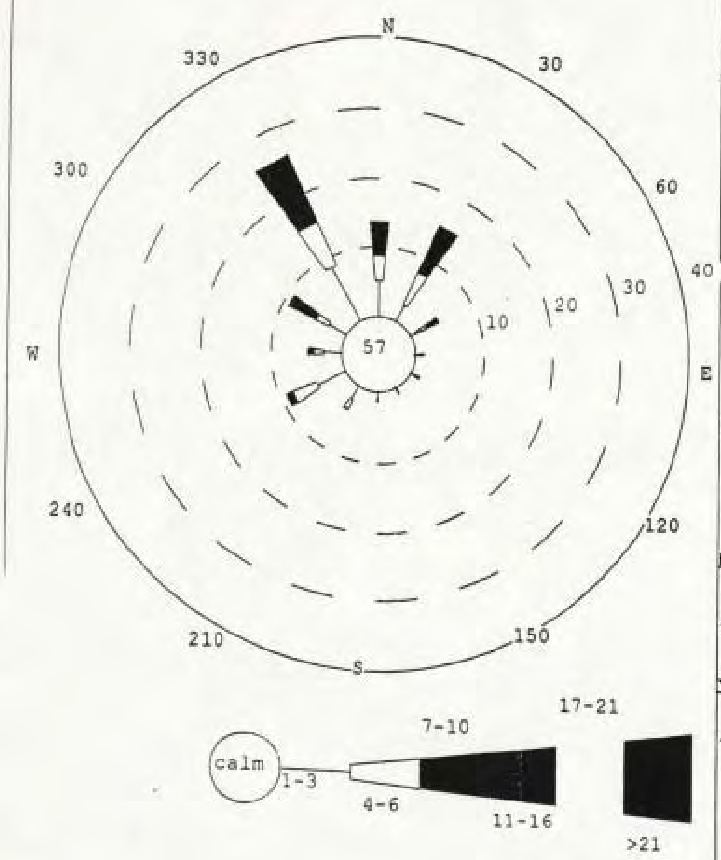
DAMIETTA

MONTHE(S) NO.:

9

YEARS:

1968-1999□□



E.M.A

COMPUTER DEPARTMENT

STATION:

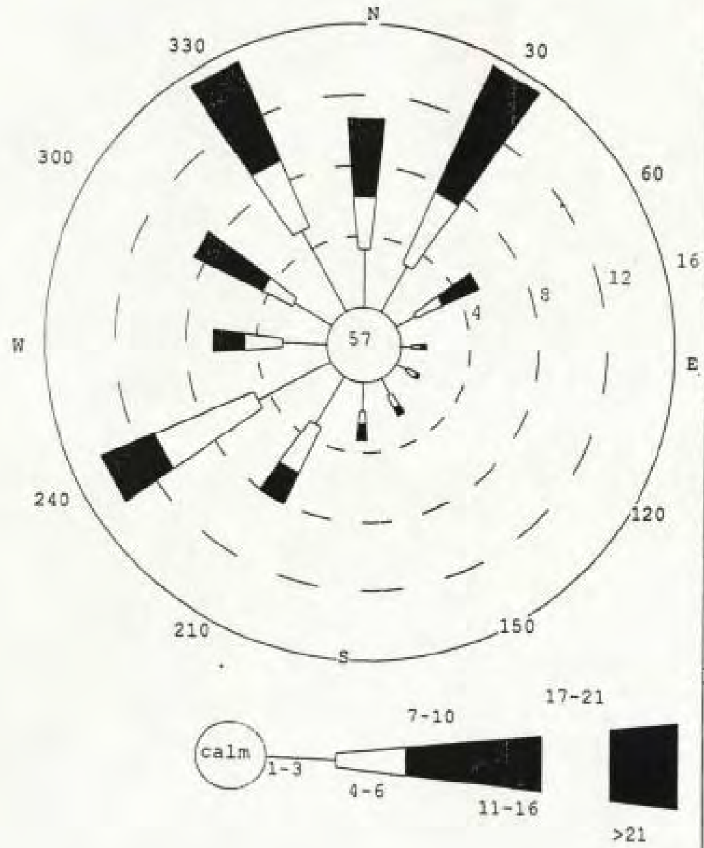
DAMIETTA

MONTHE(S) NO.:

10

YEARS:

1968-1999



E.M.A

COMPUTER DEPARTMENT

STATION:

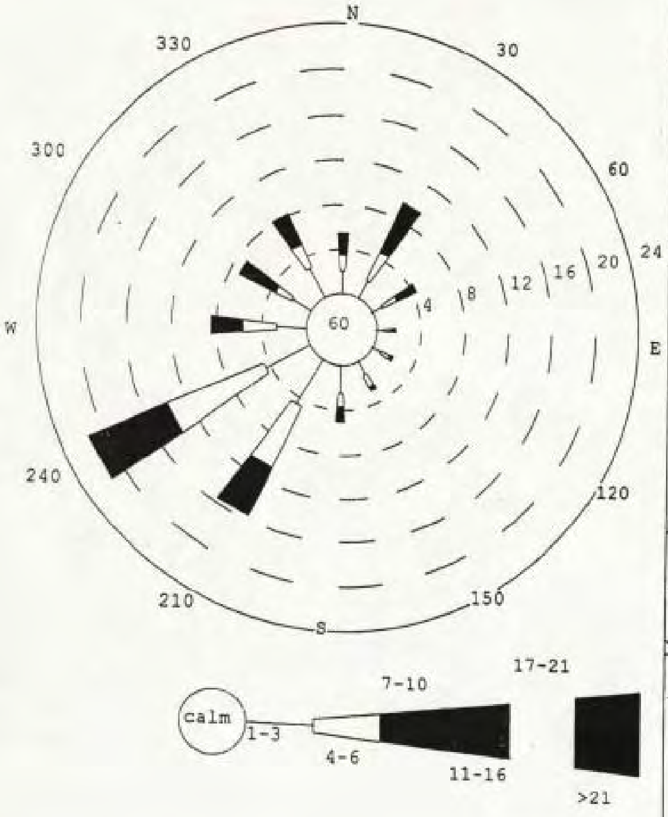
DAMIETTA

MONTHE(S) NO.:

11

YEARS:

1968-1999



E.M.A

COMPUTER DEPARTMENT

STATION:

DAMIETTA

MONTHE(S) NO.:

12

YEARS:

1968-1999

APPENDIX VI – SITE SELECTION ENVIRONMENTAL EVALUATION REPORT

PROPOSED SITES ENVIRONMENTAL EVALUATION REPORT IDKU, GAMASAH, DAMIETTA EGYPT

Prepared for:

KELLOGG BROWN & ROOT

Prepared by:

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DRAFT V1.0

KE 60024 (50930) **SEPTEMBER 2004**

Komex Project No.	:	KE 60024/ KEP 50930
Report Title		Sites Environmental Evaluation Report
Report Status	:	DRAFT V1.0
Date	:	29 September 2004
Prepared by	:	Mohamed Hassan
Reviewed by	:	M. L. Lauria
Approved by	:	F Haraisty
Controlled Copy No.	:	

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INTRODUCTION

Background

ECHEM is planning to build an Ammonia/Urea facility and a Methanol facility in Egypt. ECHEM secured funding from the US TDA to finance the feasibility study of the project. Kellogg Brown and Root (KBR) has been awarded the contract to conduct the feasibility study according to the TDA Terms of Reference (TOR). ECHEM proposed four alternative sites to evaluate and identify the most suitable site for the project. The Ammonia/Urea and the Methanol facilities would be on the same site. ECHEM would partner with Agrium for the Ammonia/Urea plant, and with Methanex for the Methanol plant.

KBR Environmental subcontracted Komex Egypt, as a local / Egyptian environmental consultancy firm to participate in the site selection/environmental ranking and later conduct a preliminary EIA for the selected site, as per TDA TOR Task C.

Field Program

Komex conducted two site visits. The first site visit was conducted by ECHEM, Methanex, Agrium and Komex on 07 September 2004. The group visited the Idku site, Damietta ECHEM site, and Damietta Port site. The Gamasah site was not visited due to other group commitments. The overall trip distance (round trip: Cairo – Alexandria – Idku – Damietta – Port Said - Cairo) was 764 km.

The second site visit was conducted by KBR, ECHEM, and Komex on 12 and 13 September 2004. Four sites were visited. The overall trip distance (round trip: Cairo – Damietta – Gamasah - Alexandria (overnight) – Idku – Damietta - Cairo) was 1,080 km. The approximate distances between sites are presented in Table 1.

Table 1 : Approximate Distances between the Four Proposed Sites

Site	Idku Site	Gamasah Site	Damietta Sites
Idku Site	0	120 km	155 km
Gamasah Site	120 km	0	35 km
Damietta Sites	155 km	35 km	0

1st Site: Idku (visited 07, 13 September 2004)

Site Summary

The proposed site is located on the Mediterranean Sea (northern boundary with approximate length of 3.5 km) 45 km east of Alexandria. The southern boundary of the site is a paved road (full length of the southern boundary), drainage canal, and cultivated land (crops). At the western boundary of the site there are two cannons (Napoleonic Fort of archaeological importance) and further west is the Rashpetco site (Oil & Gas company). The offshore wells of Rashpetco can be seen to the north. The agricultural wastewater drains are on the southern side of the paved road. The total area of the site is approximately 600 Feddans (250 Hectares). A lake was observed on the site. Large quantities of agricultural wastewater are pumped into the site lake from a drain on the other side of the main road. Two persons were noticed fishing in the lake. Many birds were observed around the lake and some were feeding on the lake. The dry area of the site is sandy and flat with minor vegetation. The eastern boundary of the site is unused land with a similar nature to the ECHEM site.

The site is east of existing oil and gas facilities (ELNG and Rashpetco). Komex is very familiar with this area, as Komex have been working on the neighbouring facility for more than a year.

Environmental Concerns:

- Socio-cultural (cultivated land, fisheries).
- Potentially contaminated lake onsite (need for baseline assessment).
- Existing on site ecosystem of significance (lake, fish, birds, some vegetation).
- Two cannons of archaeological importance (western boundary).
- Offshore dredging/construction activities needed for the jetty, sea cooling water intake/outfall.

Benefits:

- No construction camp is required (lower impact during construction phase) due to being close to Idku and Alexandria.
- Natural Gas pipeline passes by the site (no major additional works needed to connect NG to site).
- Possibility of sharing facilities of the LNG jetty (access channel, etc.).
- Good road access.

Table 2 Idku Site: Locations

Time/ date	LM	GPS Readings[1]		Measurement	photos	Remarks
		N	E			
10:35 7/9/04	1	31° 22' 00.9"	30° 20' 03.4"		Panorama 1-4 for the site facing north taken from west to east	Wrong site (west of ECHEM site)
				Noise & Meteorol.	Photo 5 noise meter during measurement	
					6 & 7 shows stagnant water on site	
11:14 7/9/04	2	31° 22' 23.2"	30° 20' 17.0''		Panorama 8-13 facing north, from west to east	SW corner of ECHEM site
11:15 7/9/04	3	31° 22' 23.1"	30° 20' 16.9''	Noise	Photo 14, 2 people fishing onsite. Panorama 15-17 facing east, shot taken from north to south Photo 18 on the other side of the road facing west. Photo 19 on the other side of the road facing east.	On the road south of ECHEM site
11:35 7/9/04	4	31° 22' 36.3"	30° 20' 32.5"		Photos 20-22 showing pump house and pipe discharging to the site (agricultural wastewater) Panorama 23-28 from west to east facing north.	Name of Area "Tabyet Al-Alayem"

[1] Geod Datm '49, CDI +/- 0.25

Table 3 Idku Site: Meteorological Data

Time/date	LM	Meteorological Information: Wind Direction	Max 3 sec Gust m/s	Average Wind m/s	Temp °C	Wind Chill °C	Humidity %	Heat Index %	Dew Point %	Remarks
10:35 7/9/04	1	N/NE	3.8	2.9	27.8	27.3	74	30.0	22.6	Wrong Location, (west of the ECHEM site)
11:15 7/9/04	3	N/NE	3.6	2.5	27.8	28.2	68	31.4	22.1	Southwest corner of ECHEM site on the public road

Table 4 Idku Site: Background Noise Data

Site	LM	Time/Date	Leq (dB)	Remarks
Wrong Site (West of ECHEM site)	1	10:41 – 7/9/04	65.6 (5 min Average)	The background noise is high due to heavy traffic (truck movements) and ongoing activities at Rashpetco site (hammering) west of the measurement location.
ECHEM Site	3	11:10 – 7/9/04	42.9 (5 min Average)	The measurement was taken on the southern border of ECHEM site on the public road. The instrument was paused when trucks were passing.

Table 5 Idku Site: List of Photos

Photo #	Description
102, 103	Shot taken from the International Coastal Road showing ELNG Jetty.
104-107	Panoramic shot from the SW corner of the site (N-NE-E) showing Rashpetco site, the drain, the Fort, and ECHEM site.
108 – 111	Panoramic shot facing W-S taken from the Fort location showing the ELNG facilities and the Western boundary facilities.
112-113	Napoleonic Fort
114-124	Panoramic shot taken from the Fort location S – S (360°)
125, 126, 137	Pipe (on site)/pump (south of the site) discharging agricultural wastewater to the lake on ECHEM site. Foam can be seen in the photos.
127, 128	Birds species onsite feeding on the lake.
129	Photo taken from the SE corner of the site facing south
130-136	Panoramic shot from the SE corner of the site N – W – S

2nd Site: Gamasah (visited on 12 September 2004)

Site Summary

The site is located 155 km east of Alexandria and 35 km west of Damietta, on the Coastal International Road. The total area of the site is approx 2500 Feddans (1050 Hectares). The site is rectangular in shape and is bounded by the Mediterranean on the North (after a 200 m set back area by law, there is a military post) and the Coastal International Road on the south (full length of the southern boundary). On the eastern boundary, there is an unpaved road and a drain that discharges to the sea. The site is flat, sandy, and homogeneous in nature. The eastern area of the site is wet and marshy. Few birds species were noticed in the area. On the available drawings/layouts, the southern side of the coastal road is agricultural land (has similar homogenous nature as ECHEM land) owned by different associations, but not cultivated. The site is remote. There are 2 dry drains passing from south to north of the site.

A 32" Natural Gas pipeline is passing by the southern boundary of the site (parallel to the site). No other existing infrastructure was noticed at the site.

On the northern edge of the site, nets were observed, which are installed by locals to catch migratory birds (seasonal).

Environmental Concerns:

- Socio-cultural (fishing activities of locals, seasonal bird catching, etc).
- A camp may be needed onsite.
- Gamasah is known as a summer holiday place for Egyptians.
- No other industrial activities in the area. Area is not classified as an industrial area (needs confirmation from ECHEM).
- Offshore dredging/construction activities needed for the jetty, sea cooling water intake/outfall.
- Possible wetland, with associated ecological impact concerns.

Benefits

- Natural Gas pipeline passes by the site (no major additional works needed to connect NG to site).
- Good access to main coastal road.

Table 6 Gamasah Site: Locations

Time	LM	GPS Reading		Measurement	Remarks
		N	E		
17:45 12/9/04	10	31° 29' 11.8"	31° 24' 13.3"		SE corner of the site
17:50 12/9/04	11	31° 29' 09.8"	31° 24' 12.9"		- Agricultural Drain (photo 84) - NG pipeline sign (photo 85), site shown at the background.
18:00	12	31° 29' 39.5"	31° 24' 33.9"	Noise, Meteorological	NE corner of the site
	13	31° 29' 49.3"	31° 24' 41.4"		- The agricultural drain discharging to the sea (photo 92, N direction). - Birds catching nets installed by locals, photo 93 facing west.
	14	31° 29' 54.6"	31° 22' 41.8"		Dry drain 1 crossing the site from south to north, photo 94 facing N. Shot taken from the ICR.
	15	31° 30' 36.5"	31° 21' 17.2"		Dry Drain 2 crossing the site from south to north, photo 95 facing N. Shot taken from the ICR.
	16	31° 31' 12.6"	31° 20' 03.8"		SW corner of the site on ICR.

Table 7 Gamasah Site: Meteorological Data

Time	LM	Meteorological Information								Remarks
		Wind Direction	Max 3 sec Gust m/s	Average Wind m/s	Temp °C	Wind Chill °C	Humidity %	Heat Index %	Dew Point %	
18:10 12/9/04	12	NW	5.7	3.6	27.2	27	54	28.7	16.7	Windy, readings were recorded on the Eastern boundary of the site adjacent to the drain.

Table 8 Gamasah Site: Background Noise Data

Site	LM	Time/Date	Leq (dB)	Remarks
ECHEM Site	12	18:05 – 12/9/04	48.7	Windy, reading (5 min Average) was recorded on the Eastern boundary of the site adjacent to the drain.

Table 9 Gamasah Site: List of Photos

Photo #	Description
84, 92	Agricultural drain discharging to the sea. Shots taken facing north.
85	GASCO natural gas pipeline passing parallel to the site southern boundary
86-88	Marshes on the eastern area of the site.
89-90	NE corner of the site facing n-NW
91	Noise measurement at the NE corner
93	North to the site, nets installed by locals to catch migratory birds. On the right a military post can be seen. Shot was taken facing west.
94	Onsite Dry Drain 1, shot taken from the Coastal Road facing north.
95	Onsite Dry Drain 2, shot taken from the Coastal Road facing north
96	Onsite building, shot taken from the Coastal Road facing north
97-101	Panoramic shot taken from the Coastal Road facing W – N – E, from the SW corner of the site

3rd Site: Damietta ECHEM Site (visited on 7, 12 September 2004)

Site Summary

The site is located to the east of Damietta Port on a navigational channel that is connected to the the port. The site is trapezoidal in shape. To the northern boundary of the site is a flour mill property. The eastern and southern boundaries are agricultural lands. The western boundary is a navigational canal connecting the Damietta Branch (the River Nile) with the sea. The northern corner of the site is about 400 m away from the sea shoreline.

The soil of the site is very rich/fertile. There are ongoing excavation activities on the site taking fertile soil to use for desert land reclamation. The excavations vary up to 8 meters in height. This would require a tremendous amount of soil for back filling the site. The site is severely impacted by the excavation activities.

Environmental Concerns:

- Site is impacted by the ongoing excavation activities.
- Site is not easily accessible.
- Socio-cultural (agricultural/fertile land).
- Substantial offshore dredging/construction activities needed for the jetty, sea cooling water intake/outfall, as the site is not on the shoreline.
- Nets were installed by locals to catch migratory birds.

Benefits

- A camp is not needed onsite.
- There are industrial and agricultural activities in the area. Area classification is not clear (needs confirmation from ECHEM).

Table 10 Damietta ECHEM Site: Locations

Time	LM	GPS Reading		Measurement	Photos
		N	E		
18:30 7/9/04	6	31° 28’ 05.8”	31° 46’ 50.2”	Noise, Meteorological	Panorama 39-48 from north to west clockwise direction, showing El Rehab facility, the site, road, navigation canal and the other side of the canal (DPA). Photos 49, 50 shows noise instrument used for noise measurement.
					Photo 51 shows the gate of the facility located north to the proposed site. Shot were taken on our way to investigate the jetty location
18:45 7/9/04	7	31° 29 10.3”	31° 46’ 29.9”		Photos 52-56 facing north at jetty proposed location
18:50 7/9/04	8	31° 29’ 10.8”	31° 46’ 28.9”		Photos 57-61 facing east, south for jetty propose location (about 30 meter north east of LM 7)
14:45 12/9/04	9	31° 29’ 10.8’’	31° 46’ 28.9”		Birds catching nets on the shore line, approx 400 meters north of the site. Photos 67 (facing NE), 68 (facing west)

Table 11 Damietta ECHEM Site: Meteorological Data

Time/ date	LM	Meteorological Information								Remarks
		Wind Direction	Max 3 sec Gust m/s	Average Wind m/s	Temp °C	Wind Chill °C	Humidity %	Heat Index %	Dew Point %	
18:30 7/9/04	6	N/NE	4.8	2.5	28.2	27.2	67	30.9	21.2	Before sun set (sunset at 19:10)

Table 12 Damietta ECHEM Site: Background Noise Data

Site	Time/Date	Leq (dB)	Remarks
Damietta Site	18:35 – 7/9/04	43.6 (5 min Average)	One truck passed by during the measurement duration and the instrument was paused while the truck was passing by.

Table 13 Damietta ECHEM Site: List of Photos

Photo #	Description
62	Construction waste onsite
63-66	Ongoing excavation activities onsite
69	Excavated soil
70-72	Excavation onsite
73-75	Salt deposits onsite
76	Power Line coming from the Damietta port side and ending onsite
77, 78	Signs onsite with names of land owners (probably previous land owners)
79	Onsite truck way, used by trucks loaded by excavated clay/soil.
80, 81	Pipe noticed onsite
82	Facing SE on the road showing navigation channel on the right, the bridge crossing the navigation channel and a neighbourhood agricultural land.
83	Shot taken facing NW while crossing the bridge. Site is shown on the right between the flour mill and the neighbourhood agricultural land.

4th (optional) Site: Damietta Port Site (visited 07, 13 September 2004)

Site Summary

The Port authority suggested this site for the project. No detailed investigation was conducted as this site is out of the scope of work of Komex. However, Komex is very familiar with this site, as Komex have been working on the neighbouring facility for the last 4 years.

The site is impacted by the ongoing activities in the port. The dredging spoil from the LNG jetty was dumped onto this site. The site is in an industrial zone, within DPA premises.

Environmental Concerns:

- Sea cooling water outfall is not close to site as it has to discharge to the open sea and not into the basin (Law 4/94). Possibility of sharing the LNG plant outfall worth consideration.

Benefits:

- This site has a better option for Jetty construction than other sites. Lower dredging and only 30-50 m jetty length instead of 2-2.5 km jetty for other sites.
- Good access and infrastructure.
- No camps needed on site.
- Sea cooling water intake structure direct from the basin.
- This site has lower environmental impacts than other sites.
- Designated industrial zone (applicable for noise).
- Utilise existing port facilities (spill contingency plans etc if existing).

Table 14 Damietta Port Site Location

Time/ date	LM	GPS Reading		Photos	Remarks
		N	E		
18:05 7/9/04	5	31° 27’ 44.6”	31° 45’ 07.2”	Photo 29 from the western boundary facing east.	DPA proposed Site located south of SEGAS (1 million m2).
				Photos 30-38 from the eastern boundary facing west. showing SEGAS and LNG jetty	

Table 15 Damietta Port Site List of Photos

Photo #	Description
138-141	Panoramic shot (E-S) showing SEGAS fence and the proposed site. Old Port wall can be seen on the right.
142	Southern boundary of the proposed site, the levelled site (on the right) is a neighbourhood site.
143-148	Panoramic shot (E-N-W) taken at the old port wall showing the proposed site that extends to the new port wall shown at a distance in the photos.
149	Construction waste and SEGAS/LNG jetty at the background
150	Shoreline at the proposed location south of SEGAS. Construction waste can be seen on the right.
151-152	Panoramic shot facing east taken at the new port wall.

Table 16 Sites Environmental Ranking[2]

	Idku Echem Site	Gamasah Echem Site	Damietta Echem Site	Damietta Port Site
Environmental Concerns	1. Socio-cultural (cultivated land, fisheries). 2. Potentially contaminated lake onsite. 3. Existing on site ecosystem of significance (lake, fish, birds). 4. Two cannons of archaeological importance. 5. Offshore dredging/construction activities needed for the jetty, sea cooling water intake/outfall.	1. Socio-cultural (fishing activities of locals, seasonal bird catching, etc). 2. A camp may be needed onsite. 3. Gamasah is known as a summer place for Egyptians. 4. Area is potentially not classified as an industrial area. 5. Offshore dredging/construction activities needed for the jetty, sea cooling water intake/outfall.	1. Site is impacted by the ongoing excavation activities. 2. Site is not easily accessible. 3. Socio-cultural (agricultural/fertile land). 4.Substantial dredging/construction activities needed for the jetty, sea cooling water intake/outfall, as the site is not on the shoreline. 5. Nets were installed by locals to catch migratory birds (potentially illegal).	1. Outfall route to the open sea may require additional onshore construction. ***Note full site visit not conducted***
Environmental Benefits	1. No construction camp is required (lower impact during construction phase). 2. Natural Gas pipeline passes by the site (no major additional works needed to connect NG to site). 3. Possibility of sharing facilities of the LNG jetty (access channel, etc.). 4. Good road access. 5. There are industrial activities in the area. Area classification is not clear (needs confirmation from ECHEM).	1. Natural Gas pipeline passes by the site (no major additional works needed to connect NG to site). 2. Good access to main coastal road	1. A camp is not needed onsite. 2. There are industrial and agricultural activities in the area. Area classification is not clear (needs confirmation from ECHEM).	1. Lower dredging at only 30-50 m jetty length instead of 2-2.5 km jetty for other sites. 2. Sea cooling water intake structure direct from the basin 3. No camps needed on site. This site has lower environmental impacts than other sites. 4. Designated industrial zone (applicable for noise). 5. Utilise existing port facilities (spill contingency plans etc if existing). 6. No maintenance dredging/disposal are required in main channel, as it will be conducted by DPA. 7. Good Road access. 8 Industrial zone designation.
Environmental Components/Impacts				
Soil	The lake area is potentially contaminated with agricultural wastewater.	High Possibility for the Eastern area of the site parallel to the drain. Sandy with Vegetation. The	The soil is excavated. The soil is severely impacted but no evidence of contamination. Fertile	The soil of the NE part (old port) is impacted by neighbourhood activities (dumping

[2] The predicted impacts are relative and not absolute.

	Sandy soil.	Eastern area is marshes.	clay	of dredged sediment and construction waste). Mixed sand and silt
Near Habitation	Agricultural Land & Village (South)	Remote Village (East)	Agricultural land & Village (East/South)	Fenced Industrial area, Remote Village - west
Local Fishing	Yes	Yes	At the proposed jetty location	No
Birds & Fauna	Yes (onsite Lake)	Yes (Birds migratory route)	Already impacted. Birds migratory route	No
Flora	Low	Medium in Future (Neighbourhood lands are designated agricultural)	Height impact on the neighbourhood agricultural land/crops	No or very low impact. Site is already impacted.
Local Tourism	No	Yes (few KM east of the site)	No	No
Marine Dredging	High	High	High	Low for the Jetty and Medium for the outfall
Spoil Dispersal	High	High	High	Medium
Effluents Impacts	High	High	High	Medium
Emissions Impacts	High (Impact directly on agricultural crop, nearest residential area)	Medium	High	Medium (potential for cumulative impacts)
Solid Waste	Easy to Manage	Not Easy to Manage	Can be Managed	Easy to Manage
Agricultural Land	No	No	Yes	No
Background Noise	Acceptable	Acceptable	Acceptable	----
Noise	Industrial Area (Higher allowable Limits)	Non-Industrial Area (Lower allowable Limits)	Non-Industrial Area (Lower allowable Limits)	Industrial Area (Higher allowable Limits)
Social concerns	Moderate	Moderate	High	Low
Archaeological	High	Low	Low	Low
Overall Environmental Sensitivity[3]	Medium	High	High	Low
Environmental Significance Ranking[4]	**2**	1	1	**3**

Recommendation

In summary, following the site visits, we suggest that the sites with the lowest level of environmental concern, are the Damietta Port and the Idku site. ***(Note that full site assessment was not conducted at the Damietta Port site, as it was not included in the original TOR and the above ranking is based on our experience of the area).***

[3] Classified Low, Medium, and High
[4] 1: High Significance. 2: Moderate Significance. 3: Low Significance 4. Not Significant. 5: No enough data to Rank

APPENDIX VII – EU DIRECTIVES SUMMARY

Appendix I: EU Directives of potential relevance for the Methanex project

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS
BIODIVERSITY	92/43/EEC	OJ L 206, 22.7.1992	**COUNCIL DIRECTIVE 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora** The aim of this Directive shall be to contribute towards ensuring bio-diversity through the conservation of natural habitats and of wild fauna and flora in the European territory of the Member States to which the Treaty applies. Measures taken pursuant to this Directive shall be designed to maintain or restore, at favourable conservation status, natural habitats and species of wild fauna and flora of Community interest. Measures taken pursuant to this Directive shall take account of economic, social and cultural requirements and regional and local characteristics.
BIODIVERSITY	79/409/EEC	OJ L 103, 25.4.1979	**COUNCIL DIRECTIVE of 2 April 1979 on the conservation of wild birds** This Directive relates to the conservation of all species of naturally occurring birds in the wild state in the European territory of the Member States to which the Treaty applies. It covers the protection, management and control of these species and lays down rules for their exploitation. It shall apply to birds,their eggs,nests and habitats.
ENVIRONMENT AL MANAGEMENT	2003/4/EC	O J L 041 , 14/02/2003	**Directive of the European Parliament and of the Council of 28 January 2003 on public access to environmental information and repealing Council Directive 90/313/EEC** The objectives of this Directive are: (a) to guarantee the right of access to environmental information held by or for public authorities and to set out the basic terms and conditions of, and practical arrangements for, its exercise; and (b) to ensure that, as a matter of course, environmental information is progressively made available and disseminated to the public in order to achieve the widest possible systematic availability and dissemination to the public of environmental information. To this end the use, in particular, of computer telecommunication and/or electronic technology, where available, shall be promoted.
ENVIRONMENT AL MANAGEMENT	2003/35/EC	OJ L 156 , 25/06/2003	**Directive of the European Parliament and of the Council of 26 May 2003 providing for public participation in respect of the drawing up of certain plans and programmes relating to the environment**

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS
			and amending with regard to public participation and access to justice Council Directives 85/337/EEC and 96/61/EC - Statement by the Commission Objective The objective of this Directive is to contribute to the implementation of the obligations arising under the Århus Convention, in particular by: (a) providing for public participation in respect of the drawing up of certain plans and programmes relating to the environment; (b) improving the public participation and providing for provisions on access to justice within Council Directives 85/337/EEC and 96/61/EC.
ENVIRONMENTAL MANAGEMENT	01/761/EC	OJ L 114 , 24/04/2001	**Regulation (EC) No 761/2001 of the European parliament and of the council of 19 March 2001 allowing voluntary participation by organisations in a Community eco-management and audit scheme (EMAS)** Regulation allowing voluntary participation by companies in the industrial sector in a Community Eco-Management and Audit Scheme (EMAS) replaced the old EMAS scheme (Council Regulation (EEC) No.1836/93 of 29 June 1993). The new scheme increases the scope of EMAS to include all sectors of economic activity, including local authorities. The main elements of the new Regulation include the following: (a)extension of the scope of EMAS to all sectors of economic activity, including local authorities; (b) integration of ISO 14001 as the environmental management system required by EMAS; (c) the revised EMAS Regulation differentiates between direct and indirect environmental aspects; (d) adoption of a visible and recognisable EMAS logo to allow registered organisations to publicise their participation in EMAS more effectively; (e) involvement of employees in the implementation of EMAS; and (f) strengthening the role of the environmental statement to improve the transparency of communication of environmental performance between registered organisations and their stakeholders and the public.
		OJ L 327 , 04/12/2002	**Corrigendum to Regulation (EC) No 761/2001 of the European Parliament and of the Council of 19 March 2001 allowing voluntary participation by organisation in a Community eco-management and audit scheme (EMAS) (OJ L 114 of 24.4.2001)**
ENVIRONMENTAL MANAGEMENT	97/265/EC	OJ L104 22 April 1997	**97/265/EC: Commission Decision of 16 April 1997 on the recognition of the international standard ISO 14001:1996 and the European standard EN ISO 14001:1996, establishing specification for environmental management systems, in accordance with Article 12 of Council Regulation (EEC) No 1836/93 of 29 June 1993, allowing voluntary participation by companies in the industrial sector in a**

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS
			Community eco-management and audit scheme (Text with EEA relevance) Commission Decision Recognises ISO 14001:1996 in relation to EMAS Regulation
ENVIRONMENTAL MANAGEMENT	**85/337/EC**	OJ L 175 , 05/07/1985	**Council Directive 85/337/EEC of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment** This Directive applies to the assessment of the environmental effects of those public and private projects which are likely to have significant effects on the environment.
		OJ L 073 , 14/03/1997	**Council Directive 97/11/EC of 3 March 1997 amending Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment**
PROCESSING	**67/548/EEC**	OJ P 196 , 16/08/1967	**Council Directive 67/548/EEC of 27 June 1967 on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances** This Directive has been amended 9 times (9th Amendment: **Directive 1999/33/EC**)and adapted to technical progress 29 times. Protecting the environment from the dangerous effects of substances was only introduced with the 6th amendment of the Directive, adopted in 1979. This Directive recognised the need to ensure the protection of public health, in particular the health of workers handling dangerous substances. The Directive introduced common provisions on the: o classification of dangerous substances: o packaging of dangerous substances: and o labelling of dangerous substances.
EFFLUENT AND WATER	**91/271/EEC**	OJ L 135, 30/05/1991	**Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment** Concerns the collection, treatment and discharge of wastewater from certain industrial sectors. The objective is to protect the environment from the adverse effects of the abovementioned wastewater discharges.

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS
			Annex I: Requirements for Urban Waste Water: C. Industrial waste water Industrial waste water entering collecting systems and urban waste water treatment plants shall be subject to such pre-treatment as is required in order to: Protect the health of staff working in collecting systems and treatment plants; Ensure that collecting systems, waste water treatment plants and associated equipment are not damaged; Ensure that the operation of the waste water treatment plant and the treatment of sludge are not impeded; Ensure that discharges from the treatment plants do not adversely affect the environment, or prevent receiving water from complying with other Community Directives; and Ensure that sludge can be disposed of safety in an environmentally acceptable manner.

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS
			(table reproduced below)

Table 1: Requirements for discharges from urban waste water treatment plants subject to Articles 4 and 5 of the Directive. The values for concentration or for the percentage of reduction shall apply.

Parameters	Concentration	Minimum percentage of reduction (¹)	Reference method of measurement
Biochemical oxygen demand (BOD5 at 20 °C) without nitrification (²)	25 mg/l O_2	70-90 40 under Article 4 (2)	Homogenized, unfiltered, undecanted sample. Determination of dissolved oxygen before and after five-day incubation at 20 °C ± 1 °C, in complete darkness. Addition of a nitrification inhibitor
Chemical oxygen demand (COD)	125 mg/l O_2	75	Homogenized, unfiltered, undecanted sample Potassium dichromate
Total suspended solids	35 mg/l (³) 35 under Article 4 (2) (more than 10 000 p.e.) 60 under Article 4 (2) (2 000-10 000 p.e.)	90 (³) 90 under Article 4 (2) (more than 10 000 p.e.) 70 under Article 4 (2) (2 000-10 000 p.e.)	— Filtering of a representative sample through a 0,45 μm filter membrane. Drying at 105 °C and weighing — Centrifuging of a representative sample (for at least five mins with mean acceleration of 2 800 to 3 200 g), drying at 105 °C and weighing

(¹) Reduction in relation to the load of the influent.
(²) The parameter can be replaced by another parameter: total organic carbon (TOC) or total oxygen demand (TOD) if a relationship can be established between BOD5 and the substitute parameter.
(³) This requirement is optional.

Analyses concerning discharges from lagooning shall be carried out on filtered samples; however, the concentration of total suspended solids in unfiltered water samples shall not exceed 150 mg/l.

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS
			Table 2: Requirements for discharges from urban waste water treatment plants to sensitive areas which are subject to eutrophication as identified in Annex II.A (a). One or both parameters may be applied depending on the local situation. The values for concentration or for the percentage of reduction shall apply.
		OJ L 067 , 07/03/1998	**Commission Directive 98/15/EC of 27 February 1998 amending Council Directive 91/271/EEC with respect to certain requirements established in Annex I thereof (Text with EEA relevance)**

Parameters	Concentration	Minimum percentage of reduction (1)	Reference method of measurement
Total phosphorus	2 mg/l P (10 000 - 100 000 p. e.) 1 mg/l P (more than 100 000 p. e.)	80	Molecular absorption spectrophotometry
Total nitrogen (2)	15 mg/l N (10 000 - 100 000 p. e.) 10 mg/l N (more than 100 000 p. e.) (3)	70-80	Molecular absorption spectrophotometry

(1) Reduction in relation to the load of the influent.
(2) Total nitrogen means: the sum of total Kjeldahl-nitrogen (organic N + NH_3), nitrate (NO_3)-nitrogen and nitrite (NO_2)-nitrogen.
(3) Alternatively, the daily average must not exceed 20 mg/l N. This requirement refers to a water temperature of 12° C or more during the operation of the biological reactor of the waste water treatment plant. As a substitute for the condition concerning the temperature, it is possible to apply a limited time of operation, which takes into account the regional climatic conditions. This alternative applies if it can be shown that paragraph 1 of Annex I.D is fulfilled.

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS
EFFLUENT AND WATER	**76/160/EEC**	OJ L31 5 February 1976	**Council Directive 76/160/EEC of 8 December 1975 concerning the quality of bathing water** Concerns the quality of bathing water, with exception of water intended for therapeutic purposes and water used in swimming pools.

QUALITY REQUIREMENTS FOR BATHING WATER

	Parameters	G	I	Minimum sampling frequency	Method of analysis and inspection
	Microbiological:				
1	Total coliforms /100 ml	500	10 000	Fortnightly (1)	Fermentation in multiple tubes. Subculturing of the positive tubes on a confirmation medium. Count according to MPN (most probable number) or membrane filtration and culture on an appropriate medium such as Tergitol lactose agar, endo agar, 0·4% Teepol broth, subculturing and identification of the suspect colonies. In the case of 1 and 2, the incubation temperature is variable according to whether total or faecal coliforms are being investigated.
2	Faecal coliforms /100 ml	100	2 000	Fortnightly (1)	
3	Faecal streptococci /100 ml	100	—	(2)	Litsky method. Count according to MPN (most probable number) or filtration on membrane. Culture on an appropriate medium.
4	Salmonella /1 litre	—	0	(2)	Concentration by membrane filtration. Inoculation on a standard medium. Enrichment — subculturing on isolating agar — identification.
5	Entero viruses PFU/10 litres	—	0	(2)	Concentrating by filtration, flocculation or centrifuging and confirmation.
	Physico-chemical:				
6	pH	—	6 to 9 (0)	(2)	Electrometry with calibration at pH 7 and 9.
7	Colour	—	No abnormal change in colour (0)	Fortnightly (1)	Visual inspection or photometry with standards on the Pt.Co scale.
		—	—	(2)	

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS

	Parameters	G	I	Minimum sampling frequency	Method of analysis and inspection
8	Mineral oils mg/litre	—	No film visible on the surface of the water and no odour	Fortnightly (1)	Visual and olfactory inspection or extraction using an adequate volume and weighing the dry residue.
		≤ 0·3	—	(2)	
9	Surface-active substances reacting with methylene blue mg/litre (lauryl-sulfate)	—	No lasting foam	Fortnightly (1)	Visual inspection or absorption spectro-photometry with methylene blue.
		≤ 0·3	—	(2)	
10	Phenols (phenol indices) mg/litre C_6H_5OH	—	No specific odour	Fortnightly (1)	Verification of the absence of specific odour due to phenol or absorption spectrophotometry 4-aminoantipyrine (4 AAP) method.
		≤ 0·005	≤ 0·05	(2)	
11	Transparency m	2	1 (0)	Fortnightly (1)	Secchi's disc.
12	Dissolved oxygen % saturation O_2	80 to 120	—	(2)	Winkler's method or electrometric method (oxygen meter).
13	Tarry residues and floating materials such as wood, plastic articles, bottles, containers of glass, plastic, rubber or any other substance. Waste or splinters	Absence		Fortnightly (1)	Visual inspection.
14	Ammonia mg/litre NH_4			(3)	Absorption spectrophotometry, Nessler's method, or indophenol blue method.
15	Nitrogen Kjeldahl mg/litre N			(3)	Kjeldahl method.
	Other substances regarded as indications of pollution				
16	Pesticides mg/litre (parathion, HCH, dieldrin)			(2)	Extraction with appropriate solvents and chromatographic determination

<table>
<tr><th>CATEGORY</th><th>DIRECTIVE REF.</th><th>OFFICIAL JOURNAL REF.</th><th>DIRECTIVE DETAILS</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th></th><th>Parameters</th><th>G</th><th>I</th><th>Minimum sampling frequency</th><th>Method of analysis and inspection</th></tr>
<tr><td>17</td><td>Heavy metals such as:
— arsenic mg/litre As
— cadmium Cd
— chrome VI Cr VI
— lead Pb
— mercury Hg</td><td></td><td></td><td>(2)</td><td>Atomic absorption possibly preceded by extraction</td></tr>
<tr><td>18</td><td>Cyanides mg/litre Cn</td><td></td><td></td><td>(2)</td><td>Absorption spectrophotometry using a specific reagent</td></tr>
<tr><td>19</td><td>Nitrates and phosphates mg/litre NO_3 PO_4</td><td></td><td></td><td>(2)</td><td>Absorption spectrophotometry using a specific reagent</td></tr>
</table>
G = guide.
I = mandatory.
(0) Provision exists for exceeding the limits in the event of exceptional geographical or meteorological conditions.
(1) When a sampling taken in previous years produced results which are appreciably better than those in this Annex and when no new factor likely to lower the quality of the water has appeared, the competent authorities may reduce the sampling frequency by a factor of 2.
(2) Concentration to be checked by the competent authorities when an inspection in the bathing area shows that the substance may be present or that the quality of the water has deteriorated.
(3) These parameters must be checked by the competent authorities when there is a tendency towards the eutrophication of the water.
</td></tr>
<tr><td>EFFLUENT AND WATER</td><td>00/60/EC</td><td>O J L 327 , 22/12/2000</td><td>Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy

The purpose of this Directive is to establish a framework for the protection of inland surface water, transitional waters, coastal waters and groundwater which:
a) Prevents further deterioration and protects and enhances the status of aquatic ecosystems and with regard to their water needs, terrestrial ecosystems and wetlands directly depending on the aquatic</td></tr>
</table>

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS
			ecosystems; b) Promotes sustainable water use based on long-terms protection of available water resources; c) Aims at enhanced protection and improvement of the aquatic environment, inter alia, through specific measures for the progressive reduction of discharges, emissions and losses of priority substances and the cessation or phasing-out of discharges, emissions and losses of the priority hazardous substances; d) Ensures the progressive reduction of pollution of groundwater and prevents its further pollution; and e) Contributes to mitigating the effects of floods and droughts and thereby contributes to: • The provision of the sufficient supply of good quality surface water and groundwater as needed for sustainable balanced and equitable water use, • A significant reduction in pollution of groundwater.
EFFLUENT AND WATER	**80/68/EC**	OJ L20 26 January 1980	**Council Directive 80/68/EEC of 17 December 1979 on the protection of groundwater against pollution caused by certain dangerous substances** Aim: to prevent the pollution of groundwater by substances belonging to the families and groups of substances in lists I or II in the Annex, and as far as possible to check or eliminate the consequences of pollution that has already occurred. The emphasis of the Regulations is to prevent the direct or indirect discharge of List I substances to groundwater and to control pollution resulting from the direct or indirect discharge of List II substances. LIST I OF FAMILIES AND GROUPS OF SUBSTANCES 1. Organohalogen compounds and substances which may form such compounds in the aquatic environment; 2. Organophosphorus compounds; 3. Organotin compounds; 4. Substances which possess carcinogenic mutagenic or teratogenic properties in or via the aquatic environment (1);

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS
			5. Mercury and its compounds; 6. Cadmium and its compounds; 7. Mineral oils and hydrocarbons; and 8. Cyanides. LIST II OF FAMILIES AND GROUPS OF SUBSTANCES 1. Zinc, Copper, Nickel, Chrome, Lead, Selenium, Arsenic, Antimony, Molybdenum, Titanium, Tin, Barium, Beryllium, Boron, Uranium, Vanadium, Cobalt, Thallium, Tellurium, Silver. 2. Biocides and their derivatives not appearing in list I. 3. Substances which have a deleterious effect on the taste and/or odour of groundwater, and compounds liable to cause the formation of such substances in such water and to render it unfit for human consumption. 4. Toxic or persistent organic compounds of silicon, and substances which may cause the formation of such compounds in water, excluding those which are biologically harmless or are rapidly converted in water into harmless substances. 5. Inorganic compounds of phosphorus and elemental phosphorus. 6. Fluorides. 7. Ammonia and nitrites. (1)Where certain substances in list II are carcinogenic, mutagenic or teratogenic, they are included in category 4 of this list. More specifically, no authorisation can be granted that will permit the direct discharge of any List I substances. Nor can an authorisation be granted in relation to any activity (including disposal or tipping) that might lead to an indirect charge of a List I substance, unless the activity has been subjected to prior investigation. Any subsequent authorisation for an indirect discharge must include conditions, which require that all necessary technical precautions are observed to prevent indirect discharge of any List I substance. In respect of List II substances, there is no comparable blanket prohibition on direct discharge, but any authorisation for either direct or indirect discharge must be subject to prior investigation. Wastewater disposal which inevitably causes an indirect or direct discharge of any List II substance is specifically mentioned and will

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS
			be an issue for industry. The Regulations specify terms that must be included in any authorisation, including the essential precautions which must be taken. The EA/SEPA is given powers to issue "Regulation 19 Notices" prohibiting the carrying on of an activity on or in the ground, which might lead to indirect discharges of List I or II substances.
EFFLUENT AND WATER	**76/464/EEC**	OJ L129/32	**Council Directive 76/464/EEC of 4 May 1976 on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community as amended by Directive 91/692/EEC** Subject to Article 8, this Directive shall apply to: - inland surface water, - territorial waters; - internal coastal waters; and - groundwater. Directives on limit values and quality objectives for discharges of certain dangerous substances included in List I of the Annex to Directive: List 1: 1. organohalogen compounds and substances which may form such compounds in the aquatic environment, 2. organophosphorus compounds, 3. organotin compounds, 4. substances in respect of which it has been proved that they possess carcinogenic properties in or via the aquatic environment (1), 5. mercury and its compounds, 6. cadmium and its compounds, 7. persistent mineral oils and hydrocarbons of petroleum origin, and for the purposes of implementing Articles 2, 8, 9 and 14 of this Directive:

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS
			8. persistent synthetic substances which may float, remain in suspension or sink and which may interfere with any use of the waters. List II of families and groups of substances List II contains: - substances belonging to the families and groups of substances in List I for which the limit values referred to in Article 6 of the Directive have not been determined, - certain individual substances and categories of substances belonging to the families and groups of substances listed below, and which have a deleterious effect on the aquatic environment, which can, however, be confined to a given area and which depend on the characteristics and location of the water into which they are discharged. Families and groups of substances referred to in the second indent 1. The following metalloids and metals and their compounds: 2. Biocides and their derivatives not appearing in List I. 3. Substances which have a deleterious effect on the taste and/or smell of the products for human consumption derived from the aquatic environment, and compounds liable to give rise to such substances in water. 4. Toxic or persistent organic compounds of silicon, and substances which may give rise to such compounds in water, excluding those which are biologically harmless or are rapidly converted in water into harmless substances. (1)Where certain substances in list II are carcinogenic, they are included in category 4 of this list. 5. Inorganic compounds of phosphorus and elemental phosphorus. 6. Non persistent mineral oils and hydrocarbons of petroleum origin. 7. Cyanides, fluorides. 8. Substances which have an adverse effect on the oxygen balance, particularly : ammonia, nitrites.
EFFLUENT AND WATER		OJ L 024 , 28/01/1977	**CORRIGENDUM** TO:76/464/EEC: Council Directive of 4 May 1976 on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community
		OJ L337/48	**Amendment** to Council Directive 91/692/EEC of 23 December 1991 standardizing and rationalizing reports on the implementation of certain Directives relating to the environment

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS
		OJ L 377 of 31.12.1991	**Corrigendum** to Council Directive 91/692/EEC of 23 December 1991 standardizing and rationalizing reports on the implementation of certain Directives relating to the environment
		OJ L 181 , 04/07/1986	**Council Directive 86/280/EEC of 12 June 1986 on limit values and quality objectives for discharges of certain dangerous substances included in List I of the Annex to Directive 76/464/EEC** Complement to 76/464/EEC **(+ 3 Corrigendums)** Regarding pollution caused by certain dangerous substances discharged in the aquatic environment of the Community. Provides regulation on limit values and quality objectives for discharges of certain dangerous substances included in List 1 of the annex of Directive 76/464/EEC (see above).
EFFLUENT AND WATER		OJ L158 25 June 1988	Council Directive 88/347/EEC of 16 June 1988 **amending Annex II** to Directive 86/280/EEC on limit values and quality objectives for discharges of certain dangerous substances included in List I of the Annex to Directive 76/464/EEC
		OJ L 072 , 25/03/1993	**CORRIGENDUM TO**:Council Directive 88/347/EEC of 16 June 1988 amending Annex II to Directive 86/280/EEC on limit values and quality objectives for discharges of certain dangerous substances included in List I of the Annex to Directive 76/464/EEC
		OJ L219 14 August 1990	Council Directive 90/415/EEC of 27 July 1990 **amending Annex II** to Directive 86/280/EEC on limit values and quality objectives for discharges of certain dangerous substances included in list I of the Annex to Directive 76/464/EEC
AIR POLLUTION	2002/49/EC	OJL 189 , 18/07/2002	**Directive 2002/49/EC of 25 June 2002 relating to the assessment and management of environmental noise** **This is a Directive that is in the process of being developed**. Legislative proposals are due to be submitted by the 18th July 2006. These proposals should take into account the results of the report referred to in Article 10(1) of the Directive. The aim of this Directive shall be to define a common approach intended to avoid, prevent or reduce on a prioritised basis the harmful effects, including annoyance, due to exposure to environmental noise. To that end the following actions shall be

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS
			implemented progressively: a) the determination of exposure to environmental noise, through noise mapping, by methods of assessment b) common to the Member States; c) ensuring that information on environmental noise and its effects is made available to the public; and d) Adoption of action plans by the Member States, based upon noise-mapping results, with a view to preventing and reducing environmental noise where necessary and particularly where exposure levels can induce harmful effects on human health and to preserving environmental noise quality where it is good. This Directive shall also aim at providing a basis for developing Community measures to reduce noise emitted by the major sources, in particular road and rail vehicles and infrastructure, aircraft, outdoor and industrial equipment and mobile machinery.
AIR POLLUTION	**00/69/EC**	OJ L313 13 December 2000	**Directive 00/69/EC of the European Parliament and of the Council of 16 November 2000 relating to limit values for benzene and carbon monoxide in ambient air** Aim: (a) to establish limit values for concentrations of benzene and carbon monoxide in ambient air intended to avoid, prevent or reduce harmful effects on human health and the environment as a whole; (b) to assess concentrations of benzene and carbon monoxide in ambient air on the basis of common methods and criteria; (c) to obtain adequate information on concentrations of benzene and carbon monoxide in ambient air and ensure that it is made available to the public; and (d) to maintain ambient air quality where it is good and improve it in other cases with respect to benzene and carbon monoxide. Annex II Limit value for Carbon Monoxide: Averaging period: Maximum daily 8 hour mean Limit value: 10 mg/m^3.

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS
			Date of limit enforcement: January 2005. Detailed descriptions of the measurement and assessment of concentrations of Benzene and carbon monoxide are given.
AIR POLLUTION	**88/609/EEC**	OJ L336/1 (OJ L357/83)	**Council Directive 88/609/EEC of 24 November 1988 on the limitation of emissions of certain pollutants into the air from large combustion plants.** Has been repealed by **Directive 2001/80/EC of the European Parliament and of the Council of 23 October 2001 on the limitation of emissions of certain pollutants into the air from large combustion plants.**
AIR POLLUTION	**01/80/EC**	**OJ L 309 of 27.11.2001** (O. J. L 319 , 23/11/2002)	**Directive 2001/80/EC of the European Parliament and of the Council of 23 October 2001 on the limitation of emissions of certain pollutants into the air from large combustion plants** (+ *Corrigendum)* • This Directive shall apply to combustion plants, the rated thermal input of which is equal to or greater than 50 MW, irrespective of the type of fuel used (solid, liquid or gaseous). In Annex 1 reduction targets and emission ceilings are tabulated and described for each individual European country:

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS

CEILINGS AND REDUCTION TARGETS FOR EMISSIONS OF SO_2 FROM EXISTING PLANTS (1) (2)

Member State	0	1	2	3	4	5	6	7	8	9
	SO_2 emissions by large combustion plants 1980 ktonnes	Emission ceiling (ktonnes/year)			% reduction over 1980 emissions			% reduction over adjusted 1980 emissions		
		Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3
		1993	1998	2003	1993	1998	2003	1993	1998	2003
Belgium	530	318	212	159	− 40	− 60	− 70	− 40	− 60	− 70
Denmark	323	213	141	106	− 34	− 56	− 67	− 40	− 60	− 70
Germany	2 225	1 335	890	668	− 40	− 60	− 70	− 40	− 60	− 70
Greece	303	320	320	320	+ 6	+ 6	+ 6	− 45	− 45	− 45
Spain	2 290	2 290	1 730	1 440	0	− 24	− 37	− 21	− 40	− 50
France	1 910	1 146	764	573	− 40	− 60	− 70	− 40	− 60	− 70
Ireland	99	124	124	124	+ 25	+ 25	+ 25	− 29	− 29	− 29
Italy	2 450	1 800	1 500	900	− 27	− 39	− 63	− 40	− 50	− 70
Luxembourg	3	1,8	1,5	1,5	− 40	− 50	− 60	− 40	− 50	− 50
Netherlands	299	180	120	90	− 40	− 60	− 70	− 40	− 60	− 70
Portugal	115	232	270	206	+ 102	+ 135	+ 79	− 25	− 13	− 34
United Kingdom	3 883	3 106	2 330	1 553	− 20	− 40	− 60	− 20	− 40	− 60
Austria	90	54	36	27	− 40	− 60	− 70	− 40	− 60	− 70
Finland	171	102	68	51	− 40	− 60	− 70	− 40	− 60	− 70
Sweden	112	67	45	34	− 40	− 60	− 70	− 40	− 60	− 70

Annex II:

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS

CEILINGS AND REDUCTION TARGETS FOR EMISSIONS OF NO_x FROM EXISTING PLANTS (1) (2)

Member State	0	1	2	3	4	5	6
	NO_x emissions (as NO_2) by large combustion plants 1980 ktonnes	NO_x emission ceilings (ktonnes/year)		% reduction over 1980 emissions		% reduction over adjusted 1980 emissions	
		Phase 1	Phase 2	Phase 1	Phase 2	Phase 1	Phase 2
		1993 (1)	1998	1993 (1)	1998	1993 (1)	1998
Belgium	110	88	66	− 20	− 40	− 20	− 40
Denmark	124	121	81	− 3	− 35	− 10	− 40
Germany	870	696	522	− 20	− 40	− 20	− 40
Greece	36	70	70	+ 94	+ 94	0	0
Spain	366	368	277	+ 1	− 24	− 20	− 40
France	400	320	240	− 20	− 40	− 20	− 40
Ireland	28	50	50	+ 79	+ 79	0	0
Italy	580	570	428	− 2	− 26	− 20	− 40
Luxembourg	3	2,4	1,8	− 20	− 40	− 20	− 40
Netherlands	122	98	73	− 20	− 40	− 20	− 40
Portugal	23	59	64	+ 157	+ 178	− 8	0
United Kingdom	1 016	864	711	− 15	− 30	− 15	− 30
Austria	19	15	11	− 20	− 40	− 20	− 40
Finland	81	65	48	− 20	− 40	− 20	− 40
Sweden	31	25	19	− 20	− 40	− 20	− 40

(1) Member States may for technical reasons delay for up to two years the phase 1 date for reduction in NO_x emissions by notifying the Commission within one month of the notification of this Directive.

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS
			B. SO_2 emission limit values expressed in mg/Nm^3 (O_2 content 6 %) to be applied by new plants pursuant to Article 4(2) with the exception of gas turbines.

Type of fuel	50 to 100 MWth	100 to 300 MWth	> 300 MWth
Biomass	200	200	200
General case	850	200 (1)	200

(1) Except in the case of the 'Outermost Regions' where 850 to 200 mg/Nm^3 (linear decrease) shall apply.

NB. Where the emission limit values above cannot be met due to the characteristics of the fuel, installations shall achieve 300 mg/Nm^3 SO_2, or a rate of desulphurisation of at least 92 % shall be achieved in the case of plants with a rated thermal input of less than or equal to 300 MWth and in the case of plants with a rated thermal input greater than 300 MWth a rate of desulphurisation of at least 95 % together with a maximum permissible emission limit value of 400 mg/Nm^3 shall apply.

B. SO_2 emission limit values expressed in mg/Nm^3 (O_2 content 3 %) to be applied by new plants pursuant to Article 4(2) with the exception of gas turbines

50 to 100 MWth	100 to 300 MWth	> 300 MWth
850	400 to 200 (linear decrease) (1)	200

(1) Except in the case of the 'Outermost Regions' where 850 to 200 mg/Nm^3 (linear decrease) shall apply.

In the case of two installations with a rated thermal input of 250 MWth on Crete and Rhodos to be licensed before 31 December 2007 the emission limit value of 1 700 mg/Nm^3 shall apply.

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS
			EMISSION LIMIT VALUES FOR SO_2 **Gaseous fuels** A. SO_2 emission limit values expressed in mg/Nm^3 (O_2 content 3 %) to be applied by new and existing plants pursuant to Article 4(1) and 4(3), respectively:

Type of fuel	Limit values (mg/Nm^3)
Gaseous fuels in general	35
Liquefied gas	5
Low calorific gases from gasification of refinery residues, coke oven gas, blast-furnace gas	800
Gas from gasification of coal	([1])

([1]) The Council will fix the emission limit values applicable to such gas at a later stage on the basis of proposals from the Commission to be made in the light of further technical experience.

B. SO_2 emission limit values expressed in mg/Nm^3 (O_2 content 3 %) to be applied by new plants pursuant to Article 4(2):

Gaseous fuels in general	35
Liquefied gas	5
Low calorific gases from coke oven	400
Low caloric gases from blast furnace	200

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS

EMISSION LIMIT VALUES FOR NO_X (MEASURED AS NO_2)

A. NO_x emission limit values expressed in mg/Nm^3 (O_2 content 6 % for solid fuels, 3 % for liquid and gaseous fuels) to be applied by new and existing plants pursuant to Article 4(1) and 4(3), respectively:

Type of fuel:	Limit values (1) (mg/Nm^3)
Solid (2), (3):	
50 to 500 MWth:	600
>500 MWth:	500
From 1 January 2016	
50 to 500 MWth:	600
>500 MWth:	200
Liquid:	
50 to 500 MWth:	450
>500 MWth:	400
Gaseous:	
50 to 500 MWth:	300
>500 MWth:	200

(1) Except in the case of the 'Outermost Regions' where the following values shall apply:
Solid in general: 650
Solid with < 10 % vol comps: 1 300
Liquid: 450
Gaseous: 350

(2) Until 31 December 2015 plants of a rated thermal input greater than 500 MW, which from 2008 onwards do not operate more than 2 000 hours a year (rolling average over a period of five years), shall:
— in the case of plant licensed in accordance with Article 4(3)(a), be subject to a limit value for nitrogen oxide emissions (measured as NO_2) of 600 mg/Nm^3;
— In the case of plant subject to a national plan under Article 4(6), have their contribution to the national plan assessed on the basis of a limit value of 600 mg/Nm_3.

From 1 January 2016 such plants, which do not operate more than 1 500 hours a year (rolling average over a period of five years), shall be subject to a limit value for nitrogen oxide emissions (measured as NO_2) of 450 mg/Nm^3.

(3) Until 1 January 2018 in the case of plants that in the 12 month period ending on 1 January 2001 operated on, and continue to operate on, solid fuels whose volatile content is less than 10 %, 1 200 mg/Nm^3 shall apply.

Annex VII:

<table>
<tr><th>CATEGORY</th><th>DIRECTIVE REF.</th><th>OFFICIAL JOURNAL REF.</th><th>DIRECTIVE DETAILS</th></tr>
<tr><td></td><td></td><td></td><td>
Dust emissions:

B. Dust emission limit values expressed in mg/Nm³ to be applied by new plants, pursuant to Article 4(2) with the exception of gas turbines:

Solid fuels (O₂ content 6 %)
<table>
<tr><th>50 to 100 MWth</th><th>> 100 MWth</th></tr>
<tr><td>50</td><td>30</td></tr>
</table>
Liquid fuels (O₂ content 3 %)
<table>
<tr><th>50 to 100 MWth</th><th>> 100 MWth</th></tr>
<tr><td>50</td><td>30</td></tr>
</table>
In the case of two installations with a rated thermal input of 250 MWth on Crete and Rhodos to be licensed before 31 December 2007 the emission limit value of 50 mg/Nm³ shall apply.

Gaseous fuels (O₂ content 3 %)
<table>
<tr><td>As a rule</td><td>5</td></tr>
<tr><td>For blast furnace gas</td><td>10</td></tr>
<tr><td>For gases produced by the steel industry which can be used elsewhere</td><td>30</td></tr>
</table>
</td></tr>
<tr><td>AIR POLLUTION</td><td>99/30/EC</td><td>OJ L163 29 June 1999</td><td>
Council Directive 99/30/EC of 22 April 1999 relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air

The objectives of this Directive shall be to:

- establish limit values and, as appropriate, alert thresholds for concentrations of sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air intended to avoid, prevent or reduce harmful effects on human health and the environment as a whole;

- assess concentrations of sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and
</td></tr>
</table>

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS
			lead in ambient air on the basis of common methods and criteria; - obtain adequate information on concentrations of sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air and ensure that it is made available to the public; and - maintain ambient-air quality where it is good and improve it in other cases with respect to sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead. **Sulphur dioxide** Member States shall take the measures necessary to ensure that concentrations of sulphur dioxide in ambient air, as assessed in accordance with Article 7, do not exceed the limit values laid down in Section I of Annex I from the dates specified therein. Limit values for Sulphur dioxide: Limit values must be expressed in µg/m3. The volume must be standardised at a temperature of 293 °K and a pressure of 101,3 kPa.

	Averaging period	Limit value	Due date by which limit value is to be met
Hourly Limit value for the protection of human health	1 hour	350 µg/m³ not to be exceeded more than 24 times a calendar year	1 Jan 2005
Daily limit value for the protection of human health	24 hours	125 µg/m³ not to be exceeded more than 3 times a calendar year	1 Jan 2005
Limit value for the protection of ecosystems	Calendar year and winter (1 oct to 31 March)	20 µg/m³	19 July 2001

Alert threshold for sulphur dioxide: 500 µg/m³ measured over three consecutive hours at locations representative of air quality over at least 100 Km² or an entire zone or agglomeration, whichever is the smaller.

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS
			Nitrogen dioxide and oxides of nitrogen 1. Member States shall take the measures necessary to ensure that concentrations of nitrogen dioxide and, where applicable, of oxides of nitrogen, in ambient air, as assessed in accordance with Article 7, do not exceed the limit values laid down in Section I of Annex II as from the dates specified therein. Limit values for nitrogen dioxide and oxides of nitrogen Limit values must be expressed in µg/m3. The volume must be standardised at a temperature of 293 °K and a pressure of 101,3 kPa.

	Averaging period	Limit value	Margin of tolerance	Due date by which limit value is to be met
Hourly Limit value for the protection of human health	1 hour	200 µg/m³ NO2 not to be exceeded more than 18 times a calendar year	50% on the entry into force of this Directive, reducing on 1 Jan 2001 and every 12 months thereafter by equal annual percentages to reach 0% by 1 Jan 2010.	1 Jan 2010
Annual limit value for the protection of human health	Calendar year	40 µg/m³ NO2	50% on the entry into force of this Directive, reducing on 1 Jan 2001 and every 12 months thereafter by equal annual percentages to reach 0% by 1 Jan 2010.	1 Jan 2010
Annual value for the protection of vegetation	Calendar year	30 µg/m³ NO2	None	19 July 2001

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS
			Alert threshold for nitrogen dioxide: 400 µg/m³ measured over three consecutive hours at locations representative of air quality over at least 100 km² or an entire zone or agglomeration whichever is the smaller.

Particulate matter (PM10)

	Averaging period	Limit value	Margin of tolerance	Due date by which limit value is to be met
Stage 1				
24 hour Limit value for the protection of human health	24 hour	50 µg/m³ PM10 not to be exceeded more than 35 times a calendar year	50% on the entry into force of this Directive, reducing on 1 Jan 2001 and every 12 months thereafter by equal annual percentages to reach 0% by 1 Jan 2005.	1 Jan 2005
Annual limit value for the protection of human health	Calendar year	40 µg/m³ PM10	20% on the entry into force of this Directive, reducing on 1 Jan 2001 and every 12 months thereafter by equal annual percentages to reach 0% by 1 Jan 2005	1 Jan 2005
Stage 2				
24 hour limit value for the protection of vegetation	24 hours	50 µg/m³ PM10 not to be exceeded more than 7 times a calendar year	To be derived from data and to be equivalent to the Stage 1 limit value	1 Jan 2010
Annual value for the protection of human health	Calendar year	20 µg/m³ PM10	50% on 1 Jan 2005 reducing every 12 months thereafter by	1 Jan 2010

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS

			equal annual percentages to reach 0% by 1 Jan 2010.	

Determination of requirements for assessment of concentrations of sulphur dioxide, nitrogen dioxide (NO2) and oxides of nitrogen (NOx), particulate mater (PM10) within a zone or agglomeration

Upper and lower assessment thresholds

Sulphur Dioxide

	Health protection	Ecosystem protection
Upper assessment threshold	60% of 24 hour limit value (75 µg/m³, not to be exceeded more than 3 times in any calendar year)	60% pf winter limit value (12 µg/m³)
Lower assessment threshold	40% of 24 hour limit value (50 µg/m³, not to be exceeded more than 3 times in any calendar year)	40% pf winter limit value (8 µg/m³)

Nitrogen dioxide and oxides of Nitrogen

	Hourly limit value for the protection of human health (NO2)	Annual Limit Value for the protection of human health (NO2)	Annual limit value for the protection of vegetation (NOx)
Upper assessment threshold	70% of limit value (140 µg/m³, not to be exceeded more than 18 times in any calendar year)	80% of limit value (32 µg/m³)	80% of limit value (24 µg/m³)
Lower assessment threshold	50% of limit value (100 µg/m³, not to be exceeded more than 18 times in any calendar year)	65% of limit value (26 µg/m³)	65% of limit value (19.5 µg/m³)

Particulate matter

	24 hour average	Annual average

<table>
<tr><th>CATEGORY</th><th>DIRECTIVE REF.</th><th>OFFICIAL JOURNAL REF.</th><th>DIRECTIVE DETAILS</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><td>Upper assessment threshold</td><td>60% of limit value (30 µg/m³, not to be exceeded more than 18 times in any calendar year)</td><td>70% of limit value (14 µg/m³)</td></tr>
<tr><td>Lower assessment threshold</td><td>40% of limit value (20 µg/m³, not to be exceeded more than 18 times in any calendar year)</td><td>50% of limit value (10 µg/m³)</td></tr>
</table>
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<tr><td>AIR POLLUTION</td><td>96/62/EC</td><td>OJ L 296 , 21/11/1996</td><td>
Council Directive 96/62/EC of 27 September 1996 on ambient air quality assessment and management

To maintain and improve air quality within the Community, this Directive lays down the basic principles of a strategy for:

• establishing quality objectives for ambient air;
• drawing up common methods and criteria for assessing air quality; and
• obtain and disseminate information on air quality.

The Member States are responsible for implementing the Directive.

The European Parliament and the Council must lay down limit values and alert thresholds for the following pollutants:

• sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead;
• benzene and carbon monoxide;
• ozone; and
• polycyclic aromatic hydrocarbons (PAH), cadmium, arsenic, nickel and mercury.

Ambient air quality must be monitored throughout the territory of the Member States. Different methods may be used for this: measuring, mathematical modelling, a combination of the two, or estimates. Assessment of this type is mandatory in built-up areas with more than 250 000 inhabitants, or in areas where concentrations are close to the limit values.

If the limit values are exceeded Member States must devise a programme for attaining them within a set deadline. The programme, which must be made available to the public, must contain at least the following information:
</td></tr>
</table>

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS
			• the location where the pollution is excessive; • the nature, and an assessment, of the pollution; and • the origin of the pollution. Member States are required to draw up a list of the areas and conurbations where pollution levels exceed the limit values. Where the alert thresholds are crossed, Member States must inform the inhabitants and send the Commission any relevant information (recorded pollution level, duration of the alert, etc.). Where certain geographical areas and conurbations have pollution levels below the limit values the Member States must maintain those levels below the said values. The Directive contains provisions on the forwarding of information and on reports on pollution levels and the areas concerned.
AIR POLLUTION	**99/13/EC**	OJ L085 29 March 1999	**Council Directive 1999/13/EC of 11 March 1999 on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations** Directive on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations (+ 2 Corrigendums) Aim of this Directive: is to prevent or reduce the direct and indirect effects of emissions of volatile organic compounds into the environment, mainly into air and the potential risks to human health, by providing measures and procedures to be implemented for the activities defined in Annex I.
AIR POLLUTION	**80/779/EEC**	OJ L229 30 August 1980	**Council Directive 80/779/EEC of 15 July 1980 on air quality limit values and guide values for sulphur dioxide and suspended particulates** The purpose of this Directive is to fix limit values (Annex I) and guide values (Annex II) for sulphur dioxide and suspended particulates in the atmosphere and the conditions for their application in order to improve:

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS
			• The protection of human health; and • The protection of the environment.

ANNEX I

LIMIT VALUES FOR SULPHUR DIOXIDE AND SUSPENDED PARTICULATES

(As measured by the black-smoke method)

TABLE A

Limit values for sulphur dioxide expressed in µg/m³ with the associated values for suspended particulates (as measured by the black-smoke method (¹)) expressed in µg/m³

Reference period	Limit value for sulphur dioxide	Associated value for suspended particulates
Year	80 (median of daily mean values taken throughout the year)	> 40 (median of daily mean values taken throughout the year)
	120 (median of daily mean values taken throughout the year)	≤ 40 (median of daily mean values taken throughout the year)
Winter (1 October to 31 March)	130 (median of daily mean values taken throughout the winter)	> 60 (median of daily mean values taken throughout the winter)
	180 (median of daily mean values taken throughout the winter)	≤ 60 (median of daily mean values taken throughout the winter)
Year (made up of units of measuring periods of 24 hours)	250 (²) (98 percentile of all daily mean values taken throughout the year)	> 150 (98 percentile of all daily mean values taken throughout the year)
	350 (²) (98 percentile of all daily mean values taken throughout the year)	≤ 150 (98 percentile of all daily mean values taken throughout the year)

(¹) The results of the measurements of black smoke taken by the OECD method have been converted into gravimetric units as described by the OECD (see Annex III).

(²) Member States must take all appropriate steps to ensure that this value is not exceeded for more than three consecutive days. Moreover, Member States must endeavour to prevent and to reduce any such instances in which this value has been exceeded.

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS
			TABLE B **Limit values for suspended particulates (as measured by the black-smoke method [1]) expressed in µ g/m³**

Reference period	Limit value for suspended particulates
Year	80 (median of daily mean values taken throughout the year)
Winter (1 October to 31 March)	130 (median of daily mean values taken throughout the winter)
Year (made up of units of measuring periods of 24 hours)	250 [2] (98 percentile of all daily mean values taken throughout the year)

[1] The results of the measurements of black smoke taken by the OECD method have been converted into gravimetric units as described by the OECD (see Annex III).

[2] Member States must take all appropriate steps to ensure that this value is not exceeded for more than three consecutive days. Moreover, Member States must endeavour to prevent and to reduce any such instances in which this value has been exceeded.

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS
			ANNEX II GUIDE VALUES FOR SULPHUR DIOXIDE AND SUSPENDED PARTICULATES (as measured by the black-smoke method) TABLE A (Guide values for sulphur dioxide expressed in µg/m³ Reference period: Year — Guide value for sulphur dioxide: 40 to 60 (arithmetic mean of daily mean values taken throughout the year) Reference period: 24 hours — Guide value for sulphur dioxide: 100 to 150 (daily mean value) TABLE B Guide values for suspended particulates (as measured by the black-smoke method (¹)) expressed in µg/m³ Reference period: Year — Guide value for suspended particulates: 40 to 60 (arithmetic mean of daily mean values taken throughout the year) Reference period: 24 hours — Guide value for suspended particulates: 100 to 150 (daily mean value) (¹) The results of the measurements of black smoke taken by the OECD method have been converted into gravimetric units as described by the OECD (see Annex III).
AIR POLLUTION	**85/203/EEC**	OJ L87 27 March 1985	**Council Directive 85/203/EEC of 7 March 1985 on air quality standards for nitrogen dioxide** On 19 July 2001, the Directive was partly repealed by Directive 1999/30/EC relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air. It

TABLE A

Reference period	Guide value for sulphur dioxide
Year	40 to 60 (arithmetic mean of daily mean values taken throughout the year)
24 hours	100 to 150 (daily mean value)

TABLE B

Reference period	Guide value for suspended particulates
Year	40 to 60 (arithmetic mean of daily mean values taken throughout the year)
24 hours	100 to 150 (daily mean value)

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS
			will be fully repealed in 2010. The Directive specifies, for the concentration of nitrogen dioxide in the atmosphere: • a limit value which may not be exceeded throughout the Member States during specified periods; and • guide values, designed to improve the protection of human health and of the environment. It also introduces a reference method for analysing concentrations of nitrogen dioxide and specifications for the measuring stations established by the Member States. The limit value had to be complied with as of 1 July 1987, though Member States were allowed temporary exemptions provided they forwarded to the Commission plans for the gradual improvement of air quality. Member States may fix values more stringent than those laid down in the Directive. There is a procedure for adapting the Directive to scientific and technical progress. The Commission must publish regular reports on implementation of the Directive. The limit value for Nitrogen dioxide for a reference period of one year is 200 µg/m³. The guide values for nitrogen dioxide for a reference period of one year is 50 µg/m³ (50^{th} percentile calculated from the mean values per hour or per period of less than an hour recorded throughout the year) and 135 µg/m³ (98^{th} percentile calculated from the mean values per hour or per period of less than an hour recorded throughout the year). Monitoring guidelines detailed in the Directive.
AIR POLLUTION	**84/360/EEC**	OJ L188 16 July 1984	**Council Directive 84/360/EEC of 28 June 1984 on the combating of air pollution from industrial plants** The purpose of the Directive is to provide for further measures and procedures designed to prevent or reduce air pollution from industrial plants within the Community, particularly those belonging to the categories set out in Annex I.

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS
			(Annex I: 'Chemical industry: Chemical plants for the manufacture of other organic intermediate products' and 'plants for the manufacture of basic inorganic chemicals') Article 4: Without prejudice to the requirements laid down by national and Community provisions with a purpose other than that of this Directive, an authorisation may be issued only when the competent authority is satisfied that: 2) the use of plant will not cause significant air pollution particularly from the emission of substances referred to in Annex II; 3) none of the emission limit values applicable will be exceeded; and 4) all the air quality limit values applicable will be taken into account. Annex II: List of most important polluting substances: Sulphur dioxide and other sulphur compounds Oxides of nitrogen and other nitrogen compounds Carbon monoxide Organic compounds, in particular hydrocarbons (except methane) Heavy metals and their compounds Dust; asbestos (suspended particulates and fibres), glass and mineral fibres Chlorine and its compounds Fluorine and its compounds.
WASTE MANAGE-MENT	**75/439/EEC**	OJ L194 25 July 1975	**Council Directive 75/439/EEC of 16 June 1975 on the disposal of waste oils**

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS
		OJ L 042 , 12/02/1987	Council Directive 87/101/EEC of 22 December 1986 **amending Directive** 75/439/EEC on the disposal of waste oils "waste oils" is defined as: any mineral-based lubrication or industrial oils which have become unfit for the use for which they were originally intended, and in particular used combustion engine oils and gearbox oils, and also mineral lubricating oils, oils for turbines and hydraulic oils.
WASTE MANAGE-MENT	**75/442/EEC**	OJ L 194 , 25/07/1975	**Council Directive 75/442/EEC of 15 July 1975 on waste**
		OJ L 078 , 26/03/1991	Council Directive 91/156/EEC of 18 March 1991 **amending Directive 75/442/EEC on waste** This Directive refers to any kind of waste to be disposed of but excludeswaste waters, with the exception of waste in liquid form. Member states should take the necessary measures to ensure that waste is recovered or disposed of without endangering human health and without using processes or methods which could harm the environment and in particular: • Without risk to water, air soil and plants and animals; • Without causing a nuisance through noise or odours; and • Without adversely affecting the countryside or places of special interest. More specific legislation on waste disposal may be stipulated in individual Directives.

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS
WASTE MANAGEMENT	**91/689/EEC**	OJ L377 31 December 1991	**Council Directive 91/689/EEC of 12 December 1991 on hazardous waste** The aim of the Directive, drawn up pursuant to Article 2 (2) of Directive 75/442/EEC is to approximate the laws of the Member States on the controlled management of hazardous waste. Hazardous waste means: wastes featuring on the list to be drawn up on accordance with the procedure laid down in Article 18 of Directive 75/442/EEC on the basis of Annexes I and II.
		OJ L168 2 July 1994	Council Directive 94/31/EC of 27 June 1994 **amending Directive 91/689/EEC** on hazardous waste
HARZARDOUS SUBSTANCES	**76/769/EC**	OJ L262 27 September 1976	**Council Directive 76/769/EEC of 27 July 1976 on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations** The substances included in the list of certain dangerous substances and preparations are: • Polychlorinated biphenyls (PCB) except mono and dichlorinated biphenyls; • Polychlorinated terphenyls (PCT); • Preparations with a PCB or PCT content higher than 0.1% by weight; and • Chloro-1-ethylene (monomer vinyl chloride).
		OJ L 350 , 10/12/1982	Council Directive 82/828/EEC of 3 December 1982 **amending, for the third time** (PCT), Directive 76/769/EEC on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations
		OJ L 269 , 11/10/1985	Council Directive 85/467/EEC of 1 October 1985 **amending for the sixth time** (PCBs/PCTs) Directive 76/769/EEC on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS
		OJ L85 5 April 1991	Council Directive 91/173/EEC of 21 March 1991 **amending for the ninth time** Directive 76/769/EEC on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations Ninth amendment (PCP)
		OJ L186 12 July 1991	Council Directive 91/338/EEC of 18 June 1991 **amending for the 10th time** Directive 76/769/EEC on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations
		OJ L 253 , 10/09/1991	**CORRIGENDUM TO:** Council Directive 91/338/EEC of 18 June 1991 amending for the 10th time Directive 76/769/EEC on the approximation of the laws, Regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations
		OJ L186 12 July 1991	Council Directive 91/339/EEC of 18 June 1991 **amending for the 11th time** Directive 76/769/EEC on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations (+ I Corrigendum)
		OJ L116 6 May 1997	Directive 97/16/EC of the European Parliament and of the Council of 10 April **1997 amending for the 15th** time Directive 76/769/EEC on restrictions on the marketing and use of certain dangerous substances and preparations fifteenth amendment (hexachloroethane).
CONTROLLING POLLUTION SUBSTANCES AND PROCESSES	**96/61/EC**	OJ L 257 , 10/10/1996	**Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control (**IPPC) (+ 4 Corrigendums) Purpose: to achieve integrated prevention and control of pollution arising from the activities listed in Annex 1. It lays down measures designed to prevent or, where that is not practicable, to reduce emissions in the air, water and land from the abovementioned activities, including measures concerning waste, in order to achieve a high level of protection of the environment taken as a whole, without prejudice to Directive 85/337/EEC and other relevant Community provisions. Annex 1: 4. Chemical industry

CATEGORY	DIRECTIVE REF.	OFFICIAL JOURNAL REF.	DIRECTIVE DETAILS
			Production within the meaning of the categories of activities contained in this section means the production on an industrial scale by chemical processing of substances or groups of substances listed in Sections 4.1 to 4.6. 4.1 Chemical installations for the production of basic organic chemicals such as: ▪ Nitrate compounds (among others) 4.2 Chemical installations for the production of basic inorganic chemicals such as: ▪ Gases such as (among others) carbon oxides, sulphur compounds, nitrogen oxides, hydrogen, sulphur dioxide

APPENDIX VIII – AIR DISPERSION MODEL

AIR DISPERSION MODEL

DRAFT REPORT

KE60029 JUNE 2006

when experience counts

Introduction

This document presents a prediction of expected pollutant concentration (NOx and Particulate Matter) around the proposed EMethanex methanol facility. This facility is currently under construction inside Damietta Port, on the Egyptian Mediterranean Coast.
Air dispersion models consider future emission conditions under representative climatic and topographic conditions in the study area. This information can be used to estimate the contribution of the future emissions to the air quality in the area. The data used to feed the model includes:

- emission rates and conditions;
- a complete series of hourly annual meteorological data (2003); and
- topographic character of the area.

Background and objectives

The main objective of this study is to predict the future pollutant concentration levels emitted by the new plant and to compare these with current Egyptian and International standards. The scope of the study includes the analysis of the air quality levels on the existing environment in the area surrounding the plant.
With the information on emission sources, facility layout and meteorological data (mostly provided by EMethanex), WorleyParsons Komex has accomplished the prediction of future concentration levels using the BREEZE AERMOD software tool, an industry standard. The emission design basis set for the project, assumes two operating methanol trains.

Regulations

The following legislation has been considered for the model creation and graphic representation of the predicted noise as well as for comparison of the obtained results with the established legal limits.

Egyptian legislation

Law No. 4, passed in 1994, is the main Environmental Law in Egypt concerning the environment. This law established the Egyptian Environmental Affairs Agency (EEAA). The Executive Statutes of this law were set out in 1995. The EEAA has the power to set criteria and conditions, monitor compliance and to take procedures against violators of these criteria and conditions. The EEAA must be notified of any expansions or renewals to the existing facility or any work, which might result in an adverse impact on the environment.
The table below includes the air quality standards established for the pollutants included in the scope of the present study.

Table 01 Egyptian Air quality standards (Law 4/1994)

Parameter	1 hour period (μg/m^3)	24 hour period (μg/m^3)	Annual (μg/m^3)
NO_x (measured as NO_2)	400	150	-
SO_2	350	150	60
PM10	-	150	70
CO	30,000		

International standards or regulations

World Bank Group

Air quality standards included in Table 8 are a recommendation of the World Bank and the IFC extracted form the *Pollution Prevention and Abatement Handbook (PPAH) (World Bank Group, July 1998).*

Table 2: World Bank Ambient Air Conditions at Property Boundary, for General Application (World Bank General Environmental Guidelines, PPAH)

Parameter	Maximum concentration (µg/m³)
Particulate Matter	
Annual arithmetic mean	50
Maximum 24h	70
Nitrogen oxides	
Maximum 24 hours	150
Sulphur dioxide	
Annual arithmetic mean	50
Maximum 24 hours	125

European Union

In the EU air quality levels are regulated by the *COUNCIL DIRECTIVE 1999/30/EC of 22 April 1999 relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air*: Table 03 shows the standards for each parameter in the scope of the present study.

Table 03: EU Standards for air quality (Directive 1999/30/EC)

Parameter	1 hour period (µg/m³)	8 hour period (µg/m³)	24 hour period (µg/m³)	Annual (µg/m³)
NO_x (measured as NO_2)	200		-	40
SO_2	350		125	20
PM10	-		50	40

METHODOLOGY

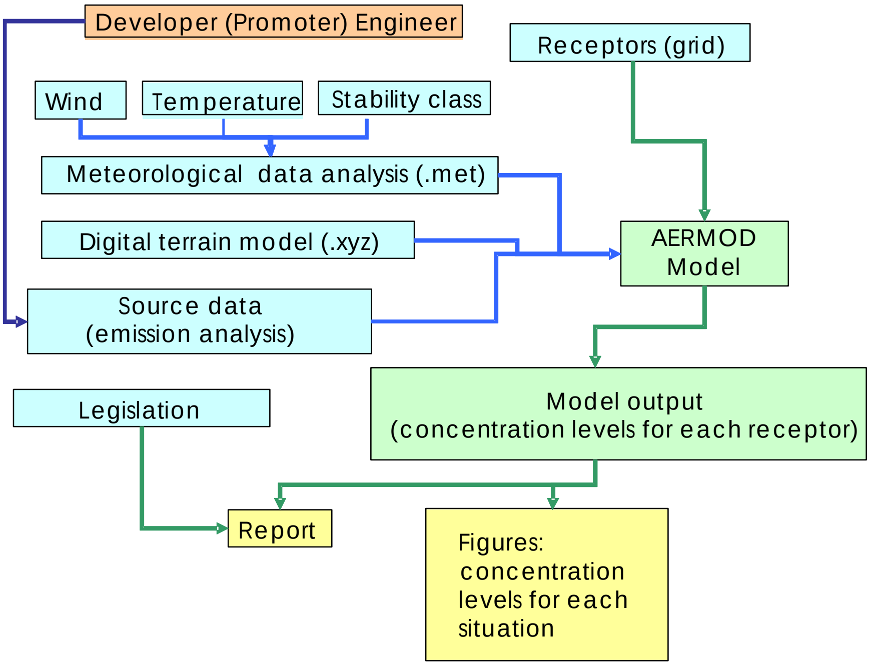
WorleyParsons Komex suggests the use of AERMOD as the recommended software to calculate pollutant concentration levels and corresponding concentration maps (included in the annexes of the present study). These maps are the graphic result of a combination of the atmospheric data, the source data and the topographical information of the area.

Firstly, the topography of the area of study was considered. This allows the identification of the effects that the morphology may have on the dispersion of pollutants. Further, the grid receptors within the model can be adjusted according to the topographical conditions. The receptor grid is located at 1.5 m above ground level.

The model can calculate, for each hour of the year and for each receptor of the grid, the concentration level for the pollutant considered. The maximum values are calculated for each receptor (or average values, depending on the environmental specifications) and isopleths or isolines are drawn.

Figure 0-1 shows the methodology followed to generate the air dispersion model of the EMethanex facility.

Figure 0-1 Methodology



MODEL INPUTS

In order to run AERMOD, the following initial data was provided by the client:

- Facility general layout
- Units layout
- Emission inventory data (Table 4).
  As mentioned in section 3, the model considers pollutant concentration on an hourly basis, using the Gaussian equation. This produces a prediction of the plume dispersion.
  The general layout provides the location of the sources outside the process units and the emission inventory provides the required data for each of the sources considered (as shown in Table 4).
  Table 4 provides all the required information to describe the sources and to feed the model: source UTM coordinates; flow rate (g/s) calculated with the flow gas and pollutant concentrations; speed (m/s); inside stack diameter (m); total height (m) of the stack; and temperature (K).
- Meteorological data

  Meteorological data were chosen from the closest meteorological station to the facility. The data included both surface and upper atmosphere data (Port Said 31.27N 32.3E). Meteorological data gathered from stations closer to the facility could not be used as they did not provide data pertaining to the large number of parameters required buy the model. Having analysed the digital terrain model, the area of study was found to be flat and therefore no topography has been considered.

Table 4 Emission and source data (normal situation)

Source	Description	UTM X	UTM Y	Flow rate (g/s) NO_x	CO	SO_2	PM	Speed (m/s)	Diameter (m)	Height (m)	Temp (K)
1H-0301 A	Reformer Flue Gas to Atmosphere	383554.89	3478392.63	14	2	-	5.9	9.413	3.24	30	413
1H-0301 B	Reformer Flue Gas to Atmosphere	383236.17	3478589.65	14	2	-	5.9	9.413	3.24	30	413
1-FL-5701 A	Flare	383483.96	3478392.29	0.02	-	-	-	0.004	1.4	50	473
1-FL-5701 B	Flare	383544.97	3478330.61	0.02	-	-	-	0.004	1.4	50	473
IH-3021 A	Package Boiler Flue Gas	383106.84	3478372.00	5.3	0.5	-	1.92	32.185	1	20	413
IH-3021 B	Package Boiler Flue Gas	383138.49	3478340.00	5.3	0.5	-	1.92	32.185	1	20	413

As shown in the table above, CO emissions are very low compared with PM and NO_x and the legislative standards for these parameters are tolerant (10,000µg/m^3 in 1h period in the EU for CO and 200µg/m^3 in 1h period in the EU for NO_x). As a result, CO is not analysed in the results as it is not considered a critical pollutant.

Low NO_x burners have been considered in the DPT reformer design.

CONDITIONS MODELED

Two different situations have been considered:

Situation 1

This situation has been considered as it refers to the actual design conditions of the plant. Pollutants considered under Situation 1 are NO_x and PM (under 'normal situation'). Other pollutants have not been considered due to the low emission rates calculated.

Sources considered under this situation are:

NO_x: 1H-0301 A/B, 1-FL-5701 A/B and IH-3021 A/B; and
PM: 1H-0301 A/B and IH-3021 A/B.

Situation 2

After analysing the results form Situation 1, some preventive measures were introduced as indicated below.

For Situation 2 a few changes were made in order to reduce the pollutant concentrations registered in Situation 1. For example, for sources 1H-0301 A/B and IH-3021 A/B the heights have been increased up to 40 m and 30 m respectively.

Sources considered under this situation:

NO_x: 1H-0301 A/B (40 m), 1-FL-5701 A/B and IH-3021 A/B (30 m).
PM: 1H-0301 A/B (40 m) and IH-3021 A/B (30 m).

MODELING RESULTS

As shown in Table 5 and PM results
As for the NOx results, maximum concentrations of PM are registered in the south corner of the plant, outside of the facility boundary. Situation 1 and Situation 2 register concentration levels below the regulatory standards. Situation 2 is approximately 50% below the 24 h averaging EU standard (the most restrictive).

Table 0-6, all results comply with the current Egyptian and international standards.
Figures showing the results for each situation and each pollutant are included in the annexes. For both situations the following results were obtained for each pollutant:

- One hour results: show the highest concentration of each pollutant measured over an hourly period (in a total of 8 760 hours), for each receptor.
- Twenty-four hour result: shows the highest pollutant concentration measured on a twenty-four hour average, for each receptor.
- Annual results: shows the highest annual average concentration for each receptor.

NO_x results
The model shows maximum concentrations are registered on the southern side of the EMethanex facilities, outside the site boundaries. For both situations considered, concentration levels are below the most restrictive standards (*EU Directive 1999/30/EC*). Situation 2 shows the lowest concentration levels, as shown in Table 5.
For the NO_2 results an estimation has been made which supposes that the 60% of the NO_x is NO_2. Taking this into consideration, the highest concentration levels obtained from the AERMOD for Situation 1 are approximately 50% below the most restrictive standard (EU Directive).
These results should be added to the background air quality to predict future situations.

Table 5 NO_x concentration results and reference standards

	Maximum concentration (µg/m^3)		
	1 hour	24 hour	Annual
Situation 1, NO_X	153.16	82.02	23.5
Situation 1, NO_2*	91.9	49.21	14.1
Situation 2, NO_X	119.17	62.58	16.65
Situation 2, NO_2*	71.5	37.55	9.99
Egyptian Air quality standards, Law 4/1994 (NO_x measured as NO_2)	400	150	-
World Bank General Environmental Guidelines, PPAH (NO_x)	-	150	-
EU, Directive 1999/30/EC (NO_x measured as NO_2)	200	-	40

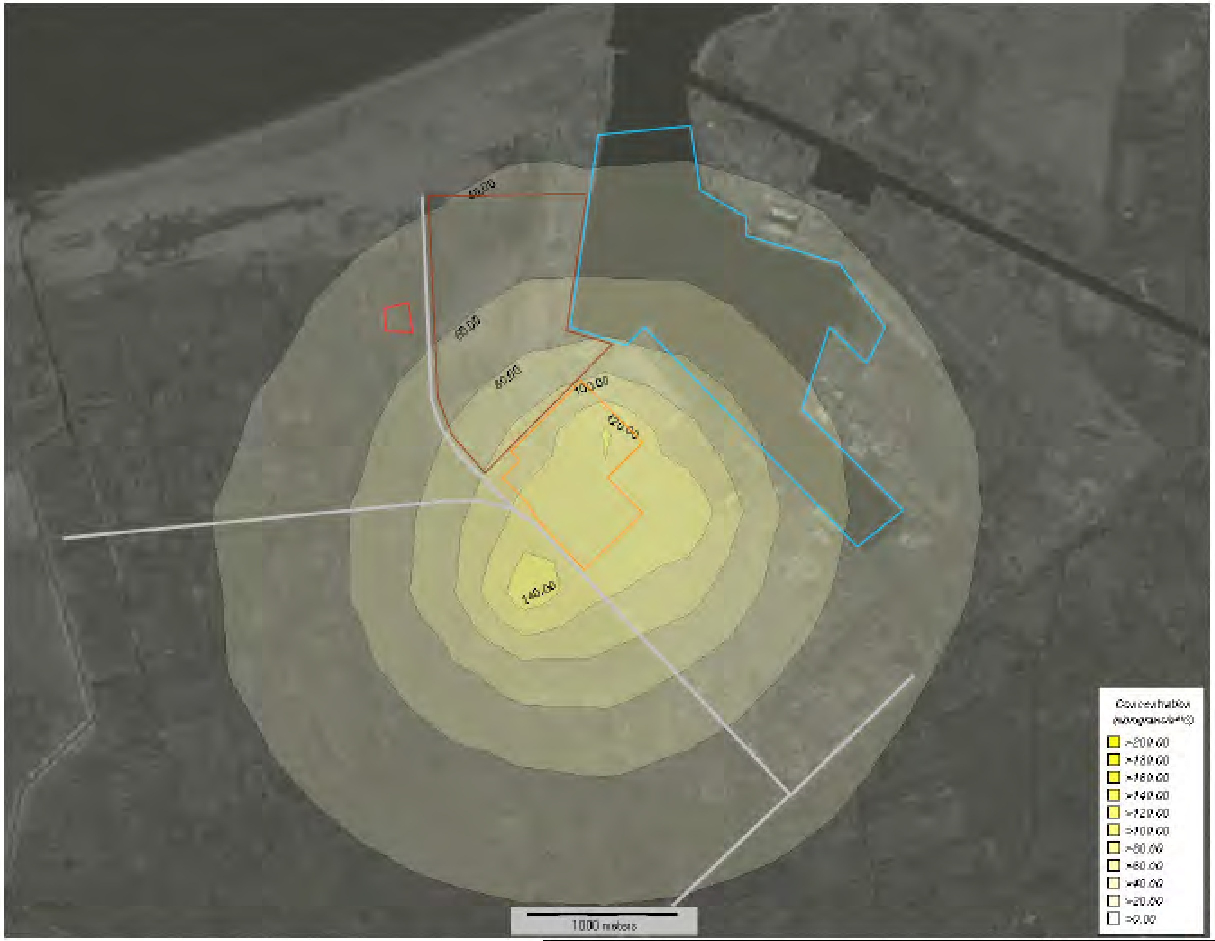
** Calculated as 60% of the NO_x concentrations*

PM results

As for the NO_x results, maximum concentrations of PM are registered in the south corner of the plant, outside of the facility boundary. Situation 1 and Situation 2 register concentration levels below the regulatory standards. Situation 2 is approximately 50% below the 24 h averaging EU standard (the most restrictive).

Table 0-6 PM concentration results and reference standards

	Maximum concentration (µg/m^3)		
	1 hour	**24 hour**	**Annual**
Situation 1, Particulate Matter	59.84	31.78	9.20
Situation 2, Particulate Matter	46.71	24.51	6.53
Egyptian Air quality standards, Law 4/1994 (PM10)	-	150	70
World Bank General Environmental Guidelines, PPAH (Particulate Matter)		70	50
EU, Directive 1999/30/EC (PM10)	-	50	40



Job No. 60029
Environmental Impact Assessment (EIA)
Air dispersion model: proposed methanol facility. Damietta, Egypt

EMETHANEX

SITUATION 1
NOX CONCENTRATION LEVELS (1h)

WorleyParsons Komex
resources & energy

DRAWN BY	STATUS	DATE	REVIEWED BY	PASSED
AMO	DRAFT	20/06/06	TOA	

Figure 1.1

Job No. 60029 **Environmental Impact Assessment (EIA)** **Air dispersion model: proposed methanol facility, Damietta, Egypt**	EMETHANEX
SITUATION 1 NOX CONCENTRATION LEVELS (24h)	WorleyParsons Komex resources & energy
DRAWN BY AMO / STATUS DRAFT / DATE 20/06/06 / REVIEWED BY TOA / PASSED	Figure 1.2

Job No. 60029
Environmental Impact Assessment (EIA)
Air dispersion model: proposed methanol facility, Damietta, Egypt

EMETHANEX
إيميثانكس

SITUATION 1
NOX CONCENTRATION LEVELS (Annual)

WorleyParsons Komex
resources & energy

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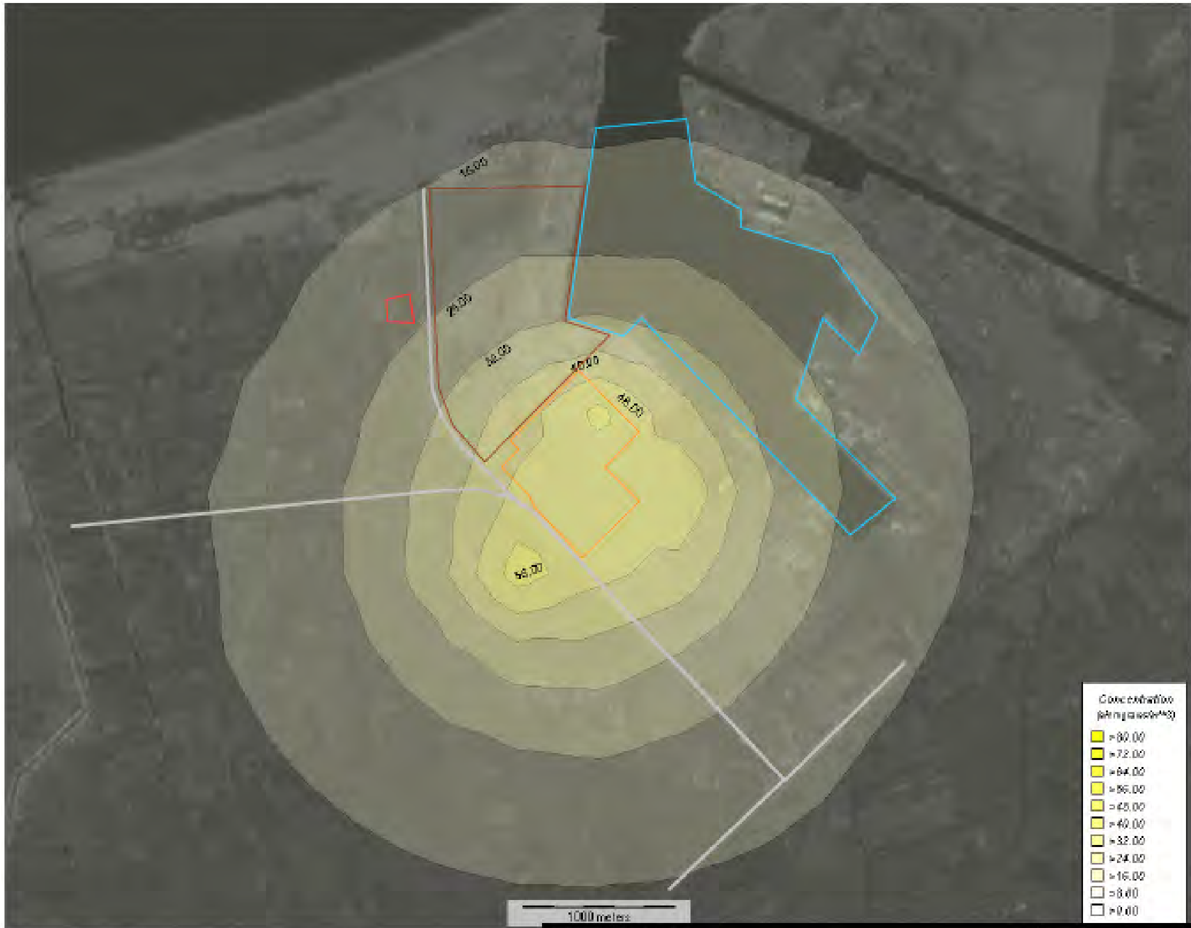
AMO	DRAFT	20/06/06	TOA	

Figure 1.3



Job No. 60029
Environmental Impact Assessment (EIA)
Air dispersion model: proposed methanol facility. Damietta, Egypt

EMETHANEX
إيميثانكس

SITUATION 1
PM CONCENTRATION LEVELS (1h)

WorleyParsons Komex
resources & energy

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Figure 1.4

Job No. 60029
Environmental Impact Assessment (EIA)
Air dispersion model: proposed methanol facility. Damietta, Egypt

EMETHANEX
إيميثانكس

SITUATION 1
PM CONCENTRATION LEVELS (24h)

WorleyParsons Komex
resources & energy

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Figure 1.5

Job No. 60029 Environmental Impact Assessment (EIA) Air dispersion model: proposed methanol facility, Damietta, Egypt	EMETHANEX إيمـيثانكس
SITUATION 1 PM CONCENTRATION LEVELS (Annual)	WorleyParsons Komex resources & energy
DRAWN BY AMO | STATUS DRAFT | DATE 20/06/06 | REVIEWED BY TOA | PASSED	Figure 1.6

Job No. 60029

Environmental Impact Assessment (EIA)

Air dispersion model: proposed methanol facility. Damietta, Egypt

EMETHANEX

إيميثانكس

SITUATION 2

NOX CONCENTRATION LEVELS (1h)

WorleyParsons Komex

resources & energy

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Figure 2.1

Job No. 60029
Environmental Impact Assessment (EIA)
Air dispersion model: proposed methanol facility. Damietta, Egypt

SITUATION 2
NOX CONCENTRATION LEVELS (24h)

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WorleyParsons Komex
resources & energy

Figure 2.2

Job No. 60029
Environmental Impact Assessment (EIA)
Air dispersion model: proposed methanol facility. Damietta, Egypt

EMETHANEX

SITUATION 2
NOX CONCENTRATION LEVELS (Annual)

WorleyParsons Komex
resources & energy

DRAWN BY	STATUS	DATE	REVIEWED BY	PASSED
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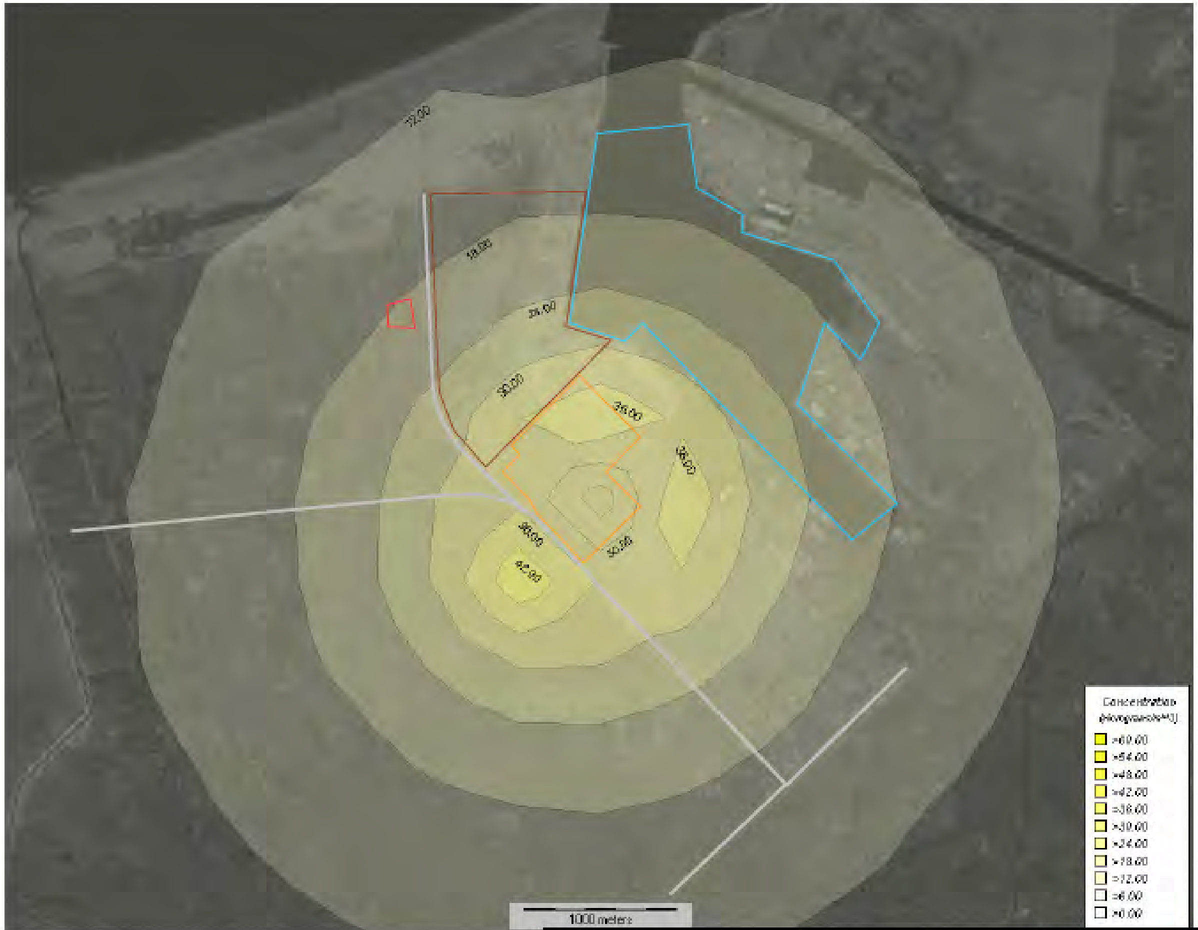
Figure 2.3



Job No. 60029 Environmental Impact Assessment (EIA) Air dispersion model: proposed methanol facility. Damietta, Egypt					EMETHANEX إيميثانكس
SITUATION 2 PM CONCENTRATION LEVELS (1h)					WorleyParsons Komex resources & energy
DRAWN BY AMO	STATUS DRAFT	DATE	REVIEWED BY TOA	PASSED	Figure 2.4

Job No. 60029
Environmental Impact Assessment (EIA)
Air dispersion model: proposed methanol facility. Damietta, Egypt

SITUATION 2
PM CONCENTRATION LEVELS (24h)

DRAWN BY	STATUS	DATE	REVIEWED BY	PASSED
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WorleyParsons Komex
resources & energy

Figure 2.5

Job No. 60029 **Environmental Impact Assessment (EIA)** **Air dispersion model: proposed methanol facility. Damietta, Egypt**	EMETHANEX إيميثانكس
SITUATION 2 PM CONCENTRATION LEVELS (Annual)	**WorleyParsons Komex** resources & energy
DRAWN BY: AMO · STATUS: DRAFT · DATE: 20/06/06 · REVIEWED BY: TOA · PASSED:	Figure 2.6

APPENDIX IX – NOISE MODEL

NOISE MODEL

KE60029

JUNE 2006

when experience counts

INTRODUCTION

This document presents a prediction of expected noise level contours around the proposed EMethanex methanol facility under construction inside Damietta Port, on the Egyptian Mediterranean Coast. The anticipated noise levels from the EMethanex facility equipment, considering existing and proposed buildings, spatial obstacles, wind data and surface characteristics have been used in developing a plant noise model. The noise model illustrates the predicted noise levels at the facility boundaries and all potentially affected area.

BACKGROUND AND OBJECTIVES

The main objective of this noise study is to predict the acoustic effects for the new working plant and its comparison with the current situation. The scope of the study is the analysis of the levels of Noise Pressure on the existing environment in the area surrounding the plant.
Data on the current noise situation in the area should be regarded and added to the prediction at each of the measurement locations (according with the formulas for adding noise) in order to establish the total future noise level in the area.

With the information on noise sources, facilities lay-out and meteorological data (mostly provided by EMethanex), WorleyParsons Komex has accomplished the prediction of future noise levels using the SoundPlan software tool, an industry standard. The software is able to correctly model point, line and area noise sources along with the screening effects of barriers and buildings and the effects of ground absorption, which allows an accurate detailed acoustic model to be created. Average site weather information has been used for the predictions, which have been calculated using the ISO 9613 standard "Acoustics – Attenuation of sound during propagation outdoors".

The results of these predictions are presented in the form of acoustic maps with contour lines of equal noise levels (isophones) at 5 decibel (dB) intervals.

The Project noise limits will be compared with national and international standards for Sound Pressure Levels for a two-train methanol plant.

The noise design basis set for the project assumes two operating methanol trains with all the necessary utilities to support the plant.

REGULATIONS

The following legislation has been considered for the model creation and graphic representation of the predicted noise as well as for comparison of the obtained results with the established legal limits.

EGYPTIAN LEGISLATION

Law No. 4, passed in 1994, is the main Environmental Law in Egypt concerning the environment. This law established the Egyptian Environmental Affairs Agency (EEAA). The Executive Statutes of this law were set out in 1995. The EEAA has the power to set criteria and conditions, monitor compliance and to take procedures against violators of these criteria and conditions. The EEAA must be notified of any expansions or renewals to the existing facility or any work, which might result in an adverse impact on the environment or workers.

Noise levels within a facility are discussed in the Egyptian Environmental Law 4/1994, in its executive regulations (D338, A44) and its additional annexes (Annex 7). It is also discussed in the Egyptian Labour Law 12/2003 (D211). Both laws include guidelines regarding the maximum permissible noise levels a facility may produce depending on the zone within which the facility lies.

Table 7 Maximum Permissible Limits for Noise Intensity (dBA) (Law 4/1994)

Type Of Zone	Day	Evening	Night
Rural dwelling zones, Hospitals and Gardens	45	40	35
Dwelling suburbs together with an existing weak movement	50	45	40
Dwelling zones in the city	55	50	45
Dwelling zone including some workshops or commercial business or on a public road	60	55	50
Commercial, administrative and downtown areas	65	60	55
Industrial zones (heavy industries)	70	65	60

NOTE: "Day" from 07:00 to 18:00; "Evening" from 18:00 to 22:00; "Night" from 22:00 to 07:00

INTERNATIONAL STANDARDS OR REGULATIONS

World Bank Group:
The World Bank also has guidelines regarding the maximum permissible noise levels a facility may generate. The Pollution Prevention and Abatement Handbook (PPAH) (World Bank Group, July 1998) refers to guidelines for industry sectors.

Ambient Noise
Noise abatement measures should achieve either the following levels or a maximum increase in background levels of 3 dB(A). Measurements are to be taken at noise receptors located outside the project property boundary.

Table 8: World Bank Maximum Allowable Noise Levels (Leq 1 hour dBA)

Receptor	Daytime	Night-time
Residential, institutional, educational	55 dBA	45 dBA
Industrial, Commercial	70 dBA	70 dBA

Note: Day Time - from 7 am to 6 pm, Night - from 10 pm to 7 am

METHODOLOGY

WorleyParsons Komex suggests the use of SoundPlan as specific software to calculate the sound pressure levels and generate noise maps. Those maps are the graphic result of the combination between the geometry data of buildings at the site and calculations of sound reflections and diffractions. The pressure level calculated for each point within the defined calculation area is shown as a contour map of isophones (lines of equal pressure). SoundPlan generates the industrial noise maps using the calculation methods given by European Directive 2002/49/CE (ISO 8913 for noise emissions and ISO 9613 for noise diffusion).

During the first stage, the program generates scenarios that contain all data required for the processing of the project: terrain elevation, geometrical data of all objects relevant to the investigation (layout, building shape and height). All data entered into this database can be edited further by adding attributes like x, y, z coordinates, noise emission, and reflective properties.

The Grid Noise Map generates a grid of receivers over the calculation area defined in the database. The main calculation module provides the necessary data to calculate or interpolate (from the receivers around it) the noise pressure in the middle of each grid cell. The grid spacing is chosen as the project requires.

SoundPlan allows the user to add additional corrections such as the reflection and absorption coefficients of walls and ground material. Impulse and tonal sources can be also defined; the sources can also be associated with a radiation pattern.

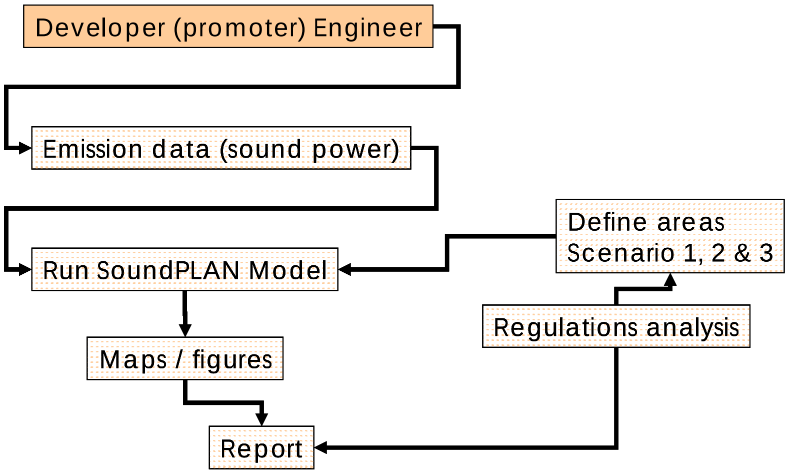
Every source is described in terms of acoustic power, which allows the calculation to be based on any of the standards that are included in the software. Data can be introduced based on a given weighting curve or by octave bands.

The noise sources can be of three different types: point sources, line sources and area sources. The two latter can be defined by the total acoustic power or by the acoustic power density of the source.

Each noise source can be shown in terms of central frequency or in terms of a frequency spectrum. If spectral data are unknown and the project has an industrial application, as in this case, the noise pressure in each cell is calculated using a central frequency of 500 Hz.

Figure 1 shows the methodology followed to generate the noise maps of the EMethanex facility.

Figure 1. Methodology



MODEL INPUTS

To generate the noise maps some initial data provided by the promoter is required:

- Location of the main noise emission sources.
- Type of noise source and its acoustic power level.
- Facility layout. (Figure 2)
- Buildings attributes such as height, shape and materials (Figure 3)

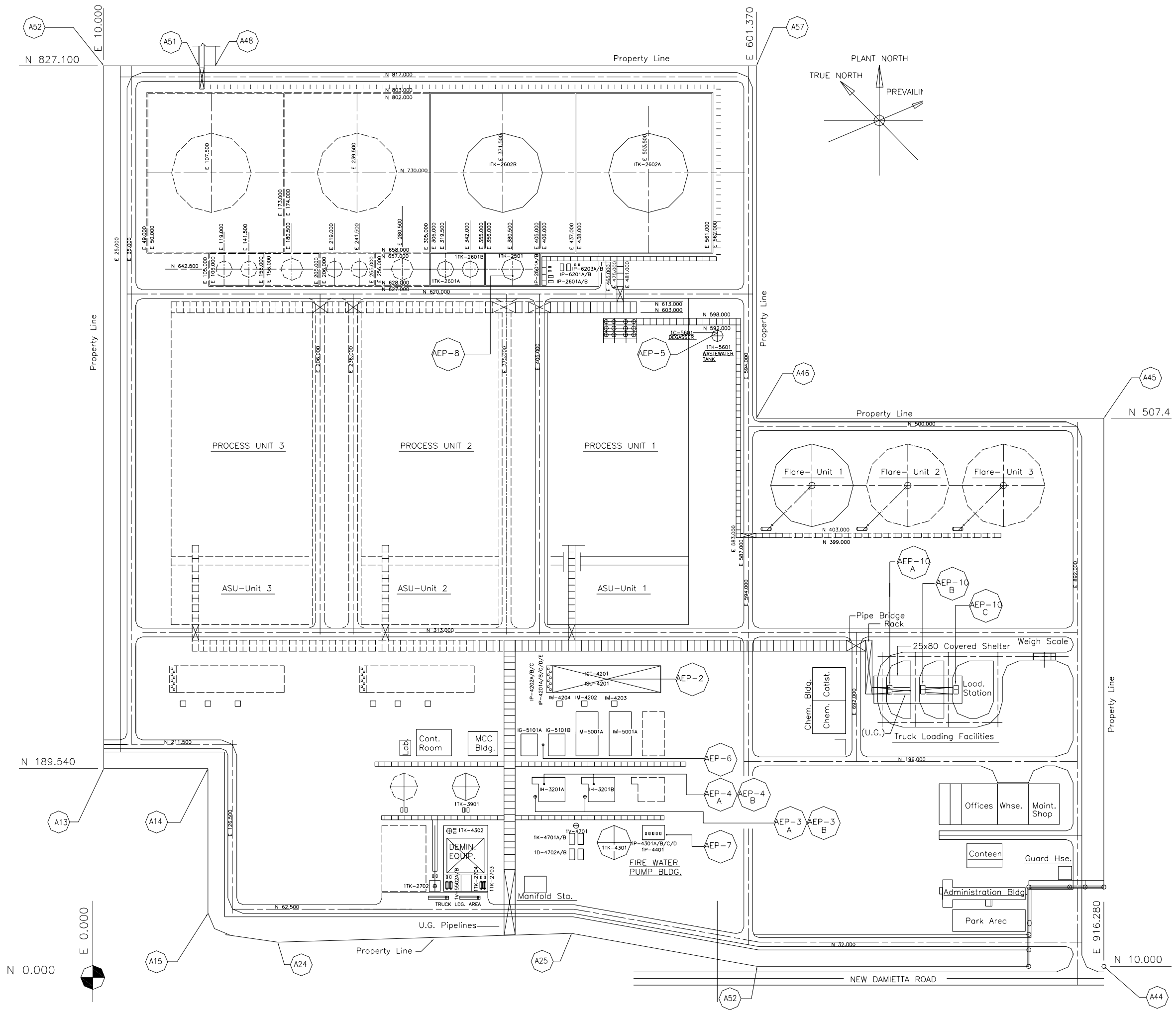


Figure 2. Facility layout

The noise power level for each considered source is shown in Table 1.

Table 1. Noise power levels

Description	Noise power level dB(A) range	
	From:	To:
Air Cooler	105	115
Air Cooler	105	115
Air Cooler	105	115
Air Cooler	105	115
Air Cooler	105	115
Centrifugal Compressor	95	105
Centrifugal Compressor	85	95
Centrifugal Compressor	85	95
Centrifugal Compressor	95	105
Centrifugal Compressor	95	105
Centrifugal Turbine	105	115
Centrifugal Turbine	105	115
Centrifugal Turbine	85	95
Centrifugal Turbine	105	115
Turbine	95	105
Reformer	90	100
Stack	95	105
Lube Oil Package	105	115
Air Separation Unit 1 - Cryogenic	85	95
Main Air Compressor(MAC)	100	110
Air Booster Compressor(BAC)	100	110
Compressor Steam Turbine	100	110
Steam Turbine Condensate pump	100	110
MAC Condensate Pump	100	110
Expansion turbine booster	100	110
Water Chiller pump	85	95
LOX Pump Vaporiser	85	95
HP LOX Pump 1	85	95
LP LIN Pump	85	95
Common Silencer	85	95
BFW Dosing Package	85	95
Pump	85	95
Pump	85	95
Pump	85	95
Pump	85	95
Pump	85	95
Pump	85	95
Pump	85	95
Pump	85	95

Description	Noise power level dB(A) range	
Pump	85	95
Pump	85	95
Pump	85	95
Pump	85	95
Pump	85	95
Pump	85	95
Flare	110	120

CONDITIONS MODELED

Three different situations have been considered for the noise mapping:

- Situation 1: calculation area includes the EMethanex facility boundaries.
- Situation 2: calculation area includes the EMethanex facility boundaries and nearest receptors.
- Situation 3: calculation area includes the EMethanex facility and potentially affected area.

Table 2 shows the model run details

Table 2. Model run information

Run description	Situation 1	Situation 2	Situation 3
Calculation	Grid Noise Map		
Run parameters			
Angle increment	2,00 deg		
Reflection depth	0		
Number of reflections	3		
Weighting	dB (A)		
Standards			
Industry	ISO 9613-2 : 1996		
Air Absorption	ISO 9613		
Limitation of screening loss: single/multiple	20 dB /25 dB		
Dissection Parameters			
Search Diameter Factor	2 m		
Minimum distance [m]	1 m		
Max. Difference GND+Diffraction	1 dB		
Max. Number of Iterations	4		
Regulations	CRTN (UK)		
Map			
Grid spacing	5,00	10,00	20,00
Height above ground	2,000 m	1,500 m	1,500 m
Grid Interpolation			
Field size	9x9		
Min/Max	10,0 dB		
Difference	0,1 dB		
Geometric contains	Calculation area		

Run description	Situation 1	Situation 2	Situation 3
	Buildings Sources Walls		

MODELING RESULTS

The results of noise mapping of the facility and increasingly larger areas are included in the figures listed below:

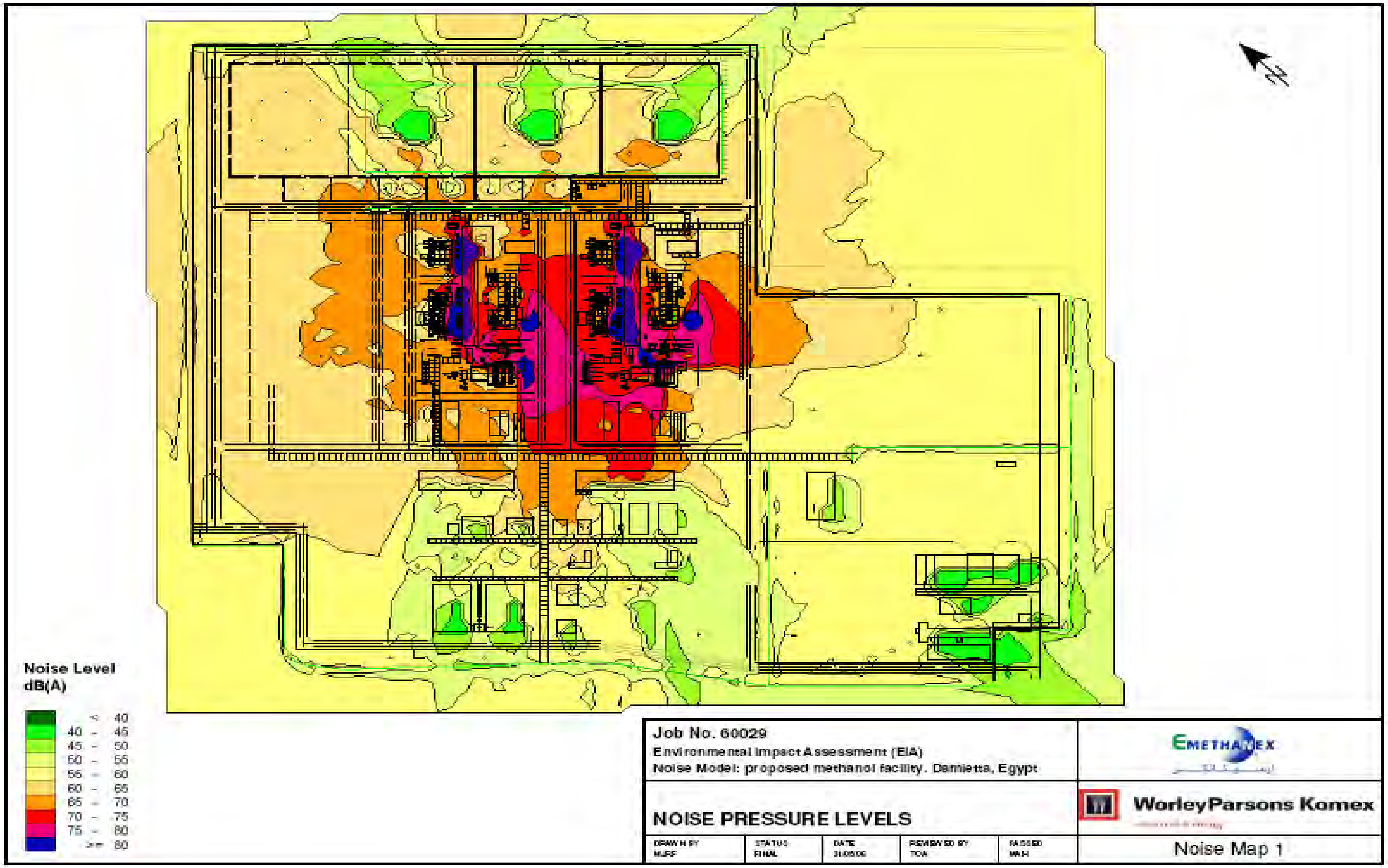
- Noise Map 1 shows the noise pressure levels within the area of the proposed facility
- Noise Map 2 includes the proposed facility and the nearest receptors
- Noise Map 3 includes the proposed facility and potentially affected surrounding areas

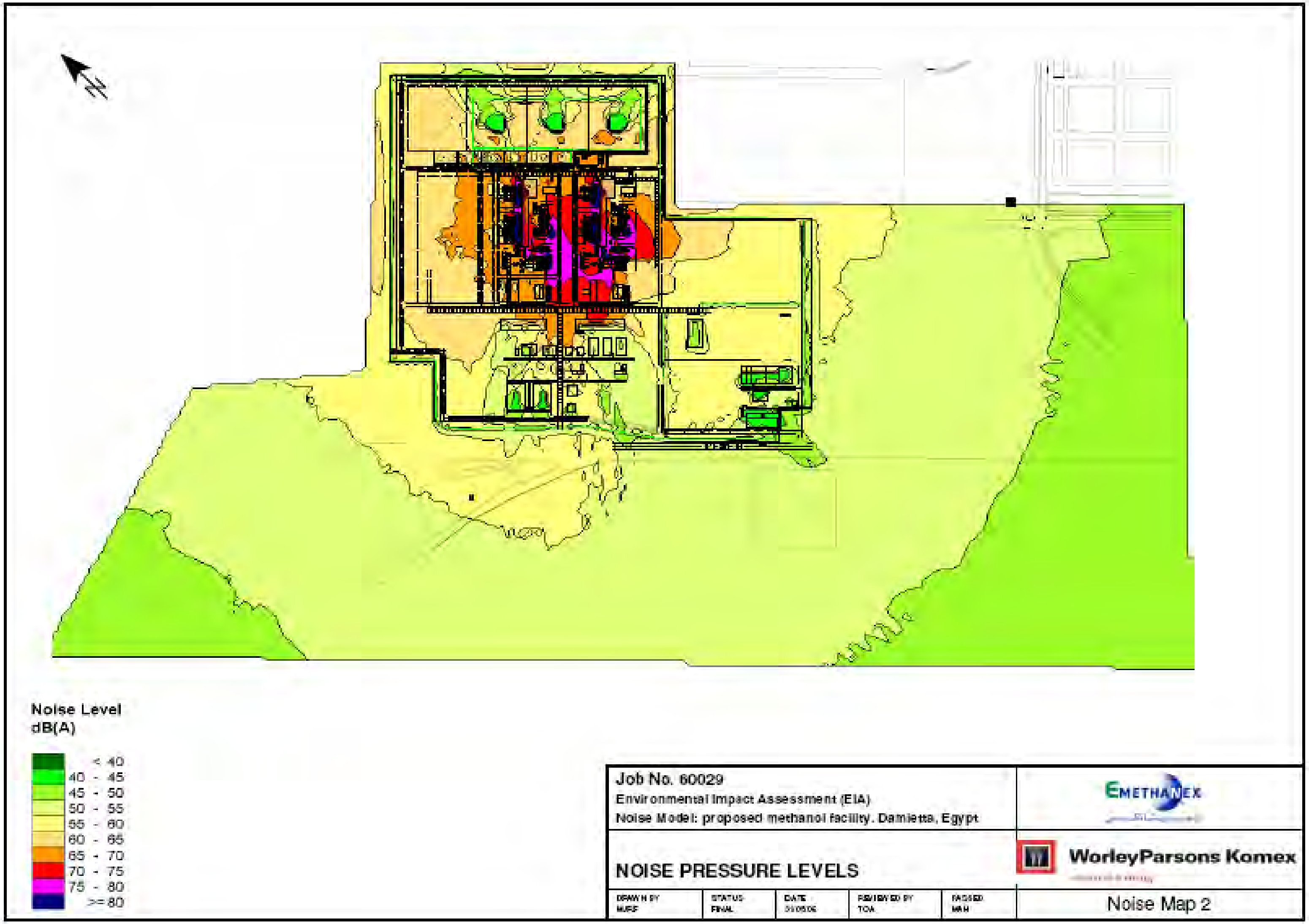
CONCLUSIONS

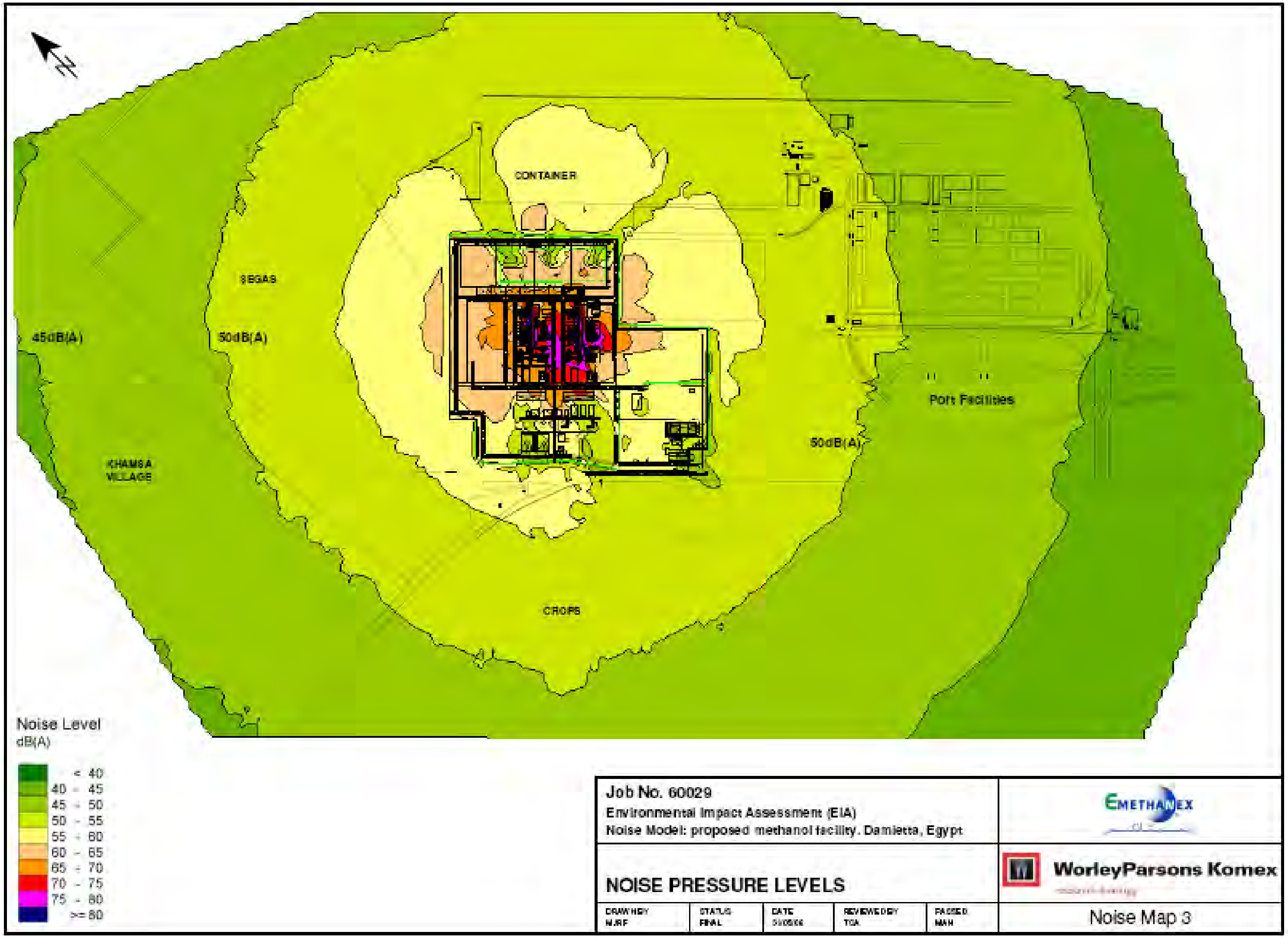
The results represented in noise maps 1, 2 and 3 have been calculated without considering any obstacles outside the facility (vegetation, buildings, etc) and assuming a worst case wind direction toward the receptor.
Noise maps 2 and 3 have been estimated at a height of I,5 m above ground to assess the noise effects on population. Noise map 1 has been calculated at a height of 2 m above ground to analyze the worst effects behind the boundary concrete wall.

Any conclusion based in the predicted noise maps will have to consider other noise sources such as traffic, industrial noise and water pumps.
The main conclusions from the noise models are:

- The noise pressure level will not exceed 70 dB (A) outside the facility boundaries
- The predicted noise pressure at the nearest residential area (Khamsa Village) is between 45 and 50 dB(A). It is important to note that no consideration has been made for any of the existing obstacles lying between the source (Methanex) and receptors (Khamsa Village). These sound obstacles include the Seagas perimeter walls, Seagas buildings and facilities and the palm crop vegetation, which would reduce the sound pressure from anywhere between 8 and 20 dB(A). Therefore the predicted noise levels, emitted solely from the Methanex plant (i.e. not taking into consideration the noise generated from the Seagas plant) and experienced at the Khamsa Village should be less than 40 dB(A) during Methanex plant operation. This is in compliance with the Egyptian noise regulation.


Noise Level
dB(A)
< 40
40 - 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
75 - 80
>= 80
Job No. 60029
Environmental Impact Assessment (EIA)
Noise Model: proposed methanol facility. Damietta, Egypt
NOISE PRESSURE LEVELS
EMETHANEX
WorleyParsons Komex
Noise Map 1


Noise Level
dB(A)
< 40
40 - 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
75 - 80
>= 80
Job No. 60029
Environmental Impact Assessment (EIA)
Noise Model: proposed methanol facility. Damietta, Egypt
NOISE PRESSURE LEVELS
EMETHANEX
WorleyParsons Komex
DRAWN BY
STATUS
FINAL
DATE
REVIEWED BY
TOA
PASSED
Noise Map 2


CONTAINER
SEGAS
45dB(A)
50dB(A)
Port Facilities
50dB(A)
KHAMSA VILLAGE
CROPS
Noise Level
dB(A)
< 40
40 - 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
75 - 80
>= 80
Job No. 60029
Environmental Impact Assessment (EIA)
Noise Model: proposed methanol facility, Damietta, Egypt
NOISE PRESSURE LEVELS
STATUS
FINAL
EMETHANEX
WorleyParsons Komex
Noise Map 3

APPENDIX X – Thermal Dispersion Model

1. INTRODUCTION

WorleyParsons Komex has been retained to conduct thermal discharge modeling for the proposed discharge of wastewater from the Egyptian Methanex Methanol Company S.A.E. (Emethanex) plant to be built at the Damietta Port, Egypt. The discharge modeling is part of an Environmental Impact Assessment for the proposed plant. The CORMIX model was used to determine the predicted temperature differential between the discharge effluent and the receiving environment. The modeled effluent flow rate and temperatures was provided by Emethanex, while the discharge location was based on Egyptian Law, and the predicted effluent plume temperatures were compared to World Bank environmental protection criteria.

1.1 LIMITATIONS

The thermal discharge study was undertaken using available information. The outfall diffuser configurations used in the thermal discharge modeling are based on previous designs by WorleyParsons Komex. A detailed design for the outfall has not been completed therefore the predicted effluent plume temperatures will depend on the final design for the outfall.

2. SITE CHARACTERIZATION

2.1 PROJECT LOCATION

The Emethanex plant will be located at the Damietta Port, along the north eastern coast of the Nile Delta (see Figure 1). The port is located approximately 10 km from one of the discharge locations of the Nile River. Damietta Port is located at the geographic co-ordinates:

- Longitude 31° 45'
- Latitude 31° 28'

Wastewater from the plant will be discharged to the Mediterranean Sea at least 500 m from the shoreline to the west of the entrance to the port (see Figure 2).

2.2 OCEANOGRAPHIC CHARACTERISATION

Oceanographic characteristics of the receiving environment will influence the predicted path of the discharged effluent (effluent plume) and will influence the temperature differential between the effluent plume and the ambient water temperature. Characteristics relating to the dilution of an effluent plume include:

- bathymetric features such as the depth, size of the water body, and bottom roughness;
- ambient water density calculated from the salinity and temperature of the water body; and
- wind and tidally driven currents.

2.2.1 Bathymetry

The bathymetry of the Damietta Port and the surrounding area is shown on Figure 2. The slope of the seabed is relatively gentle. The slope of first kilometre out from the shoreline is roughly 0.5%. Beyond the first kilometre, water depth remains shallow. For an outfall of reasonable length the terminus will therefore be located in relatively shallow water (<10 m).

Other bathymetric features in the area of the proposed outfall include a dredged channel leading to the Damietta Port and two breakwaters extending from the mouth of the port on either side of the dredged channel.

For the purpose of dilution modeling the region is assumed to be bounded by the shoreline and to have a depth equal to the water depth at the terminus. A more sophisticated description of the area is not permitted within the CORMIX model, and based on the shallow slope of the seabed, a flat bottom is considered reasonable.

2.2.2 Expected Bottom Material

The shoreline materials on the North African coast in the vicinity of the Nile River delta are generally composed of mud and muddy sand with possibly some local gravely or inshore sandy areas. This offshore area is described as the Nile Fan, which is a sloping depositional area extending seaward for many kilometres off the delta.

The sea bottom in the immediate area of Damietta Port is expected to be relatively free of significant features or landforms.

2.2.3 Salinity

The salinity of the ambient surface water compiled by ufisa / ALATEC (2000) in the area of the Damietta Port is given in the table below. Based on the values presented there is little variation in the salinity with the seasons.

Table 1 – Surface Salinity Data, Damietta Port

Period	Salinity (ppt)
January – March	39
April – June	38.75
July – September	38.75
October - December	39

Source: ufisa / ALATEC

The locations of the salinity measurements given were unknown. It was assumed that the measurements were taken offshore, and that the salinity near the shore could potentially be lower as a result of the fresh water input from the Nile. For the purpose of this study the ambient salinity was therefore assumed to be 38 ppt.

2.2.4 Temperature

The ambient surface water temperatures compiled by ufisa / ALATEC (2000) in the area of the Damietta Port is given in the table below. The surface waters are coolest in the winter with a minimum temperature of 14.4 °C and are the warmest in the summer when they reach a maximum temperature of 28.9 °C. The most critical parameter with respect to the proposed discharge is the temperature difference between the effluent and the receiving environment. Therefore the minimum water temperature for summer (20 °C) and winter (14 °C) were used in the modeling.

Table 2 - Monthly Surface Water Temperature

Month	Temperature (°C)		
	Maximum	Average	Minimum
January	18.9	17.8	15.6
February	18.9	16.7	14.4
March	17.8	16.7	14.4
April	20	17.8	15.6
May	23.3	21.1	17.8
June	25.6	23.3	20.0
July	27.8	25.6	23.3
August	28.9	26.7	24.4
September	27.8	25.6	23.3
October	25.6	24.4	22.2
November	23.3	22.2	18.9
December	22.2	18.9	15.6

Source: ufisa / ALATEC

2.2.5 Density

The ambient water density is calculated from the temperature and the salinity of the water. Surface water densities reported by ufisa / ALATEC (2000) are given in the table below. The variations in density are most likely a result in of the variations in the temperature as there is little variation in the salinity throughout the year. It is anticipated that the density will vary little with depth in the area of the proposed discharge. Wind and wave action are expected to thoroughly mix the water through the entire water column in the area of the proposed discharge.

Table 3 - Surface Water Density

Month	Density (kg/m^3)
February	1028
May	1028
August	1025
November	1027

Source: ufisa / ALATEC

For the purpose of dilution modeling the receiving water was assumed to have a uniform density. The two most extreme cases were considered; February when the density is a maximum and August when density is at a minimum.

2.2.6 Tides

The tides in the Damietta Port area are semi diurnal (i.e. two highs and lows every 24 hours). The maximum amplitude of the tidal range is 0.65 meters. Currents generated from the tidal action are expected to be minimal.

The minimum water depth above the terminus of the outfall was used for dilution modeling. The minimum water depth reduces the potential for dilution and should provide the most conservative estimate for dilution.

2.2.7 Winds, Currents, and Waves

Wind patterns will generate surface waves, currents and affect the rate of heat transfer from the water surface. Maximum wind speeds measured in the area of Damietta Port reach over 20 m/s (ufisa / ALATEC). Wind generated currents in the area of Damietta Port generally flow from the west. Historic reference material reports an average current velocity on the order of 0.35 m/s (0.7 knots). The frequency of this current is in the order of 40 %.

The rate of heat transfer from the surface of the water to air is a minimum under low wind conditions. An arbitrary wind speed of 2 m/s was chosen for modeling purposes. This is a typical breeze and can be a very common occurrence any time of the year. The wind speed has been used to select a surface heat exchange coefficient, as described by Adams, *et al.* (1981). The relationship between wind speed, water temperature and the surface heat exchange coefficient is shown on Figure 3.

The prevailing winds will also generate waves. An analysis of predicted maximum wave heights was performed by ufisa / ALATEC, and is given in the table below. The largest waves are predicted to be aligned parallel to the shoreline, aligned with the prevailing west north west winds.

Table 4 - Significant Wave Heights from WNW

Return Period (years)	Significant Wave Height (m)
1	4.6
2	5.0
5	5.5
10	5.9
20	6.3
50	6.8
100	7.2
200	7.5
500	8

Source: Ufisa / ALATEC

2.2.8 Summary of Ambient Conditions for Modeling

A summary of the ambient water characteristics used in the modeling are given in the table below.

Table 5 - Summary of Ambient Water Characteristics

Parameter	Ambient Value
Summer Temperature	20 °C
Winter Temperature	14 °C
Salinity	38 $^{o}/_{oo}$
Current	0.35 m/s to ESE
Wind Speed	2 m/s
Manning's n	0.02

3. DESIGN CRITERIA

3.1 REGULATIONS

Egyptian laws for the discharge of effluent to the marine environment are outlined in "*Annex (1) of Law Number 4 of 1994, The Environment Law.*" Under the law, discharge is not permitted except at a distance of 500 m from the shoreline, and must not affect fishing zones, bathing zones or natural reserves, and the discharge must not exceed 10 degrees over the prevailing receiving water temperature. The Presidential Decree Law No 93 for 1962 Concerning Drainage of Liquid Wastes, additionally states that discharges should not be warmer than 40 °C.

Criteria pertaining to marine discharges are outlined in the "*Pollution Prevention and Abatement Handbook*" (The World Bank Group, 1998). Petrochemical manufacturing guidelines within the handbook state that the temperature of the effluent plume must be within 3 degrees of the receiving environment temperature at the boundary of the zone of initial mixing and dilution (ZIMD). For a single port diffuser the ZIMD extends 100 m radially from the point of discharge. For multi port diffusers, this has been interpreted as 100 m from the diffuser mid point.

4. DIFFUSER AND EFFLUENT CHARACTERISTICS

4.1 EFFLUENT CHARACTERISTICS

The effluent to be discharged from the outfall is a combination of normal wastewater which is made up of streams from the neutralisation vessel, treated domestic waste, wastewater treatment effluent, and cooling tower blowdown and rainwater. The flow to the outfall is intermittent as needed to empty the storm water catch pond basin.

Emethanex has indicated that the total design flow rate for the outfall is 700 m^3/day, and will be discharged via a 14" diameter outfall. Diffuser characteristics for the outfall have not been finalized therefore two typical diffuser designs described in the following section were used for the modeling.

Emethanex has indicated that the effluent will be fresh water with a design temperature 31 °C in the summer and 25 °C in the winter. Under average summer and winter conditions these temperatures will meet the "end of pipe" criteria of a 10 °C temperature difference between the ambient water and the effluent. The modeled effluent temperatures and the resulting effluent density are given in the table below.

Table 6: Modeled Effluent Parameters

	Effluent Temperature	Effluent Density
Summer	31 °C	995.3 kg/m^3
Winter	25 °C	997.0 kg/m^3

4.2 DIFFUSER CHARACTERISTICS

The diffuser of the outfall could be either a single or multi port diffuser. The single port diffuser would be aligned perpendicular to the predominant flow of the current, and angled up at a vertical angle of 45 degrees. The multi port diffuser was assumed to have 16 ports spaced 0.5 m apart. The individual ports were assumed to discharge at an angle horizontal to the seabed, at an angle perpendicular to the axis of the outfall. The direction of the ports were chosen to alternate so that eight ports discharge to the left side of the terminus and eight to the right side of the terminus. The total length of the multi port diffuser was 7.5 m with the port closest to the shore located at least 500 m from the shoreline. These terminus designs are typical for the proposed application and would need to be optimized during detailed design.

The terminus depth for both the single and the multi port diffuser were modeled for depths of 3.5 m, 5 m and 7 m. The minimum depth is the measured depth at the minimum distance from the shoreline (500 m) for a discharge required under "*The Environment Law*" (Egypt, 1994). The water depth at this distance from the shoreline was considered relatively shallow for typical outfall design. The two additional water depths were therefore modeled. The 7 m depth contour ranges from approximately 1000 m to 1500 m in distance from the shoreline, an outfall longer than this was considered unnecessary.

The diffuser ports were assumed to be fitted with variable orifice "duckbill valves". The size of the opening of the valves was estimated from the curves supplied by the manufacturer of "Tideflex™" valves. The curve for a 400 mm (16 inch) Tideflex valve was used for the single port case as a 350 mm (14 inch) Tideflex valve is not rated for the proposed flow rate. The modeled port diameters at the design flow rate are given blow.

Table 7: Diffuser Port Opening Sizes

Diffuser Option	Port Size	Valve Opening Diameter
Single	400 mm	254 mm
16 Port	75 mm	50 mm

5. THERMAL DISPERSION MODELING

Thermal dispersion modeling was completed using the Cornell Mixing Zone Expert System (CORMIX) model. CORMIX is a hydrodynamic mixing zone model developed for the analysis, prediction and design of aqueous or conventional pollutant discharges into various water bodies. The program is supported by the United States Environmental Protection Agency (USEPA) to assess water quality impacts from point source discharges at surface or sub-surface levels.

The program creates plume geometry and dilution predictions for both "near-field" and "far-field" mixing. In the near-field calculations, the program addresses how the outfall geometry influences momentum flux, buoyancy flux, jet trajectory, and mixing. Far-field mixing is the successive phase, which occurs when the influence of the initial jet mixing diminishes and the plume is controlled by the ambient conditions.

5.1 CONDITIONS MODELED

The effluent plume was modeled at the design effluent flow rate for the following conditions:

- Single port diffuser using the minimum summer (August) and minimum winter (February) water column density, along with the three terminus depths;
- 16 port diffuser, using the worst case (February) scenario for water column density and three terminus depths.

A summary of all model inputs is given in the Table below

Table 8: CORMIX Model Input Summary

Average Depth (m)	3.5	5	7
Depth at Discharge (m)	3.5	5	7
Ambient and Effluent Characteristics			
	Summer	**Winter**	
Ambient Velocity	Steady		
	0.35 m/s		
Ambient Density (kg/m3)	Non-Fresh Water		
	Uniform		
	1025	1028	
Water Body	Unbounded		
Manning's n	0.02		
Wind speed (m/s)	2		
Effluent Flow Rate (m^3/s)	0.1944		
Effluent Density	Fresh Water		
Effluent Temperature (°C)	31	25	
Concentration (°C)	11	11	
Pollutant Type	Heated		
Heat loss Coefficient	29	18	
Diffuser Characteristics			
Discharge	**Single Port**	**Multi Port**	
Nearest Bank	Right	Right	
Distance to Nearest Bank (m)	500	500	
Port Diameter (m)	0.254	0.050	
Discharge Port Height (m)	0.3	0.3	
Vertical Angle (Degrees)	45	0	
Total Number of Openings	N/A	16	
Contraction Ration	N/A	1	
Diffuser alignment angle	N/A	90	
Horizontal Discharge Angle	N/A	0	
Relative Orientation Angle	N/A	90	

5.2 MODELING RESULTS

The results from single port dilution modeling are given in the table below. A graphic representation of the modeling results for the winter ambient water temperature and a terminus depth of 3.5 m are shown on Figure 4.

Table 9: Single Port Modeling Results

Season	Discharge Depth	Distance from terminus where a 3°C temperature differential is achieved	Effluent plume temperature at the boundary of the ZIMD (above ambient)
Summer	3.5 m	2.4 m	<1.0 °C
	5 m	2.2 m	<0.5 °C
	7 m	2.2 m	<0.3 °C
Winter	3.5 m	2.4 m	<1.0 °C
	5 m	2.4 m	<0.6 °C
	7 m	2.3 m	<0.3 °C

The results indicate that the temperature of the effluent plume is predicted to cool rapidly, with little variation in the predicted temperatures and path of the effluent plume between the two seasons and terminus depths. The effluent plume is predicted to be less than 3 °C above the ambient temperature within 3 m of the terminus and less than 1.0 °C above the ambient temperature at the ZIMD, for all scenarios.

The hot fresh water plume will be extremely buoyant and will surface (see Figure 4) for all discharge depths modeled. The effluent plume is then predicted to remain as a shallow surface layer spreading laterally while flowing downstream. The single port discharge will meet the 3 °C temperature criteria but may create an unsightly "boil" as the effluent plume surfaces. A multi port diffuser can be used to alleviate the boil on the surface.

The results from the dilution analysis for a multi port diffuser are given in the table below. Only the winter water temperature was modeled as this was found to be the worst case scenario for a single port diffuser, resulting in the highest temperature differentials.

The CORMIX model approximates the multi port diffuser as a discharge from a single slot the length of the outfall. A graphical representation of the effluent plume for the minimum discharge depth is given in Figure 5.

Table 10: Multi Port Modeling Results

Season	Discharge Depth	Distance from terminus where a 3°C temperature differential is achieved	Effluent plume temperature 100 m downstream of the diffuser (above ambient)
	3.5 m	0.5 m	<0.2 °C
	5 m	0.8 m	<0.2 °C
	7 m	1.1 m	<0.1 °C

The results from the dilution modeling of the multi port diffuser indicate that there will be a reduction in the temperature difference between the effluent plume and the receiving environment 100 m from the terminus using a multi port diffuser. The location where a 3 °C temperature differential is achieved for this model is relatively close to the diffuser and is considered inaccurate given the slot approximation made by the model. Two single ports from the diffuser were therefore modeled individually to predict effluent plume temperatures near an individual port. One port was modeled aligned with the ambient current, and the other port aligned opposite to the ambient current. The temperature of the effluent plume from a single port is predicted to reach 3 °C above the ambient conditions within 1 m from an individual port. This is considered a more accurate prediction of the multi port diffuser performance.

The results from the dilution modeling indicate the temperature differential criteria of 3 °C at the ZIMD will be easily achieved with either a single or multi port diffuser. The extension of the outfall beyond 500 m to increase the depth of the diffuser does not seem warranted to meet the given criteria.

When the paths of the effluent plumes from the two diffuser configurations are compared, the effluent plume rises quickly to the surface when discharged from a single port diffuser (see Figure 4) and then remain as a thin surface layer, while the discharge from the multi port diffuser will quickly mix with the full depth of the water column when discharged form a multi port diffuser. The multi port diffuser should therefore be considered to reduce the surfacing effects of the effluent plume.

The model predicted that there will be no significant interaction between the shoreline and the effluent plume. Given that the predicted temperatures of the effluent plume are close to that of the receiving environment at 100 m from the terminus it is predicted that there will be almost no temperature difference at the shoreline given the additional cooling that will occur between the ZIMD and the shoreline.

6. CONCLUSIONS

Conclusions drawn from the thermal dispersion modeling report include:

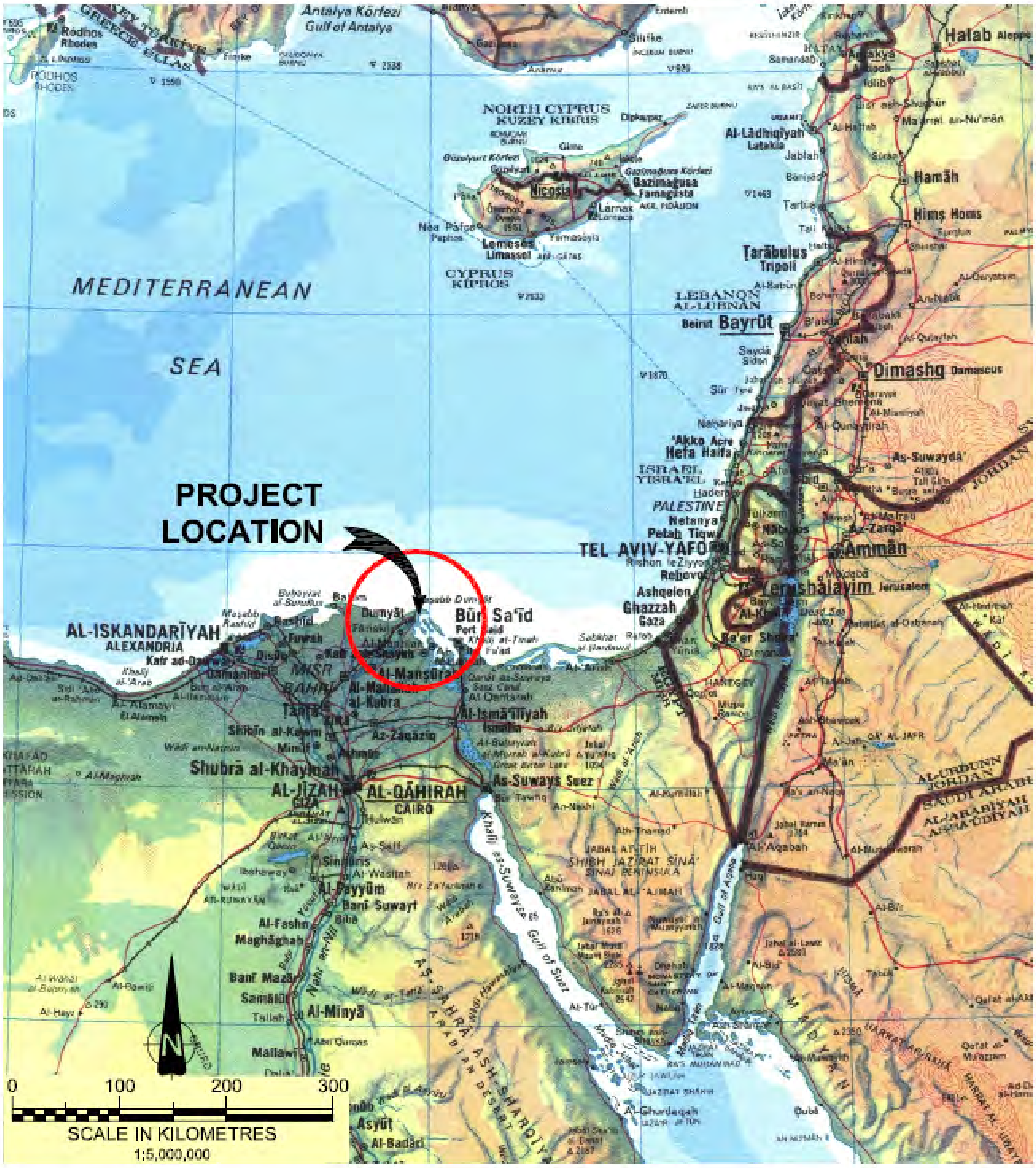
- The sea bottom slopes away from the shoreline at a relatively gentle angle. The water depth at the required discharge location (500 m from the shoreline) is only 3.5 m.
- The bottom material in the area of the proposed outfall is expected to be sand and mud. The bottom is therefore assumed to be relatively smooth.
- The receiving water density profile is expected to be essentially homogeneous as a result of currents and wave action.
- The measured salinity of the receiving environment was measured to range from 38.75 ppt to 39 ppt. A conservative estimate of 38 ppt was used for dilution modeling.
- The measured sea surface temperature of the receiving environment ranged from 14°C in the winter to 29 °C in the summer.
- Tides in the area of Damietta Port have a maximum range of 0.65 m and are unlikely to generate significant currents.
- The wind speed used to determine the rate of heat loss from the water surface was 2 m/s which is a common wind speed that is anticipated to occur during any season.
- Wind generated currents are anticipated to be on the order of 0.35 m/s
- Wind generated waves are anticipated to thoroughly mix the water column in the shallow water near the shore.
- The wastewater effluent plume will be buoyant in the receiving environment and will rise to the surface.
- The wastewater effluent plume is predicted to cool below the environmental guideline of 3 °C within 3 m of the terminus of the outfall for a single port diffuser.
- The wastewater effluent plume is predicted to cool below the environmental guideline of 3 °C within 1 m of the terminus of the outfall for a multi port diffuser.
- The discharge will meet the effluent discharge requirements for temperature set forth in the Pollution Prevention and Abatement Handbook 1998, under normal operating temperatures and average ambient water temperatures.

7. RECOMMENDATIONS

Provided that the wastewater effluent meets requirements for temperature and discharge location, receiving environment criteria for temperature are predicted to be met by the use typical single or multi port outfall diffuser designs. A single port outfall will provide sufficient cooling; however the effluent plume will surface and potentially cause a boil on the surface. A properly designed multi port diffuser will alleviate some of this surface effect, and is therefore the recommended terminus concept.

8. CLOSING

We trust this report meets you requirements for dilution modeling at this time. If you have any questions or concerns please feel free to contact either of the undersigned.



Environment & Water Resources

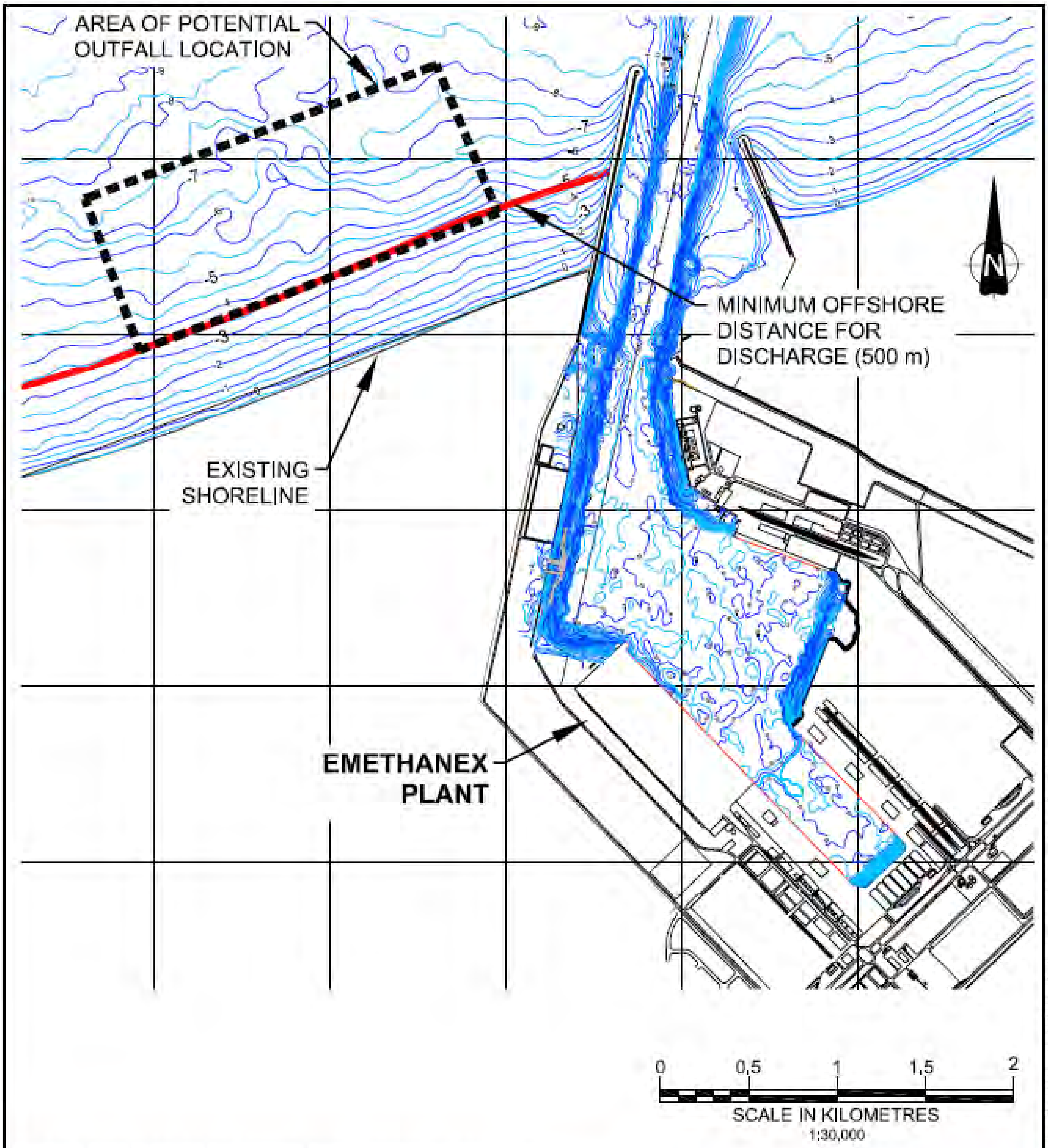
EGYPTIAN METHANEX METHANOL COMPANY S.A.E.
THERMAL DISPERSION MODELING

LOCATION MAP

WorleyParsons Komex
resources & energy

27-APR-06 date	KM edited by	FC drawn by	app by	PROJECT NUMBER: C35010500	FIGURE: 1

PREPARED SOLELY FOR THE USE OF OUR CLIENT AS SPECIFIED IN THE ACCOMPANYING REPORT. NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH WORLEYPARSONS KOMEX HAS NOT ENTERED INTO A CONTRACT.



SOURCE: DATA SUPPLIED BY DAMIETTA PORT AUTHORITY SEGAS. 2001.

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EGYPTIAN METHANEX METHANOL COMPANY S.A.E.
THERMAL DISPERSION MODELING

SITE PLAN

WorleyParsons Komex
resources & energy

23-MAY-06	date	KM	edited by	OTHERS	drawn by		app by	PROJECT NUMBER: C35010500	FIGURE: 2

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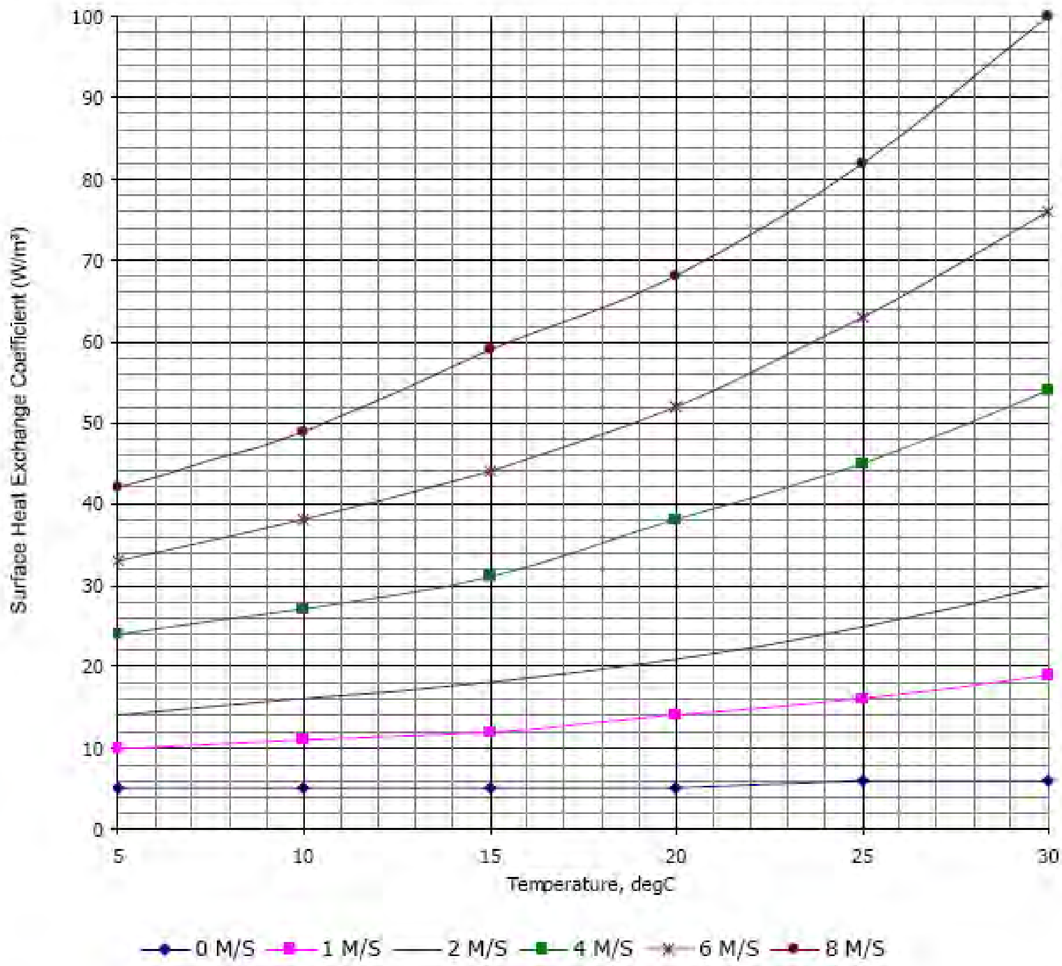

SOURCE: ADAMS, ET AL, 1981.

Environment & Water Resources

EGYPTIAN METHANEX METHANOL COMPANY S.A.E.
THERMAL DISPERSION MODELING

SURFACE HEAT EXCHANGE COEFFICIENT

WorleyParsons Komex
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27-APR-06 date	KM edited by	CM drawn by	app by	PROJECT NUMBER: C35010500	FIGURE: 3

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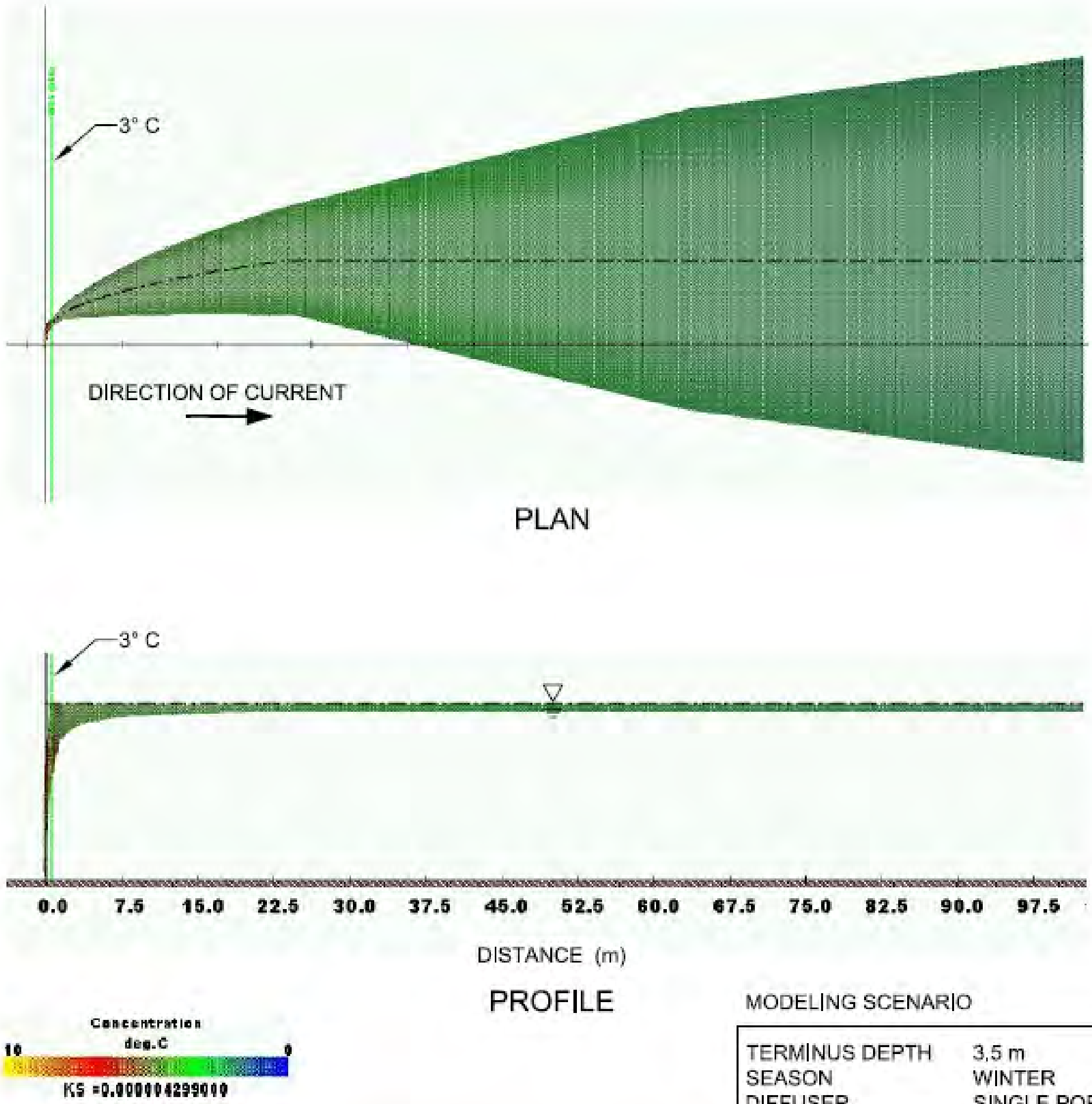

MODELING SCENARIO

TERMINUS DEPTH	3,5 m
SEASON	WINTER
DIFFUSER	SINGLE PORT

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EGYPTIAN METHANEX METHANOL COMPANY S.A.E.
THERMAL DISPERSION MODELING

SINGLE PORT EFFLUENT PLUME

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23-MAY-06	date	KM	edited by	PH	drawn by		app by

PROJECT NUMBER: C35010500

FIGURE: 4

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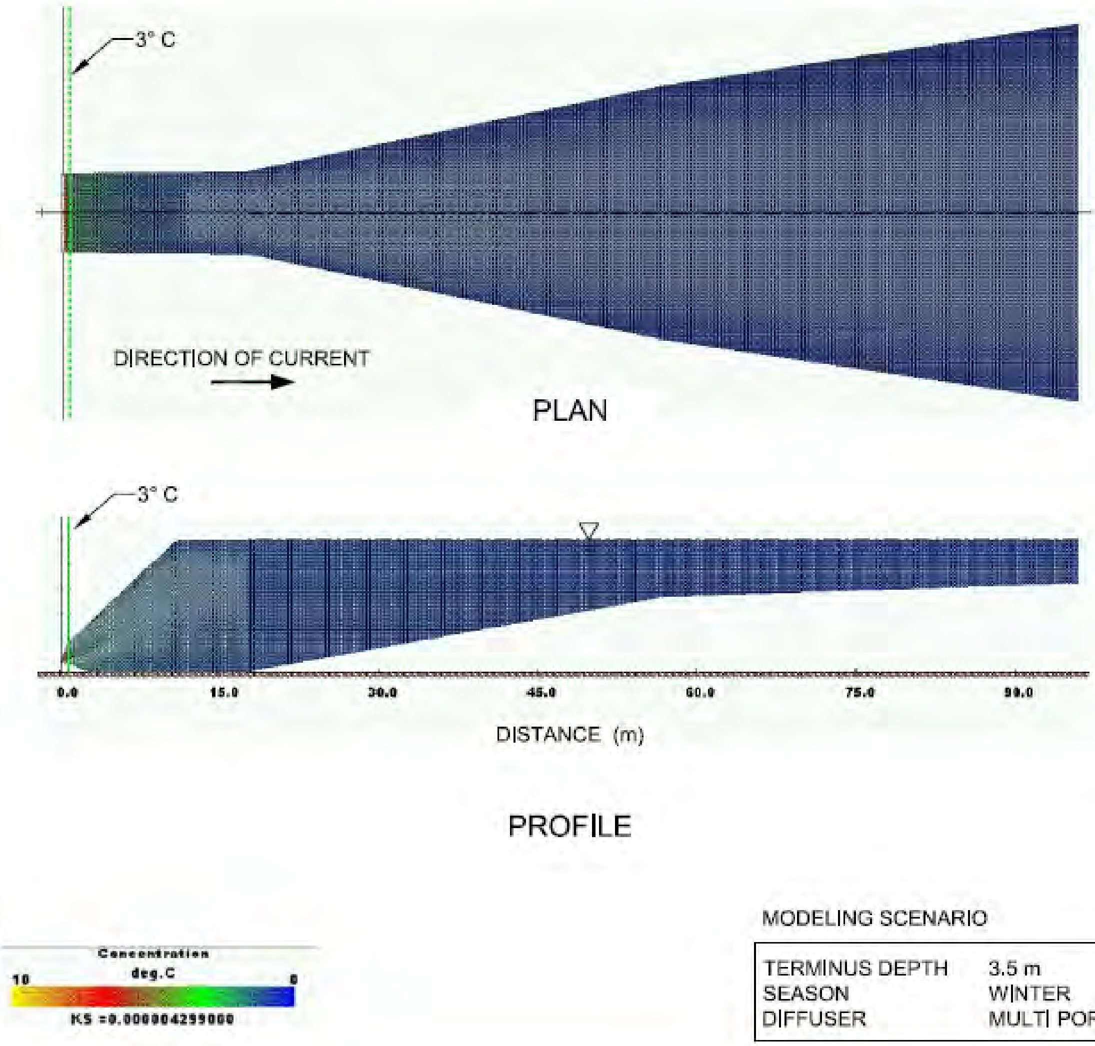

MODELING SCENARIO

TERMINUS DEPTH	3.5 m
SEASON	WINTER
DIFFUSER	MULTI PORT

Environment & Water Resources

EGYPTIAN METHANEX METHANOL COMPANY S.A.E.
THERMAL DISPERSION MODELING

MULTI PORT EFFLUENT PLUME

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23-MAY-06 date	KM edited by	PH drawn by	app by	PROJECT NUMBER: C35010500	FIGURE: 5

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APPENDIX XI – AQUATIC BIOTA ANALYSIS RESULTS

Standing crop of zooplankton (org/m³) at marine locations MO1 - MO5

Species	MO1	MO2	MO3	MO4	MO5
Protozoa					
Tintinnopsis beroidea	0	0	0	0	0
Tintinnopsis campanula	0	150	150	0	300
Tintinnopsis cylindrica	0	0	0	150	0
Favella serrata	0	150	0	300	0
Favella ehrenbergii	150	300	150	300	0
Favella markusovszkyi	0	150	0	150	0
Favella azorica	0	0	0	0	0
Helicostamella subulata	0	0	0	0	0
Eutintinnus lusus-undae	150	0	150	0	0
Condonella aspera	0	0	0	0	0
Metacylis mediterrnean	300	0	0	0	0
Subtotal	**600**	**750**	**450**	**900**	**300**
Cnadaria					
Obelia spp	1200	1050	3450	1350	2550
Phialidium hemisphericum	300	0	150	0	300
Solmundella bitentaulata	150	0	0	300	150
Subtotal	**1650**	**1050**	**3600**	**1650**	**3000**
Copepoda					
Nauplius larvae	*750*	*300*	*150*	*150*	*150*
Cyclopoid copepodid	450	2700	4500	2150	1050
Calanoid copepodid	300	750	900	750	150
Oithona nana	2550	4500	3750	2750	900
Oncea venusta	0	0	150	0	0
Paracalanus parvus	150	450	150	0	0
Acartia clausii	300	150	150	300	0
Cetropagus kroyeri	150	300	0	0	0
Calocalanus pavus	300	0	300	0	0
Clausocalanus arcuicornis	300	150	150	450	0
Euterpina acutifrons	300	450	300	150	600
Subtotal	**5550**	**9750**	**10500**	**6700**	**2850**
Rotifera					
Brachionus plicatilis	0	0	0	0	0
Synchaeta cf kitina	0	0	0	0	0

Species	MO1	MO2	MO3	MO4	MO5
Synchaeta calva	0	0	0	0	0
Subtotal	**0**	**0**	**0**	**0**	**0**
Appendicularians					
Oikopleura longicanda	600	450	300	450	300
Oikopleura dioica	150	0	0	150	0
Subtotal	**750**	**450**	**300**	**600**	**300**
Cheatognatha					
Sagitta inflata	150	300	150	450	0
Subtotal	**150**	**300**	**150**	**450**	**0**
Cladocera					
Podon polyphemoides	1050	300	450	300	150
Evadne tergestina	300	0	150	0	0
Subtotal	**1350**	**300**	**600**	**300**	**150**
Pteropoda					
Limacina inflata	300	150	0	450	0
Peraclis reticulata	150	0	0	0	0
Subtotal	**450**	**150**	**0**	**450**	**0**
Meroplankton					
Polycheate larvae	600	750	450	0	300
Echinodermata larvae	0	0	300	0	0
Mollusca larvae	750	3250	3600	150	1050
Free living nematoda	0	0	0	0	0
Fish eggs & Embryo	0	750	0	600	0
Subtotal	**1350**	**4750**	**4350**	**750**	**1350**
Total Number	**11850**	**17500**	**19950**	**11800**	**7950**

Table 9: Standing crop of zooplankton (org/m³) at marine locations MJ1 - MJ6

Species	MJ1	MJ2	MJ 3	MJ4	MJ5	MJ6
Protozoa						
Metacylis mediterrnean	0	400	0	0	0	0
Subtotal	**0**	**400**	**0**	**0**	**0**	**0**
Copepoda						
Nauplius larvae	1200	600	800	600	600	600
Cyclopoid copepodid	800	400	400	0	300	400
Oithona nana	400	0	0	0	0	0
Euterpina acutifrons	0	0	0	400	100	100
Subtotal	**2400**	**1000**	**1200**	**1000**	**1000**	**1100**
Rotifera						
Synchaeta cf kitina	400	0	0	400	200	100
Subtotal	**400**	**0**	**0**	**400**	**200**	**100**
Appendicularians						
Oikopleura dioica	600	0	0	400	300	200
Subtotal	**600**	**0**	**0**	**400**	**300**	**200**
Meroplankton						
Polycheate larvae	0	0	0	200	100	100
Subtotal	**0**	**0**	**0**	**200**	**100**	**100**
Total	**3400**	**1400**	**1200**	**2000**	**1600**	**1500**

Table 10: Qualitative Phytoplankton species at marine locations MO1 - MO5

Species	MO1	MO2	MO3	MO4	MO5
Bacillariophyceae					
Astrionella glacialis	*	*	*	*	*
Azeiptia africana		*	*	*	*
Azeiptia barronii	*	*		*	
Azeiptia neocrenulata	*			*	*
Bacteriastrum furcatum					
Biddulphia alternans	*	*			
Biddulphia aurita	*	*	*	*	*
Biddulphia longicruris	*		*	*	
Biddulphia smithii	*	*		*	*
Biddulphia turgida	*	*	*		
Chaetoceros borealis			*	*	*
Chaetoceros curvisetus	*	*	*	*	
Chaetoceros didymus		*			*
Chaetoceros furcellatus	*		*	*	
Chaetoceros lorenzianus	*	*			*
Chaetoceros mitra		*		*	
Chaetoceros similis			*	*	
Chaetoceros teres	*	*		*	*
Guinardia cylinderus	*		*		
Guinardia delicatula		*		*	*
Guinardia striata	*	*	*	*	*
Haslea trompii					
Hemiaulus indicus					
Hemiaulus sinensis					
Leptocylindericus danicus		*	*		*
Leptocylindericus minimus	*		*	*	
Melosira isnlandica				*	*
Navicula litoralis		*			
Nitzschia closterium	*		*	*	*
Nitzschia panduriformis			*		*
Nitzschia panduriformis var minor					
Nitzschia spathulata					
Pleurosigma elongatum		*			
Pleurosigma normanii					
Pseudonitzschia lineola		*	*	*	*
Rhizosolenia alata	*			*	
Rhizosolenia calcar		*	*		*
Rhizosolenia robusta		*		*	
Skelatonema costatum	*	*	*		*
Thalassionema nitzschiode	*		*		
Thalassiosira antarctica	*		*		

Appendix XI (Aquatic Biota Analysis Results)

Species	MO1	MO2	MO3	MO4	MO5
Thalassiosira gravide	*			*	*
Dinophyceae					
Ceratium declinatum	*			*	*
Ceratium furca	*	*	*	*	
Ceratium fusus		*	*		*
Ceratium hexacanthum		*	*		
Ceratium hurindinela	*	*		*	*
Ceratium kofoidii	*		*		*
Ceratium tripos		*		*	
Gonyaulax spinifera	*	*	*		*
Gymnodinium mikimotoi			*	*	*
Dinophysis acuminata	*	*			
Dinophysis caudata	*	*	*	*	
Dinophysis tripos			*		*
Exuviella apora	*		*	*	*
Prorocentrum arcuatum				*	
Prorocentrum compressum					
Prorocentrum gracile					
Prorocentrum lima					
Prorocentrum mechanis					
Protoperidinium cinctum					*
Protoperidinium crassipes					
Protoperidinium leonis	*			*	*
Protoperidinium sp	*		*		*
Cryptophyceae					
Hillea fusiformis			*	*	*
Rhodomonas marina					
Chlorophyceae					
Dictyocha fibula	*	*		*	
Cyanophyceae					
Chroococcus limneticus			*		

Table 11: Quantitative Phytoplankton at marine locations MO1 - MO5 (No. of cells x 10^{-4} L^{-1})

Species	MO1	MO2	MO3	MO4	MO5
Bacillariophyceae					
Achnanthes minutissima					
Astrionella glacialis	1				
Azeiptia africana			2		
Biddulphia alternans					
Biddulphia aurita	6	8	6		3
Biddulphia longicruris	3	1	6		
Biddulphia smithii					
Chaetoceros similis			4		
Coscinodiscus					
Cyclotella mengehiniana	1			1	
Cymbella microcephala		1			
Dactyliosolen fragilissmus					
Fragilaria pinnata					
Fragilariopsis oceanica					
Guinardia delicatula		4			
Guinardia striata			1	2	2
Leptocylindericus danicus		1			
Leptocylindericus minimum		2			
Lethodesmium undulatum	1			1	
Navicula cancellata					
Navicula litoralis	2				1
Navicula salinarum					1
Nitzschia closterium	17	6	4	2	2
Nitzschia paleacea					1
Nitzschia panduriformis					
Nitzschia panduriformis var minor			1		
Pleurosigma elongatum					
Pleurosigma normanii	1				
Pseudonitzschia lineola					
Rhopolodia gibba					
Skelatonema costatum	39	6	36	24	
Striatiella delicatula					
Striatiella unipunctata		1	1		
Thalassiosira antarctica			1		
Thalassiosira hyalina					
Thalassiosira minuscula					
subtotal	**71**	**30**	**62**	**30**	**10**
Dinophyceae					
Ceratium furca			1		
Exuviella apora	1				
Gonyaulax spinifera					
Gymnodinium sp.					
Gymnodinium subconica			1		

Peridinium cerasus	2	1			
Peridinium cinctum			3		
Prorocentrum gracile					
Prorocentrum lima					
Prorocentrum mechanis					
subtotal	**3**	**1**	**5**	**0**	**0**
Chlorophyceae					
Dictyocha fibula		2	4	4	3
subtotal	**0**	**2**	**4**	**4**	**3**
Cryptophyceae					
Hillea fusiformis	8	2		1	
Rhodomonas marina	1				
subtotal	**9**	**2**	**0**	**1**	**0**
Cryptophyceae					
Chroococcus dispersus					8
subtotal	**0**	**0**	**0**	**0**	**8**
Total	**83**	**35**	**71**	**35**	**21**

Table 12: Qualitative Phytoplankton species at marine locations MJ1 - MJ6

Species	MJ1	MJ2	MJ3	MJ4	MJ5	MJ6
Bacillariophyceae						
Azeiptia africana	*	*	*	*	*	*
Azeiptia antaractica	*					
Biddulphia aurita	*	*	*	*	*	*
Biddulphia alternans				*		
Chaetoceros curvisetus	*	*				
Chaetoceros cinctus		*				
Chaetoceros lorenzianus	*	*	*	*	*	*
Chaetoceros mitra	*	*				
Chaetoceros similis			*	*	*	*
Chaetoceros simplex	*	*				
Cyclotella comta		*	*	*	*	*
Guinardia delicatula	*	*	*	*	*	*
Guinardia striata	*	*	*	*	*	*
Helicotheca temesis	*		*	*	*	*
Leptocylindericus danicus	*	*	*	*	*	*
Leptocylindericus minimus	*	*	*	*	*	*
Navicula litoralis	*	*				
Navicula cancellata	*	*				
Navicula directa		*				
Nitzschia acicularis	*	*				
Nitzschia closterium	*	*	*	*	*	*
Nitzschia spathulata	*	*				
Pleurosigma marina			*	*	*	*
Pseudonitzschia lineola	*	*	*	*	*	*
Pseudonitzschia pseudodelicatissima	*		*	*	*	*
Pseudonitzschia heimii	*	*				
Pseudonitzschia delicatissima	*	*	*	*	*	*
Rhizosolenia alata		*				
Skelatonema costatum				*		*
Dinophyceae						
Ceratium furca	*	*	*	*	*	*
Gonyaulax spinifera				*		*
Gymnodinium subconica	*	*	*		*	
Dinophysis caudata		*	*		*	
Diplopsalis sp			*	*	*	*
Oxytoxum sp	*	*	*	*	*	*
Oxyphysis oxytoxoides	*	*				
Phalacroma mitra	*	*		*	*	*
Prorocentrum arcuatum	*	*	*	*	*	*
Prorocentrum compressum	*	*	*	*	*	*
Prorocentrum gracile	*		*	*	*	*
Prorocentrum lima	*	*				
Prorocentrum mechanis	*	*	*	*	*	*

Species	MJ1	MJ2	MJ3	MJ4	MJ5	MJ6
Protoperidinium crassipes	*	*				
Protoperidinium pellucidum	*	*				
Protoperidinium pallidum			*	*	*	*
Protoperidinium punctulatum			*	*	*	*
Protoperidinium wellei	*	*				
Cryptophyceae						
Hillea fusiformis	*	*	*	*	*	*
Rhdomonas salina	*	*				
Chlorophyceae						
Dictyocha fibula	*	*	*	*	*	*
Dunaliella salina	*	*				
Eutreptia globulifera		*		*		*
Eutreptiella marina		*				
Pyramimonas orientalis			*	*	*	*
Cyanophyceae						
Oscillatoria spirulinoides		*				
Euglenophyceae						
Euglena virides	*	*	*	*	*	*
Chrysophyceae						
Dinobryon balticum		*	*	*	*	*

Table 13: Quantitative Phytoplankton at marine locations MJ1 – MJ6 (No. of cells x 10^{-4} L^{-1})

Species	MJ1	MJ2	MJ3	MJ4	MJ5	MJ6
Bacillariophyceae						
Azeiptia africana	1	1	2	2	1	1
Azeiptia antaractica						
Biddulphia aurita	2	1	2		1	1
Chaetoceros curvisetus		4				
Chaetoceros teres	4					
Chaetoceros simplex	5	1		1	1	
Cyclotella meneghениana	1					
Cyclotella operculata	4	6	3	1	1	2
Guinardia striata		3	1			
Leptocylindericus minimus	49	109		39	20	17
Lithmodesmium undulatum	1	1				
Navicula cancellata			1			
Nitzschia closterium	7	7		2	3	1
Pseudonitzschia lineola	9	58	2	30	5	2
Skelatonema costatum	23	20	14	15	17	15
Thalassiosira antarctica	1					
Subtotal	**107**	**211**	**25**	**90**	**49**	**39**
Dinophyceae						
Amphidinium sp		7	2		1	1
Amphisolenia bidentata	1					
Gymnodinium mikimotoi	1	4				
Gymnodinium simplex	8	1				
Gymnodinium subconica		16		3	2	4
Diplopsalis sp	1	1				
Exuviella apora	2	17	1	10	6	2
Oxytoxum sp	4	7	2	3	3	3
Prorocentrum arcuatum		2				
Prorocentrum compressum	1					
Prorocentrum gracile	11	6		20	4	2
Prorocentrum mechanis	2	1				
Protoperidinium crassipes		2				
Protoperidinium pellucidum		2				
Protoperidinium wellei		4				
Protoperidinium cerasus		2		4		
Subtotal	**31**	**72**	**5**	**40**	**16**	**12**
Cryptophyceae						
Hillea fusiformis	3	5				
Rhdomonas salina		1				
Subtotal	**3**	**6**	**0**	**0**	**0**	**0**
Chlorophyceae						
Dictyocha fibula	13	11	9	16	9	7

Species	MJ1	MJ2	MJ3	MJ4	MJ5	MJ6
Dictyocha antaractica	1		1			
Dunaliella salina		2				
Subtotal	**14**	**13**	**10**	**16**	**9**	**7**
Cyanophyceae						
Anabaena circularis	2					
Subtotal	**2**	**0**	**0**	**0**	**0**	**0**
Euglenophyceae						
Euglena virides	10	25		16	18	15
Euglena proxima		1		1		
Subtotal	**10**	**26**	**0**	**17**	**18**	**15**
Total	**167**	**328**	**40**	**163**	**92**	**73**

Table 14: Ichthyoplankton distribution at marine locations MO1 - MO5

Species	MO1	MO2	MO3	MO4	MO5
Fish Eggs	+	-	-	-	-
Clupeidae	-	-	-	-	-
Mugillidae	+	-	-	-	-
Sparadae	+	-	-	-	-
Cichlidae	-	-	-	-	-
Cyprinidae	-	-	-	-	-

Table 15: Ichthyoplankton distribution at marine locations MJ1 – MJ6

Stations	MJ1	MJ2	MJ3	MJ4	MJ5	MJ6
Fish Eggs	+++	+++	++	+	+	-
Clupeidae	+	+	+	-	-	-
Mugillidae	+++	+	+	-	-	-
Sparadae	+	-	-	-	-	-

\+ Present - Absence

Table 16: Sediment infauna distribution at marine locations MO1 - MO5 (organisms/200 cm³)

Species	MO1	MO2	MO3	MO4	MO5
> 1 mm					
Cnidaria, Hydroidea					
Syntheciidae evansi	9	0	0	17	43
Mollusca, Bivalvia					
Glycimeris pilosa (m)	0	0	0	2	0
Margaritifera sp. (f)	0		0	0	0
Bulinus sp. (f)	0	0	0	0	0
Biomphalaria sp. (f)	0	0	0	0	0
Polychaeta					
Nerilla mediterranea	7	0	0	21	12
Polygordius lacteus	12	0	0	0	0
Eulalia viridis	2	0	0	0	0
Hesione pantherina	1	4	0	3	5
Raphidrilus nemasoma	0	0	0	1	3
Polyphthalmus pictus	0	0	0	0	0
Amphipoda					
Ampelisca diadema	0	0	0	7	10
> 0.5 mm					
Gnathostomulida					
Gnathostomula sp	10	0	0	0	0
Nemathelminthes, Gastrotricha					
Urodasys viviparus	7	0	0	0	0
Macrodasys caudatus	4	0	0	0	0
Spinculida					
Spinculus nudus	8	0	0	0	0
Thalassema gigas	3	0	0	0	0
> 0.05 mm					
Harpacticoid Copepoda					
Stenhelia inopinata	0	0	0	90	110
Foraminifera					
Elphidium crispum	123	73	22	137	116
Nematoda					
Monhystrea parva	0	0	0	0	0
Crenopharynx sp	0	61	53	36	34
Monoposthia chinensis	15	0	0	16	20
Euchromadora striata	0	0	0	0	0
Total Individual counts	**201**	**138**	**75**	**330**	**353**
Total No. of species	**12**	**3**	**2**	**10**	**9**

Table 17: Sediment infauna distribution at marine locations MJ1 – MJ4 (organisms/200 cm^3)

Species	MJ1	*MJ2*	MJ3	MJ4
> 1 mm				
Bryozoa, Bicellariidae				
Bugula neritina	0	*13*	70	40
Fishes				
Anguilla anguilla (elver)			1	
> 0.5 mm				
Polychaeta				
(un known)	3	*0*	0	0
Ostracoda				
Candona sp	21	*0*	53	0
Amphipoda				
Ampelisca diadema	0	*0*	5	0
> 0.05 mm				
Harpacticoid Copepoda				
Stenhelia inopinata	82	*0*	67	0
Psammis sp.	0	*0*	59	0
Foraminifera				
Elphidium crispum	63	*101*	0	14
Ammodiscus sp.	43	*74*	100	10
Trohemmina inflata	43	*43*	87	0
Trohemmina labiosa	38	*21*	99	23
Halyphysema sp.	0	*0*	18	0
Quinqueloculina sp.	311	*0*	0	0
Nematoda				
Monhystrea parva	33	*14*	11	12
Crenopharynx sp	52	*16*	14	15
Enoplus sp	27	*10*	17	20
Euchromadora striata	40	*0*	10	0
Ptycholiamellus ponticus	0	*0*	48	0
Total Individual counts	**756**	***292***	**659**	**134**
Total No. of species	**12**	**8**	**15**	**7**

Table 18: Protozoa analysis results for sediment samples at marine locations MO1 - MO5

Protozoa Species	MO1	MO2	MO3	MO4	MO5
Arcella spp	-	-	-	-	-
Carchesium polypinum	-	-	-	-	-
Epistylis plicatilis	-	-	-	-	-
Centropyxis aculeata	-	-	-	-	-
Difflugia urceolata	-	-	-	-	-
Euplotes affinis	-	-	-	-	-
Aspidisca spp	+	+	+	+	+
Euplotes vannus	+	+	+	+	+
Holosticha diademata	+	+	+	+	+
Protocruzia spp	+	+	+	+	+
Uronema spp	+	+	+	+	+
Parasitic protozoa					
Giardia	-	-	-	-	-
Cryptosporidia	-	-	-	-	-
Blastocystis	-	-	-	-	-

+ Present
- Absent

Table 19: Protozoa analysis results for sediment samples at marine locations MJ1 – MJ4

Protozoa Species	MJ1	MJ2	MJ3	MJ4
Aspidisca spp	++	+	++	++
Euplotes vannus	+	+	+	+
Holosticha diademata	-	-	-	-
Protocruzia spp	+	++	+	+
Uronema spp	+	+	++	++
Parasitic protozoa				
Giardia	-	-	-	-
Cryptosporidia	-	-	-	-
Blastocystis	-	-	-	-

++ Dominant
+ Present
- Absent

Table 20: Standing crop of different zooplankton (org/m³) recorded in freshwater samples

Species	MF1	MF2	MF3	MF4	MF5
Rotifera					
Anuraeopsis fissa (Gosse)	2000	0	1000	0	0
Asplanchna girodi De Guerne	7000	9000	3000	0	0
Asplanchna seiboldi Leydig	1000	3000	0	0	0
Brachionus angularis Gosse	6000	2000	9000	0	3000
Brachionus calyciflorus Pallas	8000	9000	6000	1000	1000
Brachionus caudatus (Barrois & Daday)	2000	0	1000	4000	0
Brachionus falcutus Zacharias	2000	1000	0	0	0
Brachionus quadridentatus (Hermann)	5000	1000	1000	0	0
Brachionus urceolaris (Muller)	3000	1000	0	0	0
Colurella adriatic (Ehr.)	2000	0	0	0	0
Epiphan brachionus (Ehr.)	0	1000	0	2000	0
Filinia longiseta Ehr.	3000	1000	0	0	1000
Hexarthra mira Hudson	2000	0	0	1000	0
Horella brihami Donner	4000	1000	0	0	0
Lepadella patella Muller	3000	2000	0	0	0
Lecane bulla Gosse	0	0	1000	2000	0
Lecane closterocera Schmarda	0	1000	0	0	0
Lecane luna Muller	2000	0	0	1000	0
Lecane lunaris Ehr.	1000	2000	0	0	0
Polyarthra vulgaris Carlin	6000	3000	2000	4000	2000
Synchaeta oblonga Ehr.	0	0	2000	3000	0
Synchaeta pectinata Ehr.	1000	3000	0	0	0
Trichocerca pusilla Jennings	2000	0	0	0	0
Keratella cochlearis Gosse	5000	2000	0	0	0
Keratella quadrata Muller	1000	0	0	1000	0
Keratella tropica Apestin	3000	1000	0	2000	0
Subtotal	**71000**	**43000**	**26000**	**21000**	**7000**
Cladocera					
Alona intermedia Sars	3000	0	1000	0	0
Bosmina longirostris Muller	2000	3000	2000	4000	1000
Chydorus sphaericus Muller	2000	0	0	1000	1000
Ceriodaphnia quadringula Muller	1000	3000	0	1000	0
Diaphanosoma excisum Sars	0	0	2000	0	0
Macrothrix laticornis Jurine	1000	0	1000	0	1000
Moina micrura Kurz	4000	15000	1000	3000	0

Species	**MF1**	**MF2**	**MF3**	**MF4**	**MF5**
Simocephalus vetulus Muller	2000	1000	3000	0	0
Subtotal	**15000**	**22000**	**10000**	**9000**	**3000**
Copepoda					
Nauplius larvae	3000	4000	2000	5000	1000
Cyclopoid copepodid	2000	1000	1000	2000	0
Calanoid copepodid	0	2000	0	0	0
Acanthocyclops robustris Sars	2000	1000	1000	0	0
Mesocyclops ougunnus Onabamirs	1000	0	0	1000	0
Thermocyclops neglectus Sars	2000	1000	0	0	0
Schozopira niloticus	0	0	1000	3000	0
Nitocra lacustris	0	0	0	1000	0
Onycocamptus mohammed	1000	0	0	0	0
Subtotal	**11000**	**9000**	**5000**	**12000**	**1000**
Meroplankton					
Free living Nematoda	0	0	1000	0	0
Chironomous larvae	1000	2000	0	2000	0
Ostracoda	0	0	0	0	1000
Subtotal	**1000**	**2000**	**1000**	**2000**	**1000**
Total Number	**98000**	**76000**	**42000**	**44000**	**12000**

Table 21: Qualitative Phytoplankton species recorded in freshwater samples

Species	MF1	MF2	MF3	MF4	MF5
Chlorophyceae					
Actinastrum hantzschii			*		*
Characium gracilipes	*				
Chlorella vulgaris					*
Coenochloris pyrienoidosa			*	*	*
Errerella bornhemiensis	*	*		*	
Glonkonia raadiata			*	*	
Kirchneriella obesa					*
Micractinium pusillum		*		*	
Moeogotie sp	*	*	*	*	*
Oocystis elleptica			*		*
Pandorina morum			*	*	
Pediastrum duplex		*	*	*	*
Pediastrum duplex var. clathratum	*			*	
Pediastrum simplex var duodenarium		*	*		
Planktonema braurnii	*				
Scenedesmus bicuadatus					*
Scenedesmus quadricauda			*		*
Scenedesmus spinosus		*	*		*
Selenastrum gracile					*
Staurastrum natator		*		*	*
Tetraedron trigonum					*
Tetraedron caudatrum			*		*
Bacillariophyceae					
Campylodiscus nuricus	*		*		
Chaetoceros simplex	*				
Cyclotella mengeheniana	*		*		
Melosira granulata		*			*
Melosira granulata var angustissima	*	*	*		
Navicula pupula		*			*
Synedra ulna	*	*	*		*
Synedra ulna var bicapitata			*		*
Dinophyceae					
Gymnodinium simplex				*	*
Peridinium welli		*			
Cyanophyceae					
Chroococcus limneticus		*			*
Chroococcus despersus			*		*
Microcystis aeruginosa		*		*	
Microcystis flose-aquae	*		*		
Microcystis gravillie	*	*	*		
Oscillatoria subrevis					*

Table 22: Quantitative Phytoplankton distribution (No. of cells x 10^{-4} L^{-1}) in freshwater samples

Species	MF1	MF2	MF3	MF4	MF5
Chlorophyceae					
Ankistrodesmus fusiformis	1				
Ankistrodesmus hantzschii	1			2	
Carteria sp			1	1	
Chlamedomonas globosa	2	3		1	1
Chlorella protothecoides	608	414	504	280	387
Chlorella vulgaris	91	50			60
Crucugenia rectangularis					16
Crucugenia tetrapedia					8
Dysmorphococcus globosus				4	
Franceia radiata	3	3			1
Kircdhneriella lunaris	8	6	2	1	
Legerhimia genevensis	1				
Micractinium pusillum			6	24	30
Monoraphidium contortum	2		1	1	
Oocystis elleptica	2		4	4	
Oocystis parva		4			
Oocystis solitoria					1
Pediastrum biawanse					32
Pediastrum duplex			94		
Pediastrum teres	8		8		
Planktonema braunii	2				2
Planktosphera gelatinosa	3	1	3	1	
Pyramimonas orientales	3				
Scenedesmus acutus					514
Scenedesmus bicuadatus			4		
Scenedesmus ecornis	4	8	8	8	
Scenedesmus intermidius		10	8		
Scenedesmus quadricauda		4	8	6	
Scenedesmus sempervernce	8				
Scenedesmus spinosus	4		12	8	4
Selenastrum capricornatum	5		1		
Selenastrum gracile	4		10	5	2
Staurastrum natator				2	1
Tetraedron caudatum		1	1		
Tetraedron minimum			2		
Tetraedron triangular		4	2	1	
Tetraedron trigonum					1
Tetrastrum staurogeniaeforme		4	12	4	
Subtotal	**760**	**512**	**691**	**353**	**1060**
Cyanophyceae					
Chroococcus dispersus				1.2	
Chroococcus limneticus					8

Species	MF1	MF2	MF3	MF4	MF5
Lybgya limnetica			1.5	4.2	2.3
Microcystis aeruginosa	2.3		13.2		
Microcystis flos-aquae					16
Oscillatoria subrevis				7	13
Phormidium molle			4	2.5	
Subtotal	**2.3**	**0**	**18.7**	**14.9**	**39.3**
Cryptophyceae					
Chroomonas acuta	1	29	8	1	1
Chryptomonas erosa	6		4		1
Chryptomonas obvata		13			
Chryptomonas ovata			6	2	
Chryptomonas phaseulos		5			
Subtotal	**7**	**47**	**18**	**3**	**2**
Bacillariophyceae					
Achnanthes minutissima				1	
Diatoma vulgare				4	
Melosira granulata			11		
Navicula salinarum	1				
Nitzschia amphibia			2	4	
Nitzschia filliformis var pusilla	2				
Nitzschia paleaceae				1	1
Synedra ulna			1		1
Subtotal	**3**	**0**	**14**	**10**	**2**
Dinophyceae					
Gymnodinium simplex	10	13	2	4	
Subtotal	**10**	**13**	**2**	**4**	**0**
Total	**782.3**	**572**	**743.7**	**384.9**	**1103.3**

Table 23: Ichthyoplankton distribution in freshwater samples

Species	MF1	MF2	MF3	MF4	MF5
Fish Eggs	+	+	+	+	+
Clupeidae	-	-	-	-	-
Mugillidae	-	-	-	-	-
Sparadae	-	-	-	-	-
Cichlidae	+	+	+	+	+
Cyprinidae	+	+	+	+	+

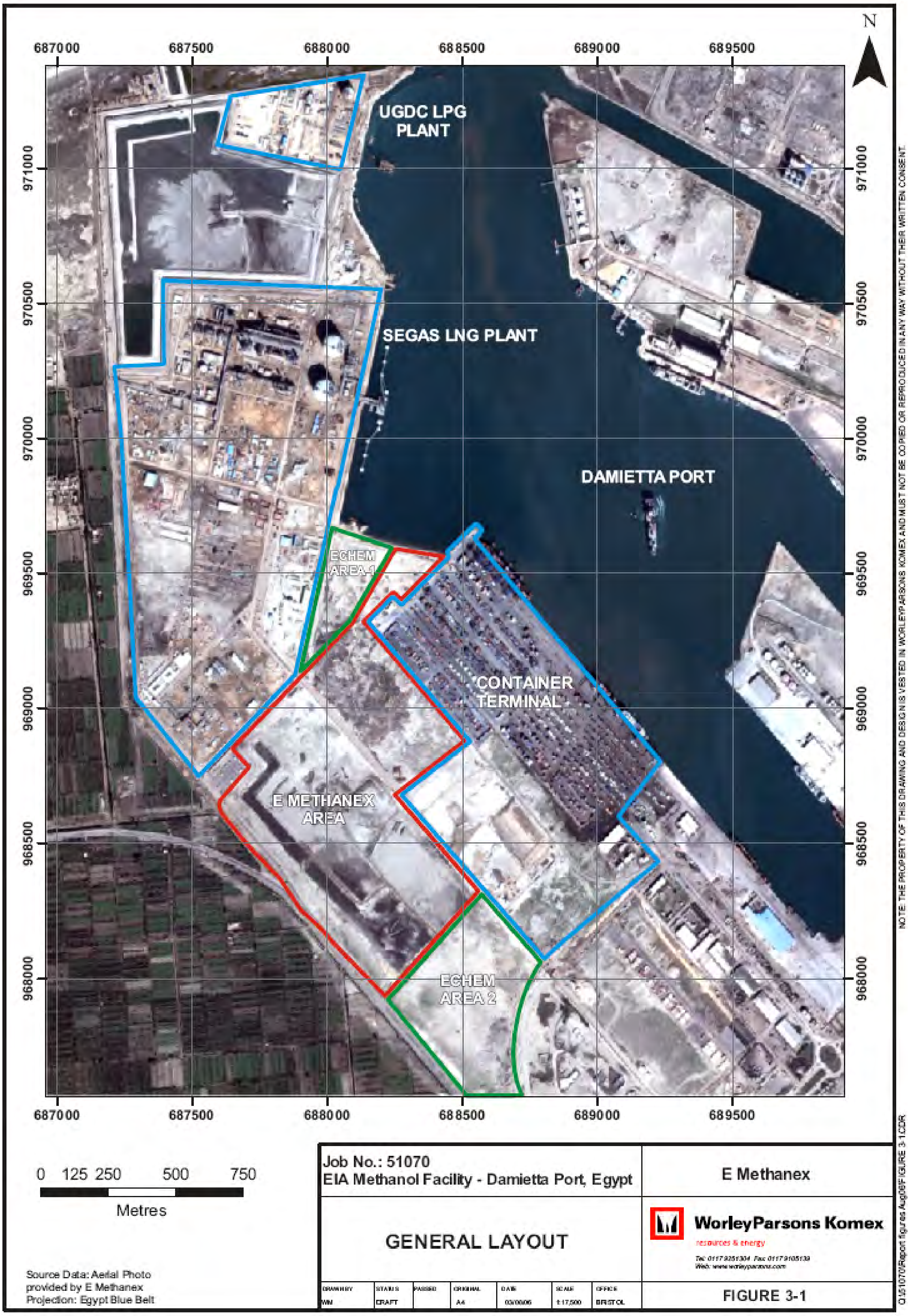
Table 24: Sediment infauna distribution in sediment samples from the freshwater intake (organisms/200 cm^3)

Species	MF1	MF2	MF3	MF 4	MF 5
> 1 mm					
Cnidaria, Hydroidea					
Syntheciidae evansi	0	0	0	0	0
Mollusca, Bivalvia					
Glycimeris pilosa (m)	0	0	0	0	0
Margaritifera sp. (f)	10	0	13	7	3
Bulinus sp. (f)	6	0	10	2	3
Biomphalaria sp. (f)	0	4	3	5	1
Polychaeta					
Nerilla mediterranea	0	0	0	0	0
Polygordius lacteus	0	0	0	0	0
Eulalia viridis	0	0	0	0	0
Hesione pantherina	0	0	0	0	0
Raphidrilus nemasoma	0	0	0	0	0
Polyphthalmus pictus	0	0	0	0	0
Amphipoda					
Ampelisca diadema	0	0	0	0	0
> 0.5 mm					
Gnathostomulida					
Gnathostomula sp	0	0	0	0	0
Nemathelminthes, Gastrotricha					
Urodasys viviparus	0	0	0	0	0
Macrodasys caudatus	0	0	0	0	0
Spinculida					
Spinculus nudus	0	0	0	0	0
Thalassema gigas	0	0	0	0	0
> 0.05 mm					
Harpacticoid Copepoda					
Stenhelia inopinata	0	0	0	0	0
Foraminifera					
Elphidium crispum	0	0	0	0	0
Nematoda					
Monhystrea parva	0	0	0	0	0
Crenopharynx sp	0	0	0	0	0
Monoposthia chinensis	0	0	0	0	0
Euchromadora striata	0	0	0	0	0
Total Individual counts	**16**	**4**	**26**	**14**	**7**
Total No. of species	**2**	**1**	**3**	**3**	**3**

Table 25: Protozoa analysis results for sediment samples from the freshwater intake

Protozoa Species	MF1	MF2	MF3	MF4	MF5
Arcella spp	+	+	+	+	+
Carchesium polypinum	+	+	+	+	+
Epistylis plicatilis	+	+	+	+	+
Centropyxis aculeata	+	+	+	+	+
Difflugia urceolata	+	+	+	+	+
Euplotes affinis	+	+	+	+	+
Aspidisca spp	-	-	-	-	-
Euplotes vannus	-	-	-	-	-
Holosticha diademata	-	-	-	-	-
Protocruzia spp	-	-	-	-	-
Uronema spp	-	-	-	-	-
Parasitic protozoa					
Giardia	-	-	-	-	-
Cryptosporidia	-	-	-	-	-
Blastocystis	-	-	-	-	-

APPENDIX XII – PLATES AND DRAWINGS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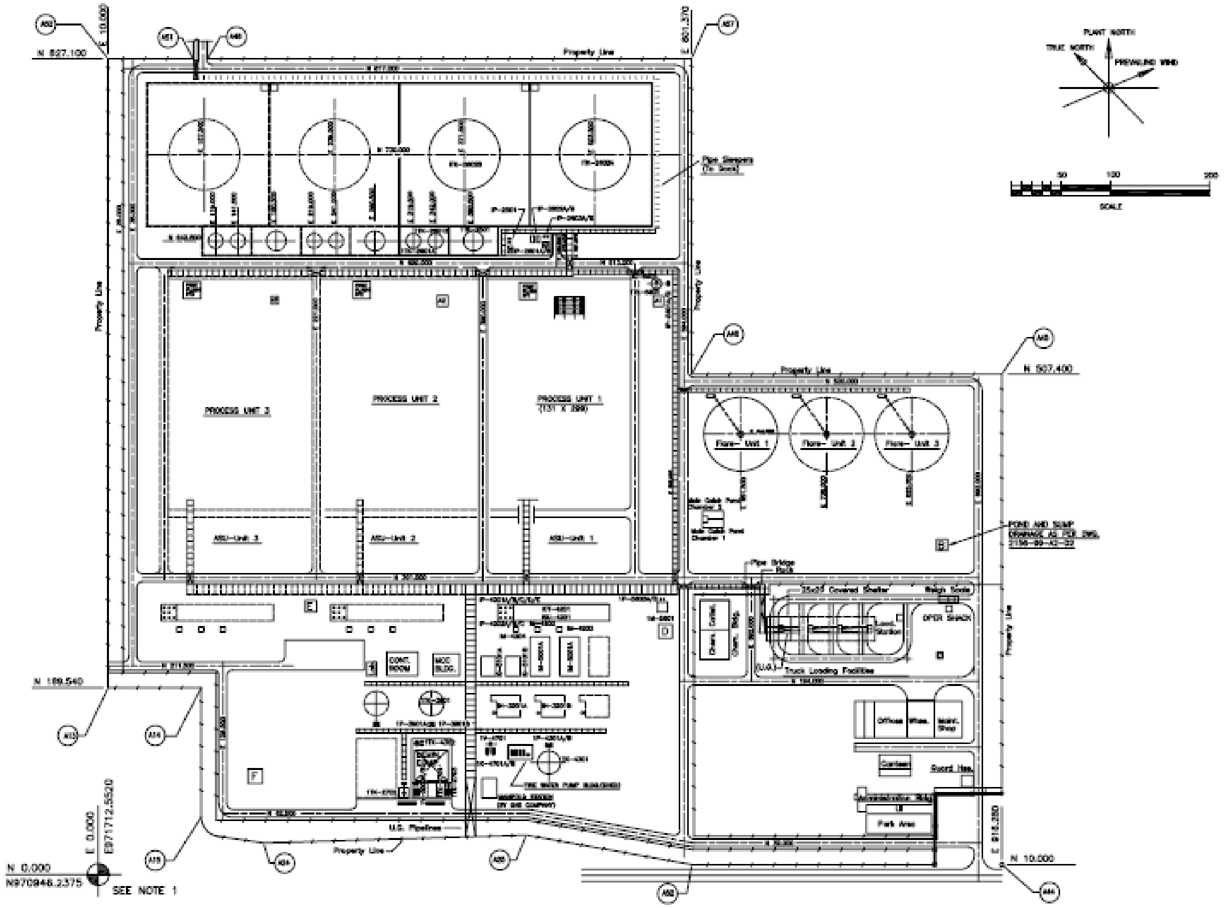
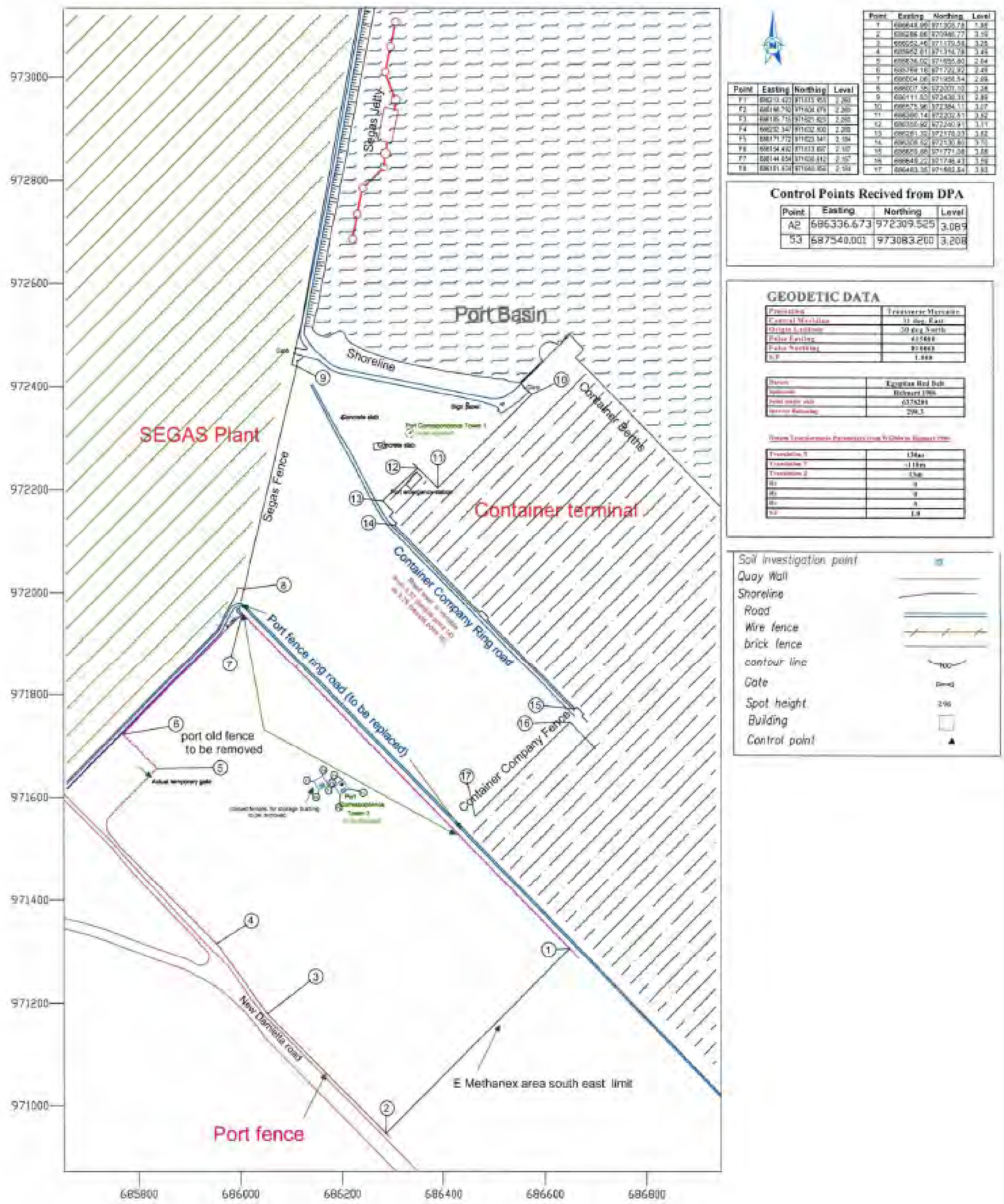
UGDC LPG PLANT
SEGAS LNG PLANT
DAMIETTA PORT
ECHEM AREA 1
CONTAINER TERMINAL
E METHANEX AREA
ECHEM AREA 2
0 125 250 500 750
Metres
Source Data: Aerial Photo provided by E Methanex
Projection: Egypt Blue Belt
Job No.: 51070
EIA Methanol Facility - Damietta Port, Egypt
E Methanex
GENERAL LAYOUT
WorleyParsons Komex
resources & energy
FIGURE 3-1
NOTE: THE PROPERTY OF THIS DRAWING AND DESIGN IS VESTED IN WORLEYPARSONS KOMEX AND MUST NOT BE COPIED OR REPRODUCED IN ANY WAY WITHOUT THEIR WRITTEN CONSENT.



Job No.: 51070/KE60029 DAMIETTA PORT, EGYPT	E METHANEX
METHANOL FACILITY SITE PLAN	WorleyParsons Komex

DRAWN BY	STATUS	PASSED	ORIGINAL	DATE	SCALE	ISSUING OFFICE	DRAWING NUMBER	REV
WM	DRAFT		A3	JUL 2006	1:4000	BRISTOL	FIGURE 3-2	

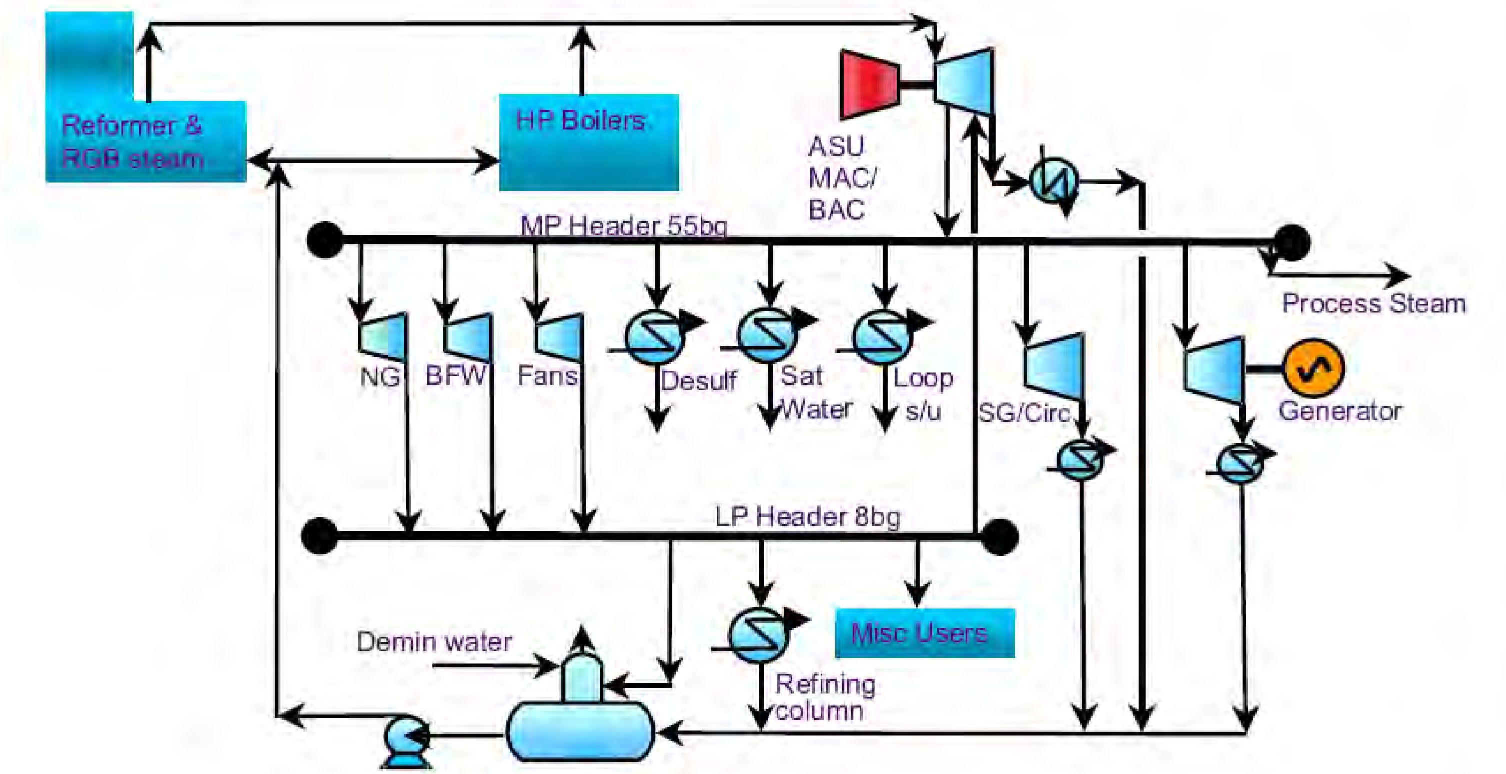
DRAWING REFERENCE:
DAVY PROCESS TECHNOLOGY: EMETHANEX DAMIETTA 1 PROJECT, SITE PLAN-PLANT, DWG. NO.: 2156-00-PI-D1, MARCH 2006



DRAWING REFERENCE:
Agis Consult, Figure 3.1: 'General Layout', January 2006

JOB NO.: 51070/KE60029 DAMIETTA PORT, EGYPT	E METHANEX
SITE LAYOUT	WorleyParsons Komex resources & energy

DRAWN BY	STATUS	PASSED	ORIGINAL	DATE	SCALE	ISSUING OFFICE	DRAWING NUMBER	REV
WM	DRAFT		A3	JUL 2006	1:7500	BRISTOL	FIGURE 3-3	_



JOB NO.: 51070/KE60029
DAMIETTA PORT, EGYPT

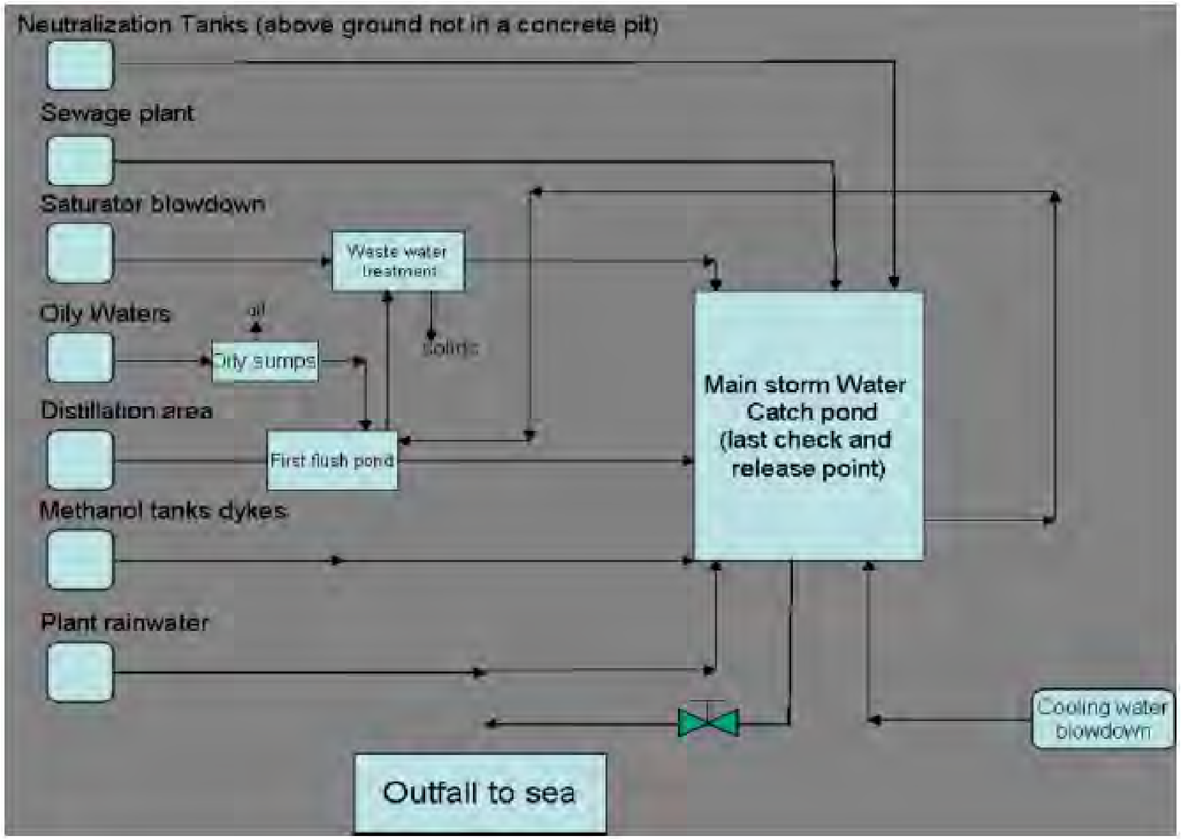
E METHANEX

STEAM SYSTEM LAYOUT

WorleyParsons Komex

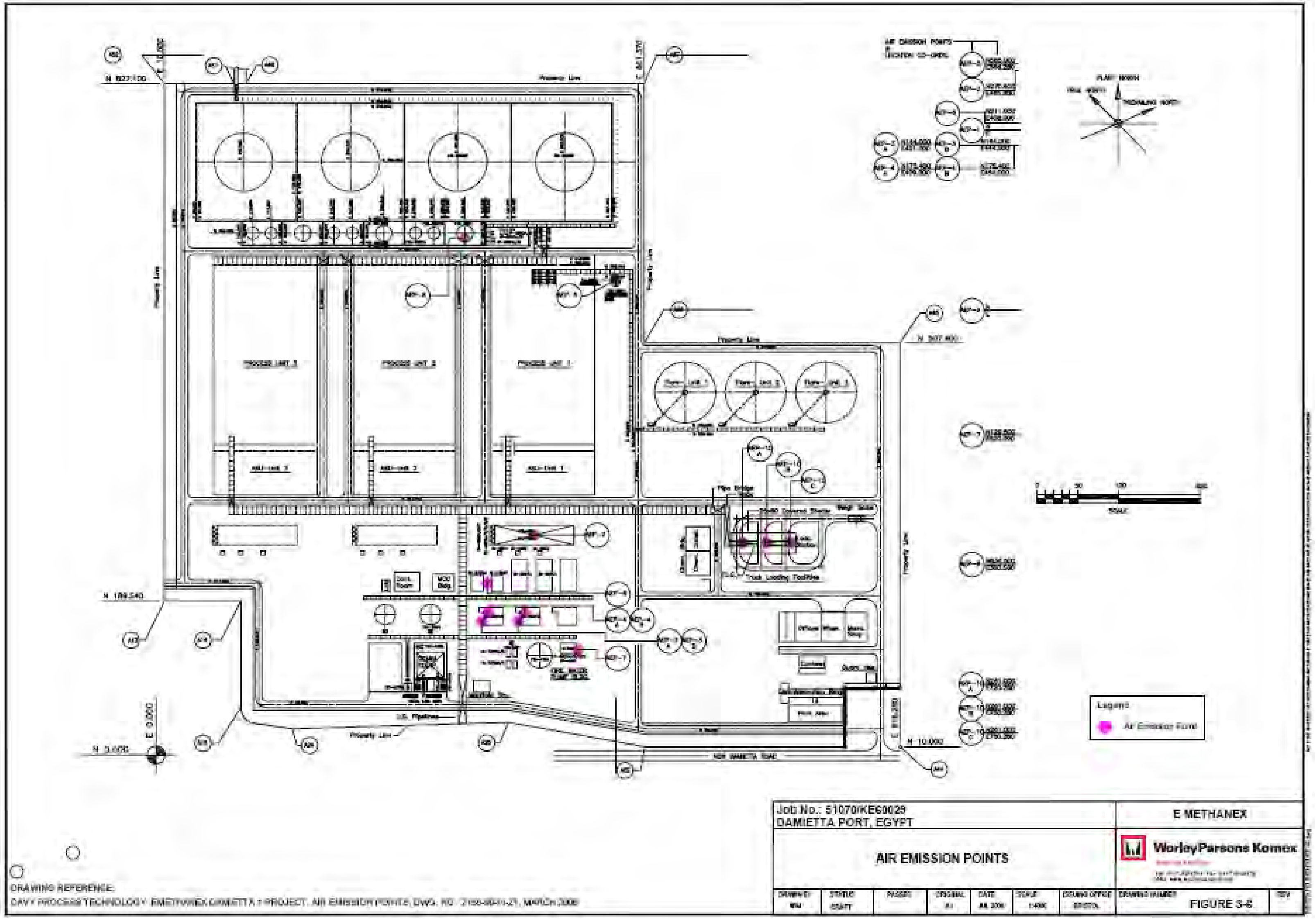
DRAWN BY	STATUS	PASSED	ORIGINAL	DATE	SCALE	ISSUING OFFICE	DRAWING NUMBER	REV
WM	DRAFT		A4	JUL 2006	N/A	BRISTOL	FIGURE 3-4	–

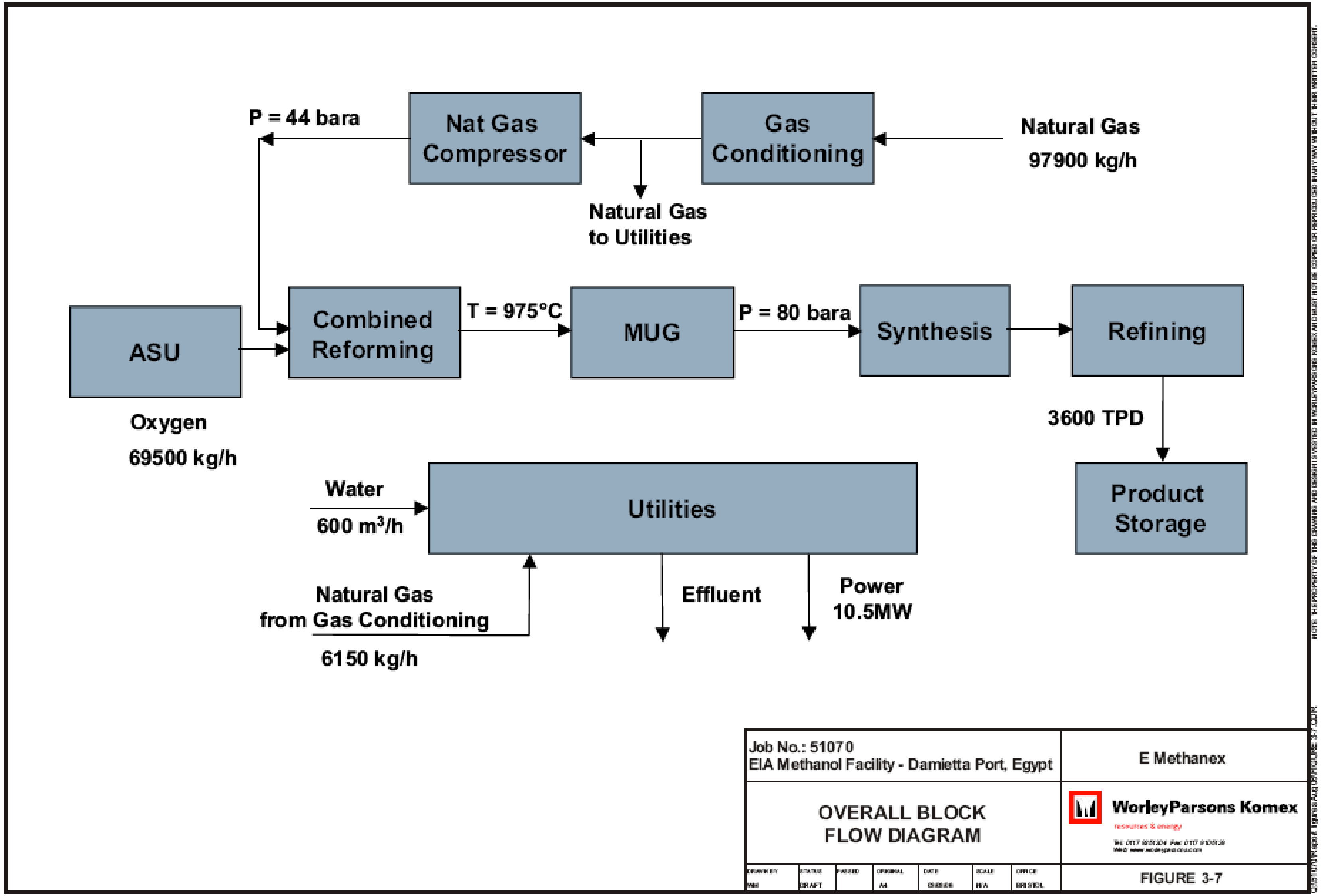
DRAWING REFERENCE:
WorleyParsons EIA report KE-60029, Figure 3.95: 'Steam System'

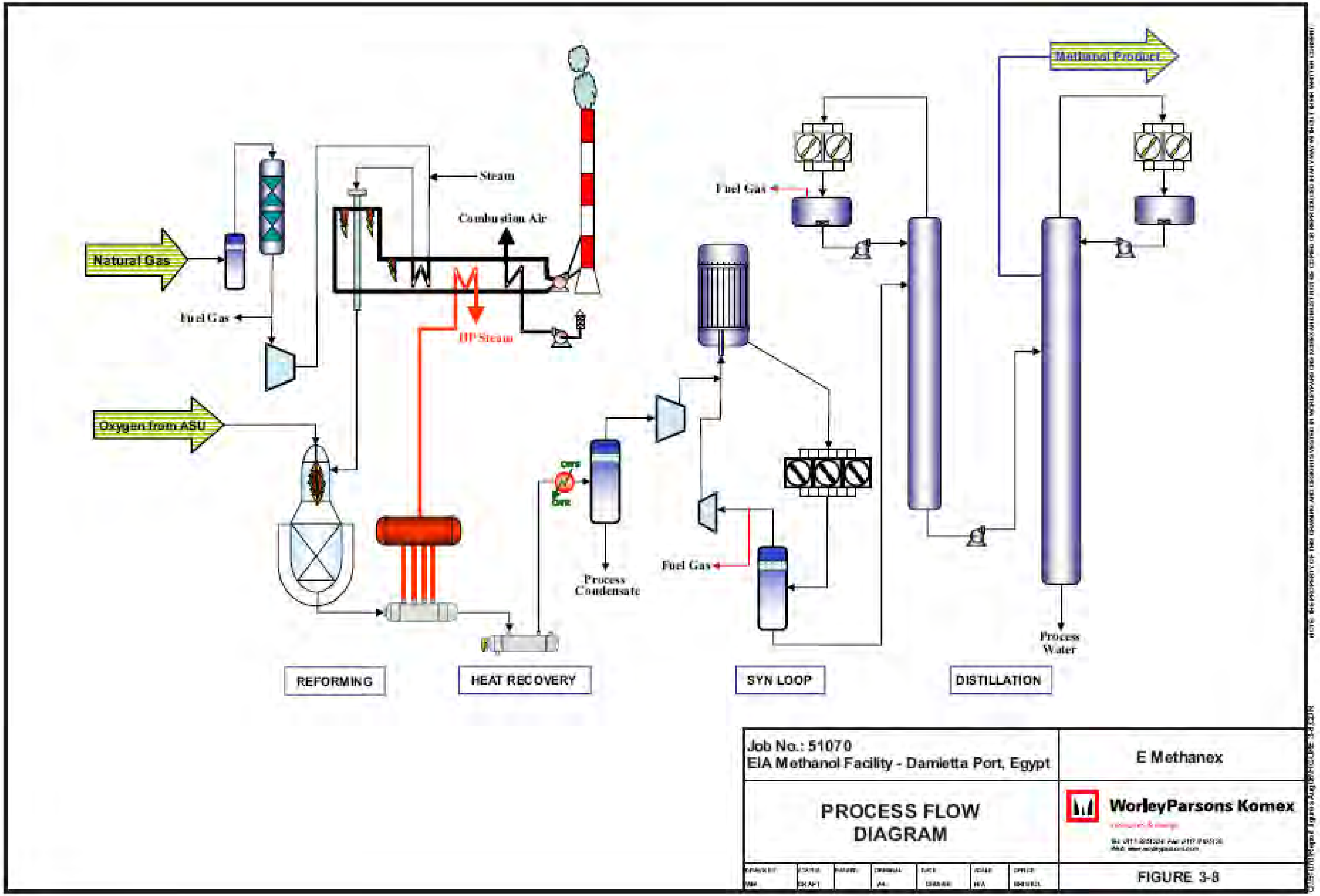


DRAWING REFERENCE:
WorleyParsons EIA report KE-60029, Figure 3.116:
'Methanol Plant Liquid Effluent'

JOB NO.: 51070/KE60029 DAMIETTA PORT, EGYPT							E METHANEX	
METHANOL PLANT LIQUID EFFLUENT							WorleyParsons Komex	
DRAWN BY	STATUS	PASSED	ORIGINAL	DATE	SCALE	ISSUING OFFICE	DRAWING NUMBER	REV
WM	DRAFT		A4	JUL 2006	N/A	BRISTOL	FIGURE 3-5	–


Legend
Air Emission Point
DRAWING REFERENCE:
Job No.: 51070/KE60029
DAMIETTA PORT, EGYPT
AIR EMISSION POINTS
E METHANEX
WorleyParsons Komex
FIGURE 3-6


P = 44 bara
Nat Gas Compressor
Gas Conditioning
Natural Gas
97900 kg/h
Natural Gas to Utilities
ASU
Combined Reforming
T = 975°C
MUG
P = 80 bara
Synthesis
Refining
Oxygen
69500 kg/h
3600 TPD
Water
600 m³/h
Utilities
Product Storage
Natural Gas from Gas Conditioning
6150 kg/h
Effluent
Power 10.5MW
Job No.: 51070
EIA Methanol Facility - Damietta Port, Egypt
E Methanex
OVERALL BLOCK FLOW DIAGRAM
WorleyParsons Komex
FIGURE 3-7


Natural Gas
Fuel Gas
Steam
Combustion Air
HP Steam
Oxygen from ASU
Process Condensate
Fuel Gas
Fuel Gas
Methanol Product
Process Water
REFORMING
HEAT RECOVERY
SYN LOOP
DISTILLATION
Job No.: 51070
EIA Methanol Facility - Damietta Port, Egypt
E Methanex
PROCESS FLOW DIAGRAM
WorleyParsons Komex
FIGURE 3-8

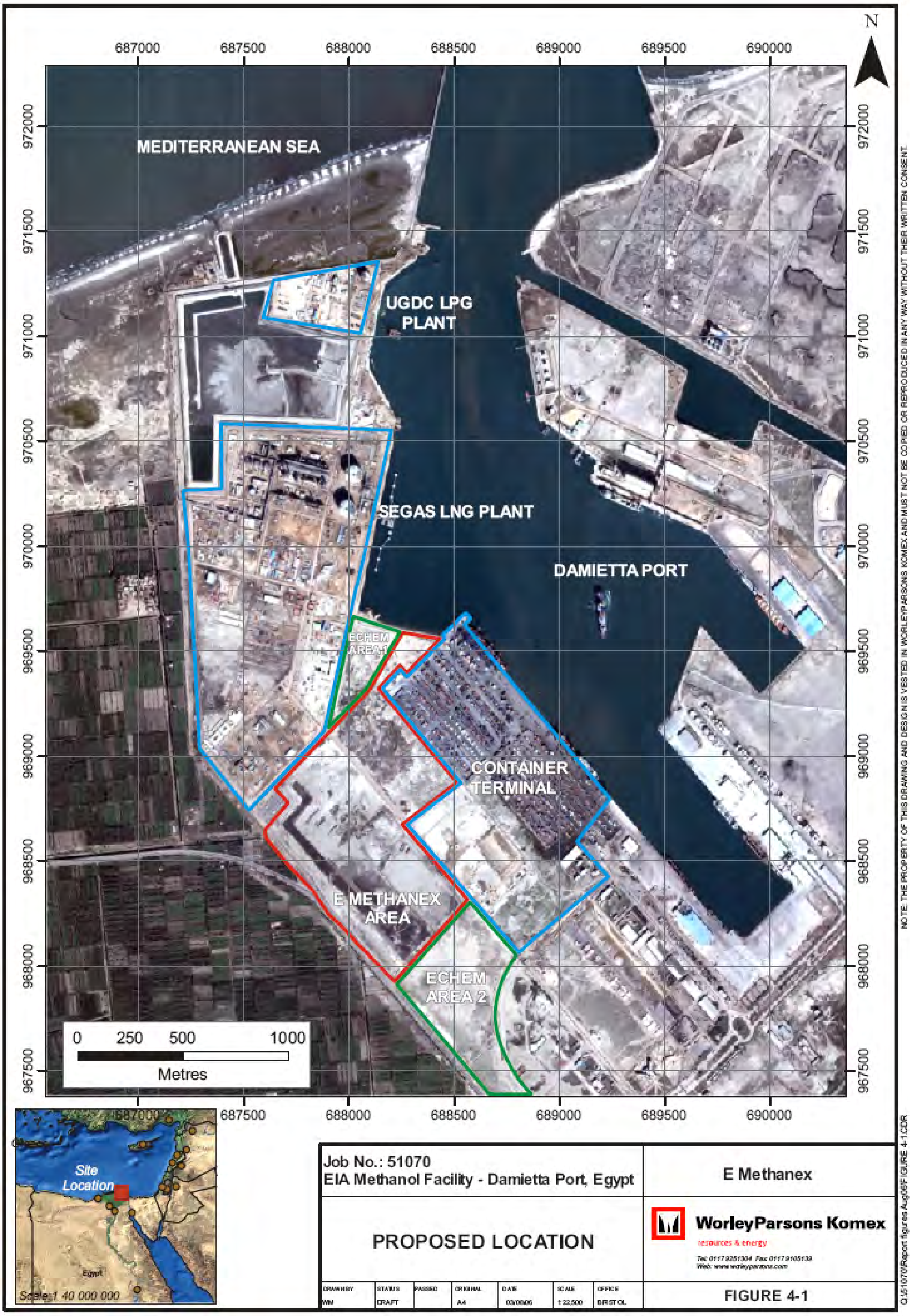

N
MEDITERRANEAN SEA
UGDC LPG PLANT
SEGAS LNG PLANT
DAMIETTA PORT
ECHEM AREA 1
CONTAINER TERMINAL
E METHANEX AREA
ECHEM AREA 2
0 250 500 1000
Metres
687000 687500 688000 688500 689000 689500 690000
972000 971500 971000 970500 970000 969500 969000 968500 968000 967500
Site Location
Egypt
Scale 1:40 000 000
Job No.: 51070
EIA Methanol Facility - Damietta Port, Egypt
E Methanex
PROPOSED LOCATION
WorleyParsons Komex
resources & energy
FIGURE 4-1
DRAWN BY WN
STATUS DRAFT
PASSED
ORIGINAL A4
DATE 03/06/06
SCALE 1:22,500
OFFICE BRISTOL
NOTE: THE PROPERTY OF THIS DRAWING AND DESIGN IS VESTED IN WORLEYPARSONS KOMEX AND MUST NOT BE COPIED OR REPRODUCED IN ANY WAY WITHOUT THEIR WRITTEN CONSENT.

Plate 1: Project Location

Plate 2: Nile Fish Farming at Water Intake

Plate 3: Onsite Air Measurement

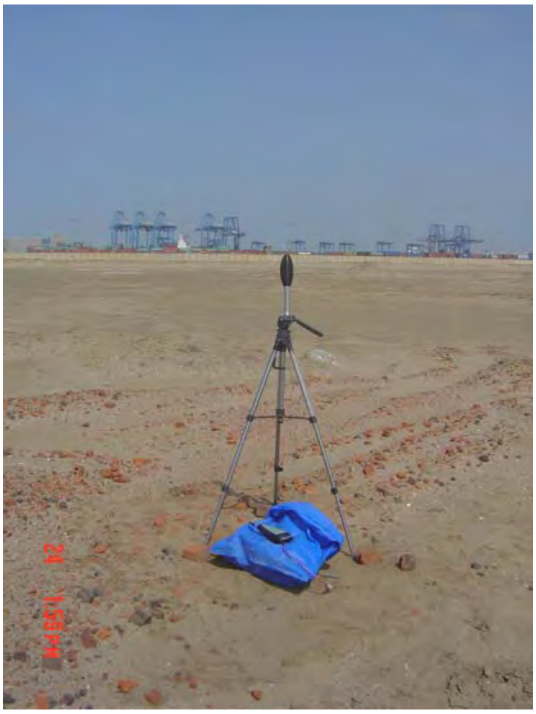


Plate 4: Onsite Noise Measurement (Type I and Type II)

Plate 5: Onsite measurements using YSI 566

Plate 6: Onsite Chlorine Analysis

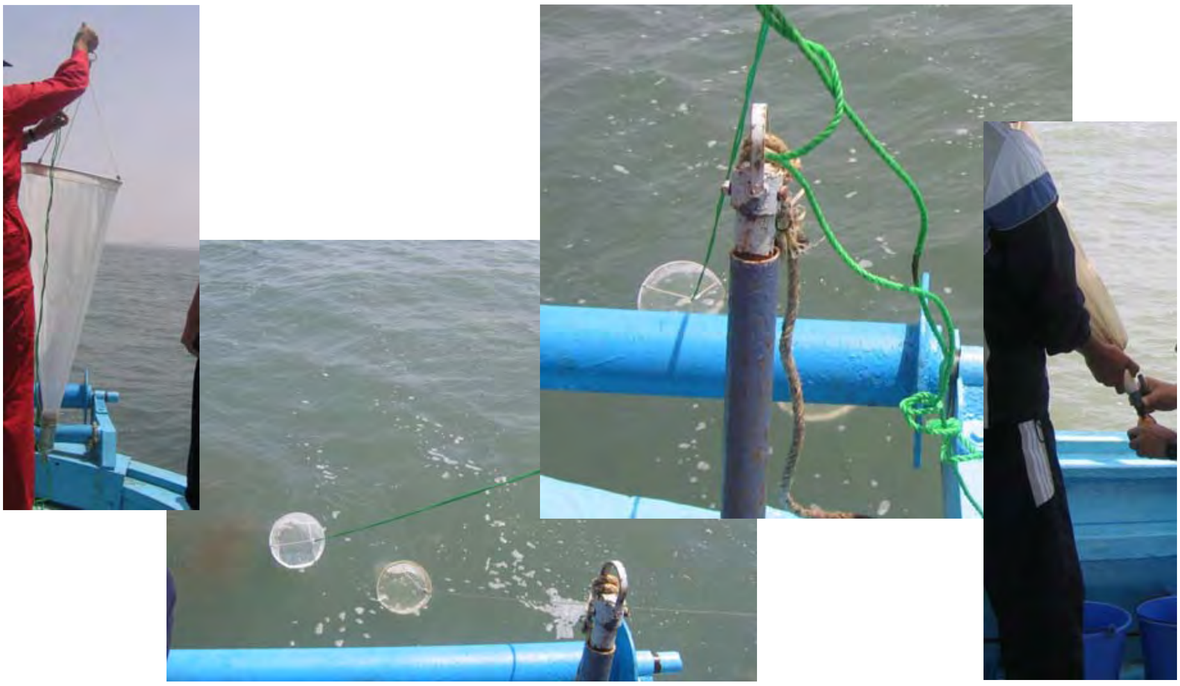


Plate 7: Seawater sampling using Plankton Nets

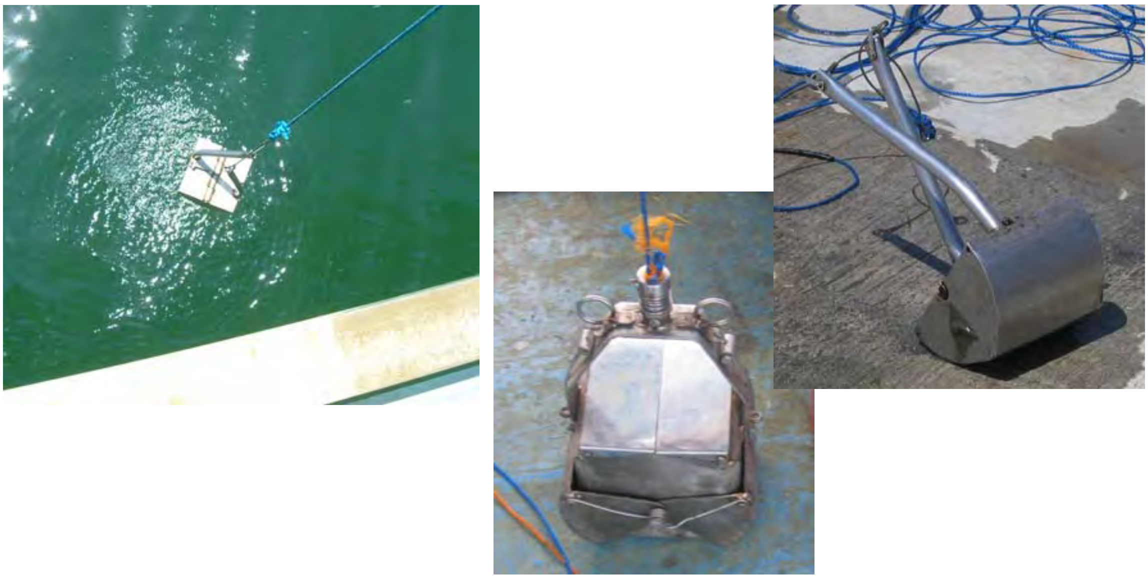


Plate 8: Seabed Sediments sampling using Grab Samplers

APPENDIX XIII – DAMIETTA GOVERNORATE REPORT ON THE PUBLIC CONSULTATION MEETING

Report on the public consultation meeting concerning the Environmental Impact Assessment for the EMethanex project at the Damietta port free zone (8 June 2006)

This report is the translation of the document provided by Eng. Adnan Abdel Galil, Assistant General Secretary, and Mr Hamed Ahmed Farrag, Head of the Environmental Dept.- Environmental Management Unit, Damietta Governorate

This public consultation meeting was conducted within the framework of the Environmental Impact Assessment (EIA) study for the construction and operation of the methanol facility owned by EMethanex at Damietta Port industrial complex in the free zone, and in accordance with the requirements of the Egyptian Environmental Affairs Agency (EEAA), including the necessity of conducting a public consultation workshop for the project during the EIA preparation.

The main purposes of this meeting are to disseminate and familiarize the public, key stakeholders, and beneficiaries on the project; to update all attendees with the current status of the project; to demonstrate the company's commitment to the environment; to allow a forum for comments and feedback, if any, on the project, and to explore the attendees opinions and concerns, in order to include them in the EIA, which will further be submitted to the EEAA, in accordance with law no. 4 for year 1994 and its executive regulations. The attendees included: Director of the central department for the free industrial zone, a representative of Damietta Port Authority, the Development Authority of New Damietta City, local NGOs, university professors (from faculties of science and education), presidents of local units adjacent to the project (Kafr El-batteekh, El-Senaneya), members and representatives of local people's assemblies, representatives of the national council for women, representatives of the EEAA EIA department in Cairo, and a representative of the environmental agency's branch in Dakahlia, a representative of ECHEM company, Mr. Larry Goodyear - representative of EMethanex, and Mr. Mohamed Hassan - WorleyParsons Komex - Middle East director.

Following the discussions, the workshop was concluded with the following recommendations:

1. The need for conducting a comprehensive study that shows the expected pollution loads in the port area. This study is to be conducted by the group of companies in the area (SEGAS, MOBOCO, EMethanex, etc.). A coordination meeting should be conducted in this respect between the aforementioned companies, the EEAA and its local branch (RBO), and all other concerned parties. It is also important to prepare a detailed description of all current and prospective activities, and the means of maintaining environmental compatibility.

2. Recommendation to the New Damietta City Development Authority, the industrial free zone, the Port Authority, the port free zone, the heads of the local cities and units (Kafr Elbatteekh and El-Senaneya), and EEAA, to set a buffer zone surrounding and adjacent to the free industrial zone boundaries, taking into account avoiding any random construction expansions that could negatively impact the inhabitants or the existing belongings.
3. Requiring EMethanex, SEGAS, and all other companies discharging their wastewater into the Mediterranean Sea to comply with the international criteria and standards for discharging to the marine environment, which should also be mentioned in the conditional environmental approval. The analysis results at the coastal areas, received from the Ministry of State for Environmental Affairs and the EEAA, have revealed the presence of high pollution levels at the port area, Ras Elbar shore, and new Damietta, which may in turn affect local tourism in the future.
4. Requiring all companies (existing and future) to contribute in establishing an environmental monitoring unit supervised by local NGOs and the institutions of the civil society, in order to act as a mediator between these companies and the civil society groups.
5. Requiring EMethanex to sign a protocol of cooperation with the General Authority for Youth Employment at the Damietta Governorate House and the Directorate of Manpower and Immigration, based on the available information concerning employment and manpower requirements in different needed disciplines, and the company can conduct the necessary training to hire 1500 workers during the construction stage, and 150 specialists during the operational stage.
6. It is also important for all industrial companies operating in the area to collectively conduct an integrative study to search for the best use of the treated industrial wastewater, provided that it complies with the relevant guidelines and standards; such wastewater could be used for example in closed-cycle systems of other facilities, cultivating unproductive trees, to create wind barriers, all of which are environmental projects that are needed in the area.
7. It is important that the company establishes environmental projects in the area, for example: the cultivation of trees to beautify the surrounding area, covering up some canals and drains that are severely polluted, deepening the navigational channel, paving roads, providing educational projects and post graduate studies at universities for the inhabitants of these areas, and to preserve the environment in these areas.
8. It is very important to conduct a study on how to preserve the agriculture, the productive trees, and the palms in the area, which represent a precious natural resource, together

with the company's commitment to avoid any environmental harm in these areas, as a primary condition to obtain the conditional environmental approval.

9. EMethanex must declare and list the means of disposal for all outputs from the different activities (solid, liquid, or gas), which should be handled safely and in compliance with the environmental law No.4 of the year 1994, its executive regulations, and all other relevant laws.
10. Requiring the company to conduct periodic measurements within the workplace and for all outputs from the facility; this should be documented in the facility's environmental register. In case the outputs are exceeding the approved standards, immediate treatment should be conducted or legal action taken.
11. It is important to provide full details of all devices and systems used for controlling and monitoring emissions inside and outside the workplace, which should comply with the laws regulating the activity, together with the development of a response plan for emergencies, accidents, and environmental disasters. A copy of this plan should be made available to the EEAA's Environmental Center for Crises Management.
12. In the case any hazardous material is used in the construction or operational stages, the quantity and type of this material should be identified, in addition to the method of disposal, with the obligation to re-export to the country of origin under the supervision of the Environment Department, the EEAA local branch (RBO), and the EEAA Hazardous waste management department in Cairo (sector).
13. The importance of health and safety measures for the workplace and workers, personal protective equipment, periodic medical examination, and the installation of fume hoods, filters, and treatment units for emissions within the workplace.
14. The need to prepare the environmental register and to make it available for inspection.
15. The need to take into account the social impacts of the project, such the impacts on employment, local community, and the economic impact on the local market.

APPENDIX XIV – PUBLIC CONSULTATIONS LISTS OF ATTENDEES

1st Public Consultation Meeting

CULTNAT, Cairo, Egypt (16 May 2006)

List of Attendees

	Name	Position	Organization
1	Larry Goodyear	Technical Operations Manager	EMethanex
2	Sadek El Kady	Project coordinator	EMethanex
3	Sherif Kamel	HSE Senior Specialist	ECHEM
4	Osama Kamal	Vice Chairman for planning & projects, member of the Board of Directors	ECHEM
5	Omar Mohammed Hassan	Chemist, environmental consultant - Nature Conservation Sector Capacity Building – Egyptian-Italian Environmental Cooperation Program	Natural Conservation Sector
6	Said M. Dahroug	National coordinator - Program Coordination Unit – Egyptian-Italian Environmental Cooperation Program	Natural Conservation Sector
7	Sherif Baha El Din	Project co-manager - Nature Conservation Sector Capacity Building - Egyptian-Italian Environmental Cooperation Program	Natural Conservation Sector
8	Ameer Abdullah	Global Marine Programme-IUCN (The World Conservation Union)	
9	Mahmoud Shawky	Egyptian Environmental Affairs Agency (EEAA)	
10	Mohamed Abdullah		
11	Amr Reda Orensa	– Sahara Safari (NGO) – Partner in Pinocchio co. for furniture	
12	Mohamed Abdel Rahman	Professor	Cairo University
13	Hala Barakat	Deputy Director	CULTNAT
14	Rania Mohamed	specialist	CULTNAT
15	Tamer El Shayal	researcher	CULTNAT
16	Mohamed Hefny	researcher	CULTNAT
17	Mr. Ebrahim Abdel Aziz	researcher	CULTNAT
18	Mohamed Abdel Gawad Hassan	Director- Middle East	WorleyParsons Komex
19	Ihab Maher Elsersy	Senior Environmental Specialist	WorleyParsons Komex
20	Sally El Komox	Environmental Specialist	WorleyParsons Komex

2nd Public Consultation Meeting

Al-Amal Club, Damietta, Egypt (8 June 2006)

List of Attendees

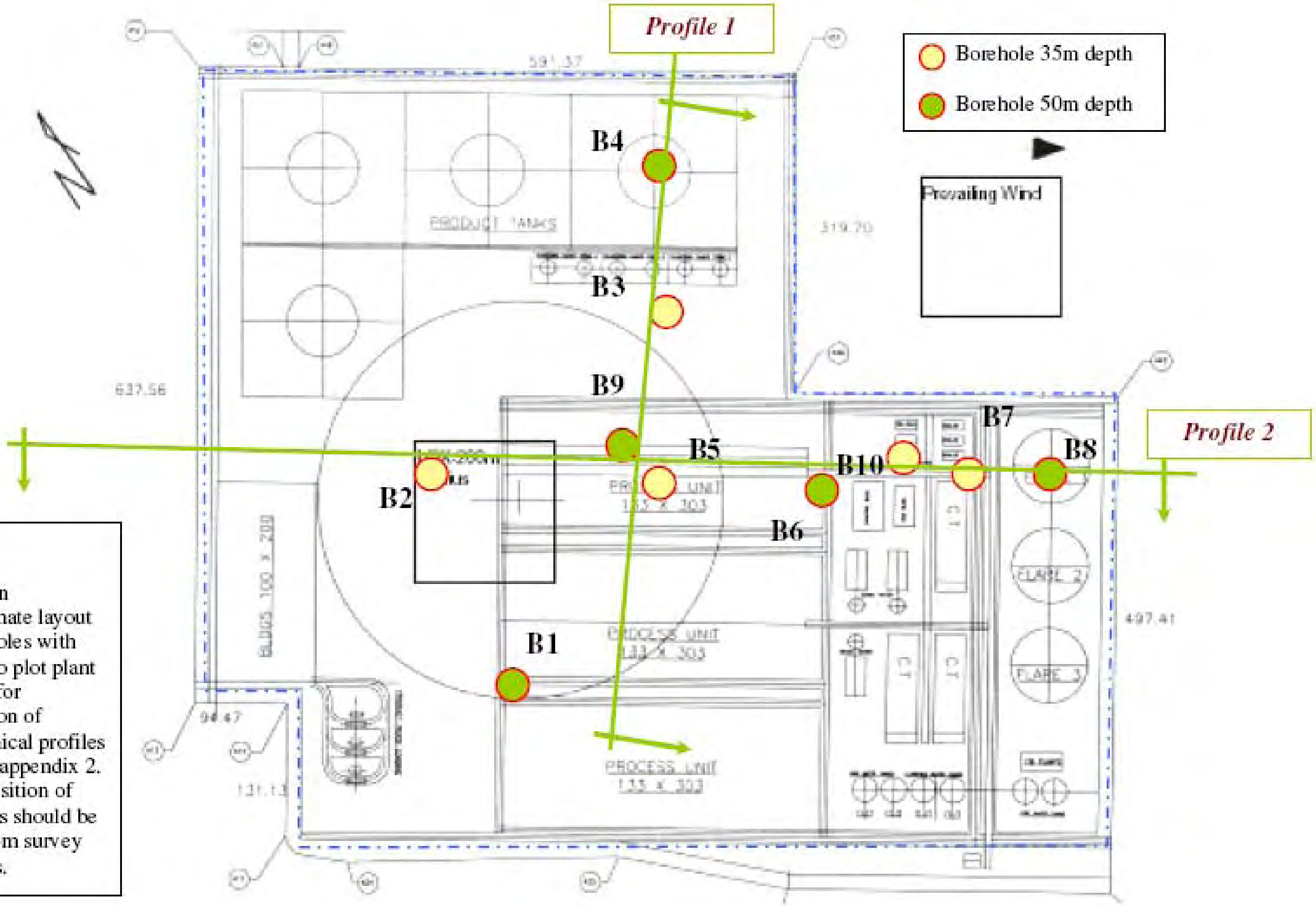
	Name	**Position**	**Organization**
1	Maher Elsaeed Nofal	Manager	Marshall Office for exporting Services
2	Mohamed Fahmy Ramadan	Project development manager	Agrium
3	Sadek Elkady	Project coordinator	EMethanex
4	Saeid Mohamed Elhady	Admin supervisor	EMethanex
5	Mohamed Hassan	Director- Middle East	WorleyParsons Komex
6	Larry Goodyear	Technical operations manager	EMethanex
7	Mohamed Elbarashy	General manager-Environment Dept.	Development Authority of New Damietta City
8	Lamyaa Elzanaty	Contracts and agreements specialist	ECHEM
9	Sherif Kamel	HSE senior specialist	ECHEM
10	Wasfy William Nashed	Manager-Industrial Security Dept.	Damietta Electrical Power Station
11	Mohamed Abdel Ghany Elezaby	Chairman of the Board of Directors	Society development community
12	Ahmed Abdel Raouf Taha	Engineer	Gasco
13	Osman Shehata	Head Consular at the Ministry of Petroleum	
14	Adel Mosad Mohamed	EEAA Technical office director-East Delta	Regional branch office of the EEAA-East Delta
15	Hamed Ahmed Farrag	Head of the Environmental Dept.-Environmental Management Unit	Damietta Governorate
16	Elsayed Elaraby Helmy	Head of solid Wastes Unit	Damietta Governorate
17	Kawthar Ibrahim	University professor	Damietta College of Education
18	Aly Elfodaly Hamed	General	Armed Forces
19	Haitham Mahmoud Hassan	Environmental researcher	EEAA
20	Yehia Abdel Aleem Gabr	Driver	Damietta Governorate - Environment Dept.
21	Aziza Abu Sabralah	Secretary General-Women Council-Damietta	College of Education
22	Raafat Mahmoud Sarhan	General manager at the General free zone	Investment Authority
23	Alhussein Radwan	Engineering dept.-Damietta free zone -	Investment Authority
24	Amr Mohamed Reda Oransa	Partner in Pinocchio co. for furniture	– Sahara Safari (NGO) – Pinocchio co. for furniture

	Name	Position	Organization
25	Mamdouh Mohamed Salem Serag	Professor of Environment and Head of the Environment and Development Department-Damietta University	Faculty of Science-New Damietta
26	Saad Moastafa Aloosh		Society development community
27	Moastafa Elsayed	Head of the Environmental Awareness Department	Damietta Governorate - Environment Dept.
28	Alhussein Aly Mohamed	Head of Kafr Elbatteekh School	Kafr Elbatteekh School
29	Wael Sobhy Hassan	Restaurant Head Waiter	Al Amal club
30	Yasser Khater	Public relation officer	Damietta free zone
31	Mohamed Deif	Damietta Governor consular	Damietta Governorate
32	Mohy Eldin Mohamed El Hendawy	Chairman-Voice of the People newspaper	Voice of the People newspaper
33	Sherif Medhat Elsaeed	Restaurant Head Waiter	Al Amal club
34	Mohamed Ahmed Elsayed	Restaurant waiter	Al Amal club
35	Ahmed Ateyya Elborshy	Owner	Al Amal club
36	Mohamed Mahmoud Omran	Employee	Al Amal club
37	Mohamed Hassan Awad	Employee	Al Amal club
38	Mahmoud Mohamed Elmenshawy	Employee	Al Amal club
39	Elsayed Abd Allah	Employee	Al Amal club
40	Youssef Mahmoud	Assistant of the General Manager	SEGAS
41	Darweesh Aly Elborshy	Agronomist	Agriculture Secondary School
42	Alaa Badawy	Executive manager	SEGAS
43	Salem Abdel Aziz		SEGAS
44	Mohamed Elsayed Elshehaby	General Director of Housing	
45	Abdel Elsatar Elezz		Public administration of sanitary sewage-Damietta
46	Mahmoud Makhareesh	Owner	Al Amal club
47	Ihab Ramadan		GASCO
48	Atef Aly	Operations Dept.	
49	Hany Maher	Shipping manager-Damietta port	REDMAR
50	Mahmoud Elbakhshawan	Director of the Police Department of Damietta Port	
51	Magdy Elsheweeky	Environmental Inspector- Damietta Governorate	
52	Aly Abu Gomaa	school teacher	
53	Elsayed Abdel Fattah	Assistant of the City Chief	
54	Waleed Eltarabily	Lawyer	Lawyers Syndicate
55	Ramy Aly	Lawyer	

	Name	Position	Organization
56	Mokhtar Samy Bahary	Environmental consultant	
57	Hassan Ahmed Helaly	Owner of a trading company, and deputy of Mr. Mohamed Kasaba- member of the people's assembly	Elhelaly Company
58	Kamal Abd Allah Salama	Assistant of Mr. Mohamed Kasaba- member of the people's assembly	Farscore
59	Mohamed Ameen Eldeeb	Accountant	
60	Maha Anwar Mostafa	Contracts specialist	ECHEM
61	Ahmed Labib Omar	Director of the Environmental Dept., Damietta Electrical Power Station	East Delta Company for Electricity
62	Mazhar Hamouda	Environmental supervisor	SEGAS
63	Taher Elhendy	Director of Marine Environment Protection Dept. Damietta Port	Damietta port
64	Yasser Mohamed Mansour	HSE manager	UGDC
65	Marwa Mansour	Chemical eng. Contracts and agreements	ECHEM
66	Moataz Elrasheedy	Chemical and project engineer	ECHEM
67	Samir Batrawy	Deputy of chairman	Society development community
68	Magdy Heeba	Assistant general director- for operation and supplies of Damietta Region	
69	Mohamed Elbadry Mohamadeen		Directorate of Health and Population in Damietta
70	Mohamed Abd Alla Awad	Environmental researcher	EEAA
71	Mohamed Hassan Abdel Badeaa	Driver	EMethanex
72	Kamal Shafeek Hassan	Ex-director of the manpower-training center, and member of the environment community in Damietta.	Delegated contact of the Egyptian-Canadian project at Dakahlia
73	Abdel Hady Ibrahim	Chief of local unit of Sananeya	
74	Abdel Monem Samy Sarya	Environmental information responsible	
75	Zenhom Abdo Mahmoud	General manager- occupational health safety	Directorate of Manpower Damietta
76	Ashraf Lotfy	Journalist	El'esboaya-Alhakika journals
78	Mohamed Elsadat Ahmed	Engineer at Damietta Port	Damietta Port Authority
79	Mohamed Abdel Aziz	HSE Mgr.	SEGAS
80	Mostafa Abu Elmakarem	HSE Mgr.	GASCO
81	Mahmoud Medhat Allam	Director-Central EIA department	EEAA
82	Ihab Maher Elsersy	Senior Environmental Specialist	WorleyParsons Komex
83	Ahmed Awad Elsabban	Environmental Specialist	WorleyParsons Komex
84	Heba Omar Kabel	Admin assistant	WorleyParsons Komex

APPENDIX XV – BOREHOLES LOCATIONS AND GEOTECHNICAL REPORT (AGIS CONSULT, 2006)

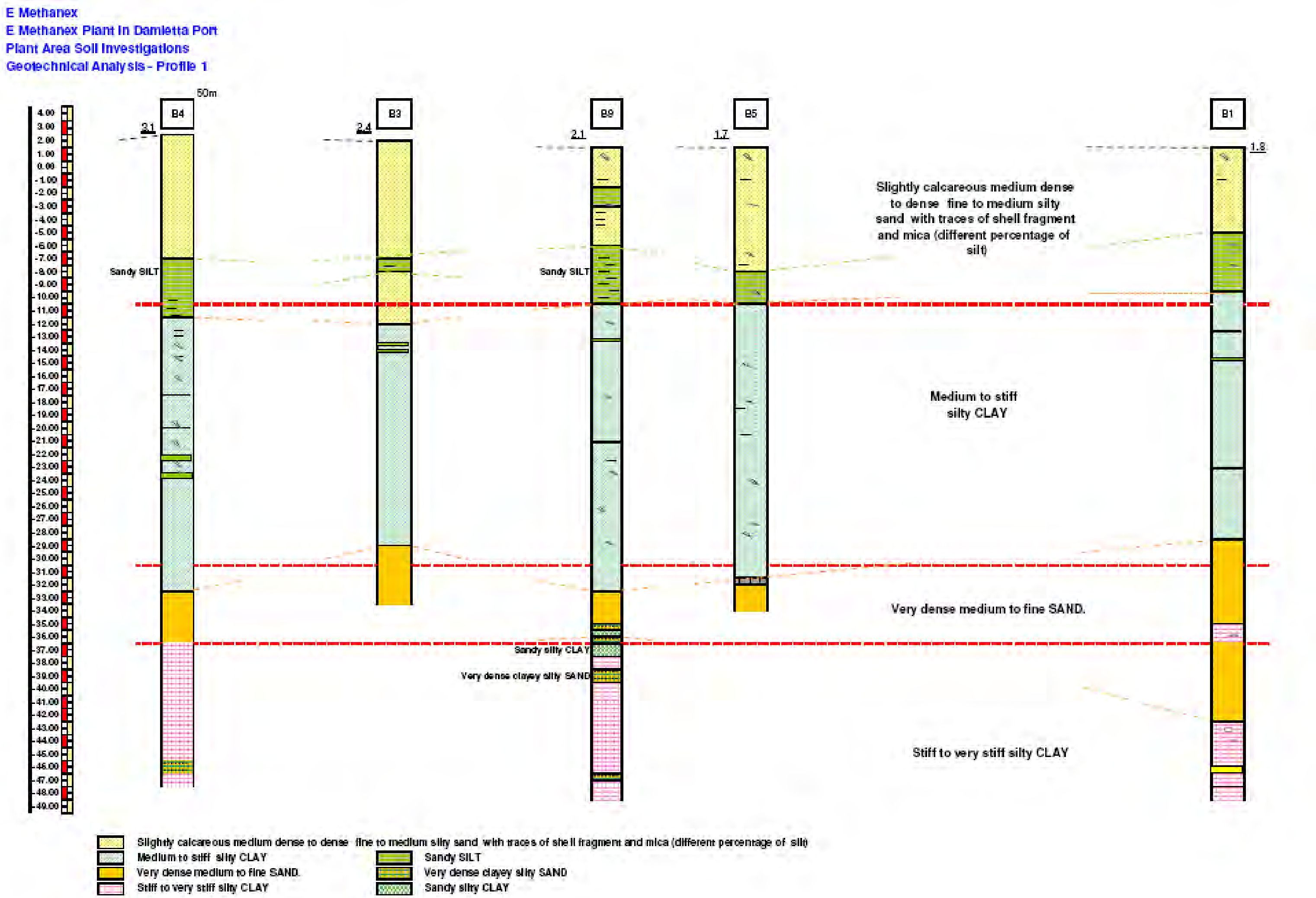
Appendix XV (Boreholes locations and geotechnical profile - AGIS Consult, 2006)



Note :

This is an approximate layout of boreholes with respect to plot plant (draft6) for illustration of geotechnical profiles given in appendix 2. Exact position of boreholes should be taken from survey drawings.

Appendix XV (Boreholes locations and geotechnical profile - AGIS Consult, 2006)



Appendix XV (Boreholes locations and geotechnical profile - AGIS Consult, 2006)